Conference proceedings of the Academy for Design Innovation Management: Research Perspectives In the era of Transformations.

Erik Bohemia, Gerda Gemser, Nua Fain, Cees de Bont y Rita Assoreira Almendra.

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Research Perspectives IN THE ERA OF Transformations

Edited by

Erik Bohemia
Gerda Gemser
Nuša Fain
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Editors
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Editorial: Research Perspectives in the Era of Transformations

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The Academy for Design Innovation Management (*A*DIM) Conference series facilitate sharing of knowledge, collaboration and advancement across a diverse range of Design Innovation discipline areas. The 2019 conference attracted speakers and attendees from across the globe, including recognised industry professionals, international scholars and emerging researchers operating in the creative, commercial and service industries. The *A*DIM 2019 conference general theme 'Research Perspectives in the Era of Transformations' provided a backdrop to what is taking place within the field of design innovation. It also signalled a desire to enable a more diverse intersection views at the conference. Thus, one of the aims was to open spaces for the early career research to actively join shaping the field of design innovation research. During the 2017 conference we succeeded by attracting significant number of early career researchers who represented a third of the conference delegates. One of the outcomes was entablement of the *A*DIM Collective. The *A*DIM Collective is now on-going global initiative of the Academy for Design Innovation Management that connects doctoral students and early career researchers from leading universities around the world. The aim of the *A*DIM Collective is to establish a strong professional network of PhD and early career researchers in the field of Design Innovation Management. *A*DIM Collective reaches this aim by providing opportunities for members of the *A*DIM Collective to meet, develop professional skills and build strong ties with other researchers interested in similar research topics. *A*DIM Collective encourages leading academics to share their experiences with the new generation of design management scholars through events, meetings and symposia. The *A*DIM Collective has successfully organised three Research Development Workshops.

Unfortunately, the opportunity to travel to conferences is not equally distributed among researchers, which meant that scholars from the 'Global South' were underrepresented at the 2017 conference. Therefore, for the 2019 conference we offered bursaries specifically targeting early career scholars from the 'Global South' to enable them to bring and share their research perspectives. Supporting early career researchers to attend the ADIM conference provided an opportunity for these scholars to present their research and gain feedback on their work, as well as network with other design innovation scholars and forge exciting, new research partnerships. We are grateful to ThinkPlace, a design network spanning eight studios across five nations, which supported a full early career research bursary.

We would like to thank the keynote speakers, Professor Rachel Cooper (the founding director of Imagination, Lancaster University) and Mr Chris Thompson (the founding Partner of Viadynamics), Mr Eric Quint (Vice President and Chief Design Officer, 3M Company) and Professor Alison Rieple (University of Westminster) who generously gave their time to share their insights with the conference delegates. Their generosity allowed us to offer bursaries to fifteen emerging researchers to attend the conference. The bursar recipients were selected from over 40 applicants. The number of applicants indicates the need for funding schemes to allow emerging researchers from the Global South to attend international events such as this conference.

We are also grateful to 28 conference delegates, of which 5 were PhD candidates, who selected to register with 'Do GOOD' registration joining fees. The 'Do GOOD' fees help the Academy for Design Innovation Management to establish '*A*DIM Development Research Fund for Early Career Researchers from the Global South'.

The call for paper tracks resulted in 40 themed paper tracks, which was a double the number from the 2017 conference. This increase was reflected in the number of submissions which has more than doubled when

compared to 2017 conference. Altogether, 350 submission were made by authors from 66 countries. The submissions included 255 full papers, 32 workshop proposals and 63 case studies. All the submissions were double blind reviewed. Less than 30 were of the 350 initial submission were single authored.

The 40 conference tracks, for which the call for papers was issued, were organised within 6 overarching themes (see Table 1). The track facilitators ultimately shaped the overall conference scope and direction. The tracks' topics acted as the focal points for the overall call for: Papers, Workshops and Case Studies. Thus, our thanks you go to all the tracks' facilitators. It was them who collectively were responsible for the conference programme and we would like to thank them and the track chairs for their valuable services on the International Scientific Programme Committee.

Table 1 Conference Tracks

1. Social Impact Transformation
- 1.a Transformation of the ageing society and its impact on design
- 1.b Re-Designing health: transforming systems, practices and care

2. Transforming Design Perspectives
- 2.a Decolonising knowledge to transform societies
- 2.b Design & democracy
- 2.c Gender of/in design practice and profession
- 2.d Power and politics in design for transition
- 2.e Design innovation and philosophy of technology: the practical turn

3. Transforming design values
- 3.a Moving Beyond Existing Economic and Social Models through Design
- 3.b Measuring and communicating the value of design
- 3.c Design policy: understanding regional and national innovation ecosystems
- 3.d How does design express value?
- 3.e Service organisation and design management

4. Design, Innovation and Business
- 4.a Effective design leadership
- 4.b Designerly ways of innovating
- 4.c Transformation IN and BY design thinking
- 4.d How is business shaping design? Explorations of the contextual environment and its effects
- 4.e Co-creation and organisational ambidexterity (O.A.) as an innovative framework for the service industries
- 4.f Strategic design of sustainable business models
- 4.g Disaster management by design-driven innovation. Shelter for resilient communities
- 4.h Uncovering organisational practices of design businesses
- 4.i Is design thinking transforming organizations or the design discipline?
- 4.j Experience Design: Method and Evaluation
- 4.k The relationship between designer, ecosystem and disruptive innovation

5. Mitigating Complexities with Design
- 5.a Transforming complexities through design in collaborative community-based processes
- 5.b Strengthening the design capabilities of professional organisations in a complex world
- 5.c Transformation of design entrepreneurship within complex systems
- 5.d Impact of digitisation on transformation of Service Design Systems
- 5.e Seeking signification in transformational times: design semiotics and the negotiation of meaning
- 5.f Transformation by strategic design: design roadmapping and creative foresight
- 5.g Design with foresight: strategic anticipation in design research
- 5.h Creative confidence – transforming individuals and organisations through design
- 5.i Epistemological strategies in design and management Research
- 5.j Innovation through design for meaning

6. Transforming Design innovation education
- 6.a Materiality in the digital age
- 6.b Design literacy enabling critical Innovation practices
- 6.c Entrepreneurship in design education
- 6.d Design Economy Futures and Direction

We would like to also thank the over 291 expert reviewers who provided their valuable time to provide critical peer feedback. Their service on the International Board of Reviewers was invaluable as the good quality peer reviews provided a vital contribution to this international conference. Each reviewer scored papers on a scale of 0 to 10 and provided critical review comments.

Submitted full papers were double blind reviewed, though some had three or even four reviewers. Total number of submitted full papers was 255 which represents an increase of 76% when compared to 2017 conference which received 140 paper submissions. After the blind peer review process 76 papers (30%) were accepted and 65 (25%) papers were provisionally accepted as these needed major revisions, and 114 (45%) papers were rejected.

In making the final decisions about papers, the Review Committee first looked at all papers where the difference of opinion between reviewers was significant and moderated the scores if necessary. The Review Committee then discussed all papers that were just under the general level of acceptance to determine outcomes, before finally looking at any exceptions. The track chairs made a final decision whether to accepted revised provisionally accepted papers. At the end of the review process 110 (43%) paper submissions were accepted for presentations and 145 (54%) papers were rejected. Three accepted papers were presented at the conference as research in progress and they were not included in the proceedings. Although, the number of accepted papers for presentation at the 2017 conference was nearly identical 103 this represented much greater acceptance rate of 73%, and in reverse lower rejection of 26% (n=37).

The workshop track provided another intersection on how delegates and workshop facilitators interacted. Altogether, 32 workshop proposals were submitted and 9 (28%) workshops were accepted and 23 (72%) were rejected by the International Workshop Organising Committee.

The case studies track was a new addition to the conference which provided another intersection on exploring design innovation management research. To get a feel for the potential interest, authors were initially asked to submit abstracts which were double-blind reviewed. The case studies track received 62 abstracts of which 22 (34%) were rejected and 41 (66%) were invited to submit the full case study. Altogether, 26 (64%) of the full case studies were accepted for presentation and 15 (36%) were rejected by the International Case Study Organising Committee.

The *A*DIM Collective 2019 Research Development Workshop event took place a day prior to the conference. Professor Gerda Gemser run a workshop on Preparing for journal publications. Then Dr Nusa Fain delivered a workshop on How to establish a theoretical framework to guide the PhD research. Professor Rachel Cooper workshop provided the participants to engage in Mapping their PhD journey. The final workshop titled Life after PhD: designing a meaningful research career was deliver by Dr Mieke van der Bijl-Brouwer.

The Design Management Academy's international research conference was organised under the auspices of the Design Society's Design Management Special Interest Group (DeMSIG) and Design Research Society's Design Innovation Management Special Interest Group (DIMSIG). The conference was a culmination of two years of planning. It is a hope that the conference will act as a platform to build a diverse community of scholars who are interested to explore and discuss design innovation practices.

Erik Bohemia

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Research Perspectives IN THE ERA OF Transformations

Track 1.a Introduction: Transformation of the ageing society and its impact on design

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There is increasing recognition of the world growing population of senior citizens, due to the rise in life expectancy and decreased fertility rates. Senior citizens are the most expensive population group for the healthcare system due to the avoidable ageing impact on health degradation. It is therefore necessary to move from the focus on curing to prevention. How can design play an important role to support healthcare prevention for the older adults? Do we need to alter our design tools and methods to be suitable for the design contexts? In this section, we gather a number of interesting papers from the scholarly in the Netherlands, China and Italy. They reported their design research experiences when designing for the specific target user groups.

When designing for societal challenges such as healthcare prevention for older adults, products need to be envisioned for this market. It is about fulfilling the specific needs of the related social groups, the older adults. Often it is hard for them to articulate their needs. Den Haan, Brankaert, and Lu proposed the Leisure Time Canvas as an empathy tool to facilitate older adults to share stories about their leisure activities and hobbies so as to elicit their desires and needs and inspire the following design. This research is especially interesting when the target users are not able to articulate their latent needs. Cui, Hu, Hengeveld and Hummels created a tangible interactive device which can encourage older adults to share their life stories in an intergenerational context. The aim of the research is how to enable and capture the stories of the elderly as well as how younger generations can be involved in the sharing of stories. The paper engages in narrative analysis to understand the kind of stories that were told according to identified themes. Kai, Hu, Hengeveld, Frens, and Hummels reported a case study of co-refining the preliminary design of an interactive system with older participants and discussed the effectiveness of the participatory design approach adopted. They found that sketching was found less effective than expected when refining the digital aspects of interactive systems for older people; the videos were more likely to trigger participants' comments on the form and interaction than the function of the systems; the animated storyboard was very useful to help the participants quickly understand the usage scenarios of the preliminary design but was not able to fully illustrate some functions and details; the hands-on experience of functional prototype proved to be very effective for the participants to fully understand the concept and facilitate them to refine the system.

When designing for preventive health for older adults, design is expected to follow an interdisciplinary approach to create, research, and implement solutions that create better healthcare solutions for older adults. Designers, technology developers, insurance companies, professional healthcare institutions, caregivers, municipalities, families, neighborhoods, and related others have to work together to create the intended solutions. How can we collectively design for and with this special target group and conduct design research in this complex social cultural context? Gao and Shen demonstrate how they came to an innovative concept to incorporate HealthRelated Quality of Life (HRQOL) with service design for efficient elderly breast cancer patient care in China. This paper presents three design opportunities (1) smart healthcare service system; (2) improvement of service scenarios in the hospital; (3) a life-long service that links communities, families, and

individuals to facilitate breast cancer patient care. This paper demonstrates the importance of integrating knowledge from other domain such as health and collaborating with stakeholders.

It is widely recognized that Product-Service System (PSS) is a promising new business creation approach for societal challenges. It provides profit and non-profit organizations with additional approaches to create differentiable innovations and build competitive advantages. It is not about designing product and product interaction only but empathizes the service-dominant logic. When designing for health prevention for older adults, PSS design has to have profound understanding of the user's needs, wants, and desires, and also has to adopt a holistic view on value co-creation with internal and external stakeholders together. Is PSS a means or an end when designing for and with older adults or both? Valk, Lovi, Chuang, Lu, Pu and Visser reported their experience in setting up a field experiment with older adults. They present a PSS method in order to engage senior adults with technology for behaviour change research. It aims to promote physical activity among older adults through smart products bearing in mind that these users are generally reluctant to accept technology. It concludes that when aiming at co-designing with and for these target user groups for behaviour change, designers should not just focus on the design process but also focus on how to create a platform to enable such co-design action. They described a PSS method that rely on the expertise and resources from the participating stakeholders in a living lab context to deliver the intended context for research.

Furthermore, the different social, cultural, economic, and political contexts where the older adults live have significant impacts on how these solutions can be designed and implemented. For example, the healthcare experiences in China differs very much from the Netherlands, so are the requirements for healthcare prevention solutions. What can we learn from these differences and design accordingly? Pei, Sedini and Zurlo present the results of an ongoing project on improving "walkability" of the city for elderly people in Italy. To promote active aging. The initial stage of the research project is reported which consists of a thorough literature review and analysis of 31 cases.

Enjoy reading!

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The Leisure Time Canvas: Eliciting Empathy for Older Adults through Activities and Hobbies

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Understanding your user's daily life and interests is essential in providing insights that can be leveraged to define new design opportunities. However, when designing for older adults, this can be challenging because, users may find it complicated to express themselves; designers may have difficulties to take their perspective and empathize with them. This paper introduces the Leisure Time Canvas, an empathy toolkit designed to facilitate older users to share stories about their activities and hobbies, to elicit their perspectives, desires and needs, and thereby inspire the design process. We report on the design of the canvas and its explorative use with six older adults and reflect on the resulting stories and design implications. This canvas aims to facilitate interaction between designers and user groups that may be difficult to empathize with or experience challenges in verbalizing their needs.

Keywords: design empathy, older adults, activities and hobbies, storytelling tool

Introduction

An increasing number of older adults want and need to live longer independently at home (Ahlqvist, Nyfors, and Suhonen 2015). The global population of 60 years and older is expected to reach nearly 2.1 billion by 2050, which is double from the population in 2017, leading to an ageing society (The Department of Economic and Social Affairs 2017). Design is one of the ways to contribute to this challenge of an ageing society, by providing concrete solutions and services (Pericu 2017). The needs and interests of older adults should be addressed to achieve the goal that 'no one will be left behind' (The Department of Economic and Social Affairs 2017). We aim to support design for prolonging healthy years, which is in line with trends identified by Stein et al. (2017) on extending well-being.

User-involvement is acknowledged to be essential in design. In research and design activities it can mainly show positive effects on 1) quality and speed of the research and design process, 2) better match between solution and user, and 3) an increased user satisfaction (Kujala 2003). Involving users in the early stages of a project facilitates exploration and articulation of problems, opportunities, ideas, and concepts (Steen, Kuijt-Evers, and Klok 2007). With this paper we aim to address the following research question: Can we support designers to make focused, personalized and meaningful designs for older adults by providing them with an empathy tool to trigger storytelling?

However, Van Kleef et al. (2005) describe three reasons to consider when gathering user's input as they: 1) may not be aware of their needs, 2) may not be able to formulate their needs and 3) may not be eager to speak about their needs. Hence users need adequate facilitation when involved in the design process. Also, users may express their preferences based on familiar products, rather than the opportunity, resulting in design process outcomes which are similar to existing ones, and possibly not optimal for the challenges at

hand (van der Panne, van Beers, and Kleinknecht 2003). It is essential to overcome these challenges because users, and especially older adults, have knowledge that designers or other experts lack (van Doorn and Klapwijk 2013). Users are experts in their own lives, but not necessarily experts in design. To bridge this gap, designers create formulations that encompass the users' goals and needs, to translate into concrete design proposals (Kujala 2003). To understand users and address their needs with design, we need to find out about their desires, wishes, priorities, and attitudes to improve the potential benefits of a design solution (Chapman, Hampson, and Clarkin 2014). This is more effective if designers do so at an early stage in the design process.

Designers and researchers can provide tools to assist the user in the position of 'expert of their own experience' (Sanders and Stappers 2008). People's hobbies and leisure time activities present an opportunity to contribute to successful ageing (Kahlbaugh and Huffman 2017) and connect to older adults on a personal level. However, there are no concrete tools to facilitate this which particularly target the context of hobbies and leisure time activities. Therefore, we developed the Leisure Time Canvas (LTC): an empathy tool designed to enable users through card sorting to share stories about their current and future hobbies and activities, to elicit their perspective, desires and needs, and thereby gain empathy for the user and inspire the design process (see Figure 1).

Figure 1: From hobbies and personal interests to design opportunities, through The Leisure Time Canvas (LTC).

In this paper, leisure activities are seen as 'preferred and enjoyable activities participated in during one's free time' (Chang, Wray, and Lin 2014). With this open discussion tool, designers are facilitated to find the drivers behind the users' hobbies and leisure activities, to learn about their values and daily lives. Also, when we better understand people's emotions and personality, we can design more personalized interventions that create potential to benefit well-being and stimulate successful ageing (Chapman, Hampson, and Clarkin 2014).

We present the LTC and explore how it supports designers to empathize with challenging user groups and their context. More specifically we provide evidence on how the LTC allows older adults to express themselves. We report on the use of the LTC together with six older adults, in one-on-one sessions with a design researcher (first author). We describe the needs and insights that were found in these sessions, through which we aim to learn about the current perspectives, daily life and engagement with the hobbies of older adults. With this contextualized information we can create more focused, personalized and meaningful designs.

Related work

It is often the case in research that participants are seen as test subjects, while in design processes design empathy is essential to see and understand people from where they stand, as persons with full lives, social networks and feelings (Mattelmäki and Battarbee 2002). Successfully creating meaningful concepts as designers or researchers largely depends on the level of understanding and empathy designers can gain for the target group (Smeenk et al. 2018).

Co-design refers to the involvement of people who are not trained in design in the design process, to creatively work together (Sanders and Stappers 2008). To be able to facilitate designers to get a better understanding of the users, researchers and designers can create tools to let users express themselves, as we draw upon Sanders' vision (2002) that all users can bring inspiration to the design process. This vision extends the perspective from Visser et al. (2005) who issues that users are 'experts on their experience'. These types of

tools facilitate empathy by getting a deeper understanding of people's feelings, dreams and imaginations (Sanders 2002).

There are several empathic methods where participants reflect on their personal experiences (Kouprie and Visser 2009), such as context mapping to understand people's interaction with products (Visser et al. 2005), generative techniques to facilitate users in making artefacts to generate a personal perspective (Stappers, Visser, and Keller 2017) and probing techniques to trigger inspirational response by maps, postcards, cameras and/or booklets (Gaver, Dunne, and Pacenti 1999). In this paper we are not focusing on tools such as context mapping as it focuses on product use, but we will elaborate upon generative techniques and probes.

Generative techniques are useful for collaborative thinking, mapping, dreaming, storytelling and envisioning (Sanders 1999). It is a participatory design language which can be used together with users early in the design process to imagine and express their ideas about living, working and/or playing in the future (Sanders 1999). However, some considerations have to be made. Lazar et al. (2018) address the importance of the materiality of the used tools, by having art therapists selecting materials to intentionally guide participants to engage with difficult emotions. By enabling people to create artefacts and explain them to peers, participants take the initiative in driving the direction of the study and as such prevent blind spots for the designer (Stappers, Visser, and Keller 2017).

Probes as a user engagement concept, originated by Gaver et al. (1999) are used to explore the design space. A probe offers boundaries to let the user creatively contribute to research in an open and sharing way (Wallace et al. 2013). With probes, the participants are given the initiative, as instead of answering a precisely framed question, it is about generating them (Stappers, Visser, and Keller 2017). Users may have different levels of creativity, and through probe theory, these can be approached in four ways: doing, adapting, making and creating (Burrows, Mitchell, and Nicolle 2015). Especially, empathy probes can provide insights into users' experience in their daily life (Mattelmäki and Battarbee 2002). An interesting example is the use of cultural probes to co-create a digital neighbourhood guide for and with older adults, important aspects such as mobility and personal limitations were found (Jarke et al. 2017).

The most significant difference between generative techniques and probes is the mindset. Probes are evoking inspiring responses which designers use, while generative techniques are used in a more steered process, making understanding explicit (Sanders and Stappers 2014).

With the LTC we differentiate ourselves from probes by positioning the tool between the design and the user in a session, instead of the user executing the probe independently (alone). Furthermore, exploring a specific technology or intervention is not our main scope. Instead, we steer the discussion as with generative techniques, focusing on what characterizes a person via their leisure activities, hobbies and activities to inform the design space for a particular user group. This can lead to new questions, insights, opportunities or perspectives on existing problems.

Leisure Time Canvas

Here we discuss the canvas design, the participants, context and method.

Canvas design

Hendriks et al. (2015) pointed out that it is necessary to provide the rationale behind a tool for purposeful implementation. Thereby we aim to enable other researchers and designers to adapt and expand this tool. With the Leisure Time Canvas we want to provide older adults a playful tool to discuss their activities. The LTC is a template consisting of three columns to sort hobbies and other leisure activities on (see Figure 2), the columns state from left to right: 'does not suit me', 'I like doing this' and 'I would like to do more often'. The participants were given a pile of cards with common activities and hobbies for older adults, displayed by an icon and corresponding name of the activity. Then they had to sort these activity cards according to their preference onto the canvas. The purpose of dividing the cards into three different places is to make the users aware of their perspective on these activities, and reflect on how they engage with them in the past, now and possibly in the future. Besides the pre-made cards, several blank cards were given to the participant to write down missing hobbies or activities that they might engage in. Afterwards, the researcher discussed the resulting 'palette' with the participants, with a primary focus on the barriers they experienced with the category 'I would like to do more often'. This conversation resulted in rich contextual stories about people's drivers, barriers, and routines regarding their hobbies.

Figure 2: The Leisure Time Canvas to facilitate the user's storytelling about their hobbies.

The hobby and leisure activity cards were chosen based on the Pleasant Activity List (Roozen et al. 2008) including social activities, domestic activities, culture/science/travelling, intimacy/personal attention and diverse activities resulting in the following eleven cards: reading, walking, visiting a museum, playing games, cooking, listening to music, drawing/painting, cycling, gardening, meeting with family/friends, making a city trip. Corresponding icons were chosen to make it playful and provide concrete visual examples, inspired by the enthusiastically received probe packages created by Gaver et al. (1999) also targeted at older adults. Our tool was discussed with other researchers both with icons and photographs on the cards, but it was decided to use icons to on the one hand remove the focus on details of a specific brand and on the other hand remove the context details so it would be more applicable to a larger group. For other target groups, the set of cards can be adjusted.

The card sorting interaction was chosen based on the redesigned semantic differential (Branco, Quental, and Ribeiro 2017) on which the users provided positive and negative adjectives which should be placed on a scale of intensity, to evaluate how the user characterizes their experience while playing a game. As it proved to be an understandable task for older adults with dementia, we used a similar interaction and mapping style for the LTC but instead used it to facilitate a conversation rather than evaluation.

LTC is a social tool that is used in the interaction between the designer and the user to stimulate sense-making and facilitate a meaningful conversation. Older adults may experience barriers when explaining their needs (van Kleef, van Trijp, and Luning 2005), and we assume we can make this easier by talking about something they like or are passionate about. In this way, we facilitate the users to choose and steer the conversation through the LTC, as they have the freedom to elaborate on specific activities they resonate with. The tool thereby allows the designer to get a deeper understanding of the particular motivators and values of the individual users.

The canvas was used in four different cases so far, on which we will elaborate and specify our learning. First, in a group setting where 28 older adults participated in a workshop led by two design researchers. This triggered discussion between the participants, yet the outcome (a picture of every canvas) lacked the stories, the important contextual knowledge. Second, five design students used it with two older adults and specified the tool even more to their context by for example zooming in on specific cooking tasks together, which showed the potential to use it within one hobby as well. Third, during a summer school in China 30 design students practiced the tool with each other and although this helped them to design for a particular user, the stories lacked depth contextually and emotionally. Fourth, it was used in a similar setting as with this paper, with 6 participants in a one on one session between design researcher and older adult, to determine the direction to develop a smartphone application based on people's interest. To summarize, it shows most potential in a one on one interaction between design researcher and target group.

Participants, context and methods

The toolkit was used together with six (1 male, 5 female) independently living older adults, aged 61-78 years (one participant was unwilling to provide this info), in a session between the user and the researcher. All participants (Table 1) were recruited via a smartphone training class and signed a consent form. All sessions were held in April 2017, in a community building, and lasted between 20 and 30 minutes.

Table 1: Demographics of our six participants who used the Leisure Time Canvas.

Participant	*Gender*	*Age*	*Living situation*
Amy	Female	61	Living together with partner
Dorothy	Female	73	Living alone
Ella	Female	71	Living alone
Frederick	Male	76	Living together with partner (Tamara)
Patty	Female	-	Living together with partner
Tamara	Female	78	Living together with partner (Frederick)

The sessions were audio recorded, and a thematic analysis was done following the steps defined by Braun and Clarke (2006). We transcribed the interviews to familiarize ourselves with the data. Then we generated initial codes across the six interviews, which resulted in 38 codes, some examples include: busy, choir and husband. From these 11 were selected to be most present with all participants, such as independence, insecurity and routines. We browsed through the data with a different lens again, so instead of finding commonalities, we structured quotes (including positive and negative label) in a table per participant in past, present and future. Then this table was colour coded by the initial codes and from this, three themes became apparent, because of extensiveness of a story (including who, what, where, how often) and emotional attachment to a story (impacting life, life changer). We will elaborate on these in the next section.

Result and analysis

We analysed six sessions and report on those by 1) describing three common themes, 2) addressing the diversity within these themes and 3) reflect on the insights for design.

Common themes

Lack of people to engage with in activities while having an existing social network

Amy, Ella and Dorothy expressed they each had individual hobby ambitions, but did not feel like going alone. This is their perspective on the situation as they feel like because they currently do not have somebody for this hobby ambition, they do not perform the hobby, while they do have the desire for it. For example, Amy is part of the gymnastics club, a choir, a woman association and an elderly association, but does not want to go by herself to a museum. Ella is board member of the choir she is part of and would like to walk at the sea more often, but does not feel confident to go alone. Dorothy goes cycling every 2 weeks with an elderly association, but she feels insecure to attend activities alone, such as walking through the forest. Interestingly, they are all part of several social communities, but may not perceive them as an option to go together with. Yet, it could be they indeed do not have similar interests in a particular hobby, as one participant mentions having different hobbies from his partner: ‘the dog is more my wife’s hobby’. We will continue to interpret this through a design lens and address this in the design for personalisation section.

Impactful experiences limiting or promoting engagement with an activity

What impressed us is the dedication with which some participants execute a hobby or certain activity for several decades already. Although this depends per person, most people may not have had one hobby as long as an older adult. And if an older adult builds up a routine over a long time, he or she may not be very likely to change this, unless certain factors cause this change. For example, serious life events might influence one’s engagement in hobbies and activities: Frederick’s wife recommended him to start playing bridge after he could not play soccer and tennis anymore due to his knee surgery. So, this means serious life events can both

facilitate and set a barrier to engage with hobbies. Because reduced time invested in hobbies can result in less social contact as well, it is important to find meaningful alternatives.

Stereotypical hobbies and activities for older adults

We have found an interesting contradiction in perspective on 'elderly hobbies': Frederick said 'I have old people's hobbies' while Ella mentioned that she moves away from 'the grey-headed hobbies'. These quotes show there is particular perspective of one's own hobbies, and hobbies that are common in the community. It is an interesting contrast that Frederick accepts the change of hobbies to things that better suit his needs, while Ella desires not to change her hobbies and does not want to be associated with these. Potentially people need support in making these decisions to start with a new hobby, or can benefit from inspiration for what is on offer in a community. For example, in the case of Ella, her opinion may change when trying out a certain hobby or knowing who else is participating. This is knowledge and experience which indeed only older adults have, as designers cannot predict this view for every individual.

Diversity within findings

Yet within these common findings, there certainly are different specific and individual reasons and contexts for making decisions. For example, in terms of not wanting to walk alone. For Amy, this is because her husband is not interested in visiting a museum, while for Dorothy and Ella it comes from anxiety to not go to the forest or sea. This illustrates that people have very individual needs and perspectives (see Table 2), and need to be respected as such when we design for this target group.

Table 2: The commonalities and diversity of our participants.

Participant	*Commonality*	*Diversity*
Amy	Cycling, knee injury	Cycling instead of walking, because of her knee injury.
	Alone	Her husband is not that interested in a museum card and she does not want to go by herself.
Dorothy	Cycling	Cycling every 2 weeks (routine).
	Alone	Because she got lost in a forest once, she does not dare to walk there alone anymore.
Ella	Cycling	Cycling with good weather.
	Alone	Because of a severe nose bleed, she got anxious and won't go by herself anymore into the forest.
Frederick	Cycling	Cycling instead of soccer and tennis.
	Knee surgery, playing bridge	Dropped previous hobbies and his wife motivated him to start playing bridge after he came out of the hospital.
Patty	Cycling	Cycling yearly with family, monthly with sisters and ever 2 weeks with elderly association, on Sundays with her husband. Strong drive to stay active.
	Knee surgery	The recovery went really well and her drive to stay active was high.
Tamara	Cycling	Cycling as summer activity.
	Alone, health	She does not feel able to travel anymore such as her trip to Brazil, due to health reasons and needing a travel buddy.

Design for personalization

Now that we have identified the diversity and commonalities for the perspectives of the six older adults, we want to address how this influences the design space. Potentially older adults may benefit from facilitation in finding people with similar interests to engage in activities with, because they may experience barriers to step outside their comfort zone and join new activity groups. In addition, by being aware of the reasons which

promote or limit doing a certain hobby, such as routines and peers, we can bring these into a design as well. This illustrates how designers could elicit new design opportunities by using the LTC.

Amy desires to go to a museum more often: 'I once said I would love to have a museum card, but my husband is not that interested in it. And to do it by yourself… you don't do it that often. At least, not me. But it would be very nice!'. She also addressed having a busy schedule: 'We are quite busy these days. I babysit the grandchildren, that's already two days a week. And you also have to do your house and garden.'. Thus, perhaps we can design a service to make Amy aware of the cultural possibilities in her neighbourhood (decreasing travel time), so she can merge it into her current life. Also, we might design a tool to find a match with someone else in her community to visit the museum together. This might add to address issues of loneliness in elderly communities.

Dorothy feels insecure to go somewhere alone since her husband deceased, and this decreases the number of places where she still goes: 'I really do not drive to the big city, it is because since the moment I was alone, I became much more insecure.' She even got lost once while walking, increasing this insecurity: 'I chose for a less crowded road but then went this way and that way… and I completely got lost… no one came by… I did not know where I was. After a while luckily, a mountain biker came by and showed me how to get back. Since that moment I do not walk in the forest alone anymore.'. Thus, perhaps we can use design to give Dorothy a feeling of security/safety in the forest by connecting her to someone, or facilitating easy access to others through technology.

Ella desires to go to the sea more often, but feels scared as well to go alone: 'I would like to walk more next to the sea, but it is so far away. And you have to take someone.' and '1 ½ years ago I had a severe nose bleed and it took so long to get back to the car… like… really long. And I am a bit stressed out, scared. I even did not dare to get out of the house for a while, so to speak. I used to go into the forest with my dog, walking or cycling, but my psychologist said better not to do it by yourself, so I only choose routes where many people are.'. Thus, perhaps we can provide her with a feeling of comfort to start feeling at ease to go by herself, or we use technology to emulate the experience of going to the forest or sea by virtual means. Or trigger to find a match with younger people to go to the beach together, in return for teaching them something she learned over the years.

Frederick enjoys the freedom of choosing his activities: 'I never have difficulties in planning things, because I can simply cancel an afternoon or evening. You are your own boss eh.' and 'I learned to play bridge when I came out of the hospital [knee surgery]. At the start really limiting… damn I could not do anything anymore. But my wife motivated me to do so.'. Thus, perhaps Frederick would have liked a service which gives potential hobby suggestions to him, if his wife did not come up with the idea. On the other hand, it is still important to stay physically active for Frederick, so perhaps design could trigger in a playful way to stay active when one is no longer able to compete in soccer or tennis.

Patty has a strong drive to be busy and active: 'The recovery [knee surgery] went really well, because I thought what if I cannot go cycling and walking anymore! Home all day! What would I have to do then?'. Furthermore, she cycles on many occasions: 'I enjoy cycling as well. Once a year we go cycling for 50 km with the whole family. We have been doing that for 25 years already. Together with the elderly association once every 2 weeks. And once a month 40-50 km with my sisters (during winter walking – a local event), we have been doing that for 15-16 years already. Every time a different route, time flies! People are impressed we still keep up. And on Sundays whenever it's good weather, with my husband. I love it!'. Thus, perhaps we can create a service to let her map out the directions of the cycling tours, and meet others that are cycle enthusiasts. Or giving Patty a tool to provide insight in the frequency and duration of her activities, as she is competitive about her physical activity.

Tamara has the desire to travel: 'Because my husband does not like travelling, I visited my oldest sister in Brazil together with my daughter three years ago. Lots of fun! My daughter arranges the travel herself.' and 'To be able to make such travels [Brazil] you have to be healthy and have somebody who joins and that's not the case anymore. So, we'll go on a weekend trip in The Netherlands…'. Thus, perhaps we can trigger to find a match with someone else to travel abroad or find ways to improve travelling individually for older adults, if she feels healthy enough to go travelling.

Discussion

With this paper we aimed to address the following research question: Can we support designers to make focused, personalized and meaningful designs for older adults by providing them with an empathy tool to trigger storytelling? Our findings reveal barriers and motivators of hobbies and leisure time activities, which can serve as specific characteristics to address in the design. These were found through applying the LTC, which allows participants to reflect on their activities in the past, present and future. Additionally, it revealed with whom, when and how often they executed these, giving the designer an empathic view on the context of their participants.

Supporting designers through the LTC to empathize with older adults

The stories generated through the LTC indeed provide us with rich contextual data to understand the user and generate creative input for the design process. Though the designer makes the final call on prioritizing what characteristics to keep and share with others, and what lens to take in engaging with the user. On the one hand, it is the designer's freedom to pick quotes which he/she resonates with and sees potential for continuation. On the other hand, this means not including the user fully in the co-design process, because the user cannot steer the findings and check misinterpretations. Therefore, we are interested in exploring the area of co-analysing the interpretations with the user similar to Doorn et al. (2013).

Furthermore, we found that social context has a major influence on which hobbies and activities are undertaken. Not having people to do activities with, limits acting on hobbies and similarly having people with similar interests promotes engaging with hobbies on a regular basis. Righi et al. (2017) argue this 'turn to a community' as well stating that when designing technology for older adults, we should say 'their community'. We are indeed not only creating a design space for an individual, but also for the people currently in their stories and even non-existing relationship which may be built through (new) design solutions. Furthermore, previous (traumatic) experiences can limit executing a hobby they would expect to enjoy. By knowing individual characteristics, we can create tailored designs while balancing barriers and motivators.

While having commonalities such as cycling, the driver to execute a hobby and the routine can be diverse and highly individual. For example, from Amy's and Frederick's perspective cycling is a replacement activity for a previous hobby, while Patty had many cycling occasions together with others and the strong desire to remain doing this: 'What if I cannot go cycling and walking anymore! Home all day! What would I have to do then?'. Therefore, we should reflect on people's hobbies in the past, present, and future, and on a personal level to be able to understand to what extent certain activities are more meaningful than others. Perhaps we can as designers learn which elements of a previously enjoyed hobby we can use in a new design. This illustrates that we cannot design for all older adults in general terms, but that we can distil trends from specific users to design personalized interventions and services.

However, the view of finding meaningful data may be influenced by our belief in the value of gaining empathy in design. Results of the LTC can be unsatisfying when designers do not see the advantages of empathy in design or do not know how to engage with it (Kouprie and Visser 2009). The data analysis is therefore influenced by the designer/researcher who interprets the data. Though our canvas addresses clear design spaces to continue working with, and thus we argue for using hobbies to understand users on a more personal level and as input for design.

The earlier identified challenge that users reflect on familiar products which might result in more 'sameness' in design (van der Panne, van Beers, and Kleinknecht 2003) can be addressed by reflecting on leisure time activities as this has an open mindset and focuses on doing the activity rather than using a product. Also, by segmenting the stories into past, present, and future, gaps can be identified: what did a person use to do? What does a person currently enjoys doing or has been doing for many years? What does a person argue for willing to do in the future, but feels a barrier limits him/her? By putting these next to each other, experiences with different hobbies and activities can be compared and more accurately valued by the designer. We believe the follow-up step should be to not only show empathy in learning about the user, but also in analysing and designing with the user. Evaluating design concepts has been done before by van Doorn et al. (2013) addressing children becoming co-researchers, yet we are interested in to what extent this could be applied to older adults as well.

Supporting older adults to express themselves through the LTC

To summarize, the problem identified by Van Kleef et al. (2005) was three-fold namely the user: 1) may not be aware of their needs, 2) may not be able to formulate their needs and 3) may not be eager to speak about their needs.

Amy and Ella explicitly mentioned a concrete need, vocalized through their hobbies and interests, and for the remaining participants, we interpret this from their stories. By the description of their activities and events in their daily life, we were able to extract drivers. However, the storytelling experience of our participants may come even more to live when we would ask participants to bring artefacts to the session (Nassir, Leong, and Robertson 2015 and Leong and Robertson 2016) or if we would have the session in people's homes, because people may feel more at ease to participate in the design process (Suijkerbuijk et al. 2015).

We argue that the user is facilitated through the LTC to formulate their perspectives and needs because they all were open while elaborating on their activities in their daily life in a brief session. Dorothy and Ella, for example, feel the need whenever they want to go for a walk; they want company as they do not dare to go alone. Tamara has a similar feeling but then in the context of traveling. Patty expresses a strong desire to keep her independence. Frederick currently does not seem to show a need for change, as he feels like he can do whatever he wants and feels free (this may be his need). Amy expresses the need for a to have someone to go to a museum with together.

Furthermore, we argue that the user with the help of our canvas was eager to speak about their needs, even including unrequested and personal topics such as surgery, anxiety, and people who deceased. These are somewhat surprising findings to us as we do not explicitly ask to discuss these topics. We see, however, in a similar study based on personal stories that participants do point out big events during their lives, although we cannot say if this is initiated by the participant or by the researcher in the semi-structured interview (Orth, Thurgood, and van den Hoven 2018). Yet, apparently, our participants felt these were related topics for them and felt the need to bring these up. As the older adult steers the conversation, they may feel more at ease to highlight the things they feel comfortable sharing. This is relevant for design because, as much as identifying the drivers also the barriers are meaningful to be aware of to get a complete understanding of a user. If we map this information onto Fogg's behavioural model (2009), we can see that Amy has a high motivation to go to a museum, but does not feel able to do so because her husband is not interested and she does not want to go alone. Resulting in that in a design for Amy, we should address the need to empower her, providing her the confidence to go by herself or actively search for a museum buddy.

We see an improvement in the method to stimulate the awareness of needs more towards the user, instead of the designer interpretation. If the canvas would include the structure past/present/future already, the user may map his/her hobbies more consciously and explicitly onto a timeline. Perhaps newer/different hobbies can be added to be included for the future part. Also, we may trigger discussion further if we make more detailed cards, as Kankainen et al. (2011) did with their postcards to trigger storytelling about mobile phone experiences. It would be interesting to explore more to what extend the storytelling is open and initiated by the participant as there are also examples such as co-constructing stories (Buskermolen and Terken 2012) where the designer tells a fictional story and then asks the user whether or not he/she recognizes this and why. This facilitates personalization of the cards so it can convincingly fit a participant, rather than aiming to be an all-encompassing general term on the card. The concept of using activities and hobbies shows potential, and could even be explored in other domains such as their social network, favourite objects in the home or memories to elicit specific design opportunities.

Conclusion

We contribute the LTC to facilitate empathy with specific user groups in the early stages of the design process. Also, the user is facilitated to provide rich contextual individual stories through their leisure activities in an effective way. With this, the designer can frame a new design space based on the personal contexts of the users' hobbies and leisure time activities.

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Research Perspectives IN THE ERA OF Transformations

Designing for Older Adults' Life Storytelling through a Tangible Interactive Device

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There appears to be a mismatch between current interactive media and intergenerational storytelling, which leads to the elderly are often viewed as passive consumers, rather than active creators of story content. In this paper, we present our study aiming to facilitate storytelling of older adults living in the care facilities with their children, driven by the research questions: *RQ1: What life stories would the older adults like to share?* And *RQ2: How to facilitate older adults to tell stories with their children?* A research prototype named Slots-story was designed, which integrated functions of memory cue generator, story recording, and preservation. In the field study, eight pairs of participants (each pair consisting of an elderly adult and his/her child) were recruited to use the prototype for around ten days. Semi-structured interviews were conducted both with the elderly and their children. Stories collected were transcribed, and thematic analysis was conducted, which formed the foundation of the insights on the research questions.

Keywords: Elderly, storytelling, tangible interface, social Interaction

Introduction

Storytelling plays a fundamental role in human communication. From a hermeneutic point of view, human life is a process of story and narrative interpretation (Widdershoven, 1993). For the elderly, intergenerational storytelling improves psychological well-being, reduces feelings of loneliness and depression of them (Driessnack, 2017). For their children, intergenerational storytelling contributes to the development of a strong sense of intergenerational self, which is associated with children's increased resilience, better adjustment, and improved likelihood of overcoming challenges (Fivush, Bohanek, & Duke, 2008). Given that multiple participants across generations not only co-narrate their shared stories but also jointly evaluate them, intergenerational family storytelling becomes important to identity development (Langellier, 2011)(Peterson & Langellier, 2006). Preservation of life stories is also necessary as they are an important part of identity preservation. The elderly hope they will be remembered, however, when the elderly passed, their family members are only left with bundles of images, materials, objects, and wishes of the deceased (Whittaker, Bergman, & Clough, 2010).

Our target group was older adults living in the care facilities and their children. According to our previous study, these user group mostly they couldn't operate computers or smartphones (Li, Lin, et al., 2018). This was because they were unfamiliar with digital devices and lack of using experiences, as well as suffering from physical decline. Most interviewees suffered from age-related declines, such as fading eyesight, losing flexibility in hands, a lack of mobility. They obtained information mainly by TV and Newspapers.

While social media like Facebook and Twitter help to share and preserve the stories to some extent, these platforms are more about the “now” moments and less about the past moments (Marcus, 2015). In addition, the elderly are still disconnected from the mainstream social circles due to lack of technology and devices that resonate with them (Waycott et al., 2013). Currently, most interfaces are designed to support younger users. Thus, they are confronted as passive consumers rather than active creators of content (Brewer & Piper, 2016).

In this paper, we describe our explorative work, focusing on prompt older adults to share and preserve their life stories with their children. Knowledge and insights were gained by the implementation of the prototype. Contributions of this paper lie in: A better understanding of elderly people's preference for life story themes, and concrete strategies and insights on facilitating intergenerational life storytelling and preservation for the elderly. In related work section, our literature review allows us to identify the stated research and design focus.

Related work

Multiple Functions of Storytelling of the Elderly

From a physiological perspective, reminiscing and sharing of life stories improve self-esteem, mood, well-being and enhances feelings of control and mastery over life as one ages. Research has also associated reminiscence with improving psychological well-being, reducing feelings of loneliness and depression, and helping older adults find meaning in their life (Driessnack, 2017). From a social perspective, stories transmit cultural and individual traditions, values, and moral codes (Kemper, 1984). Stories told by the elderly create meaning beyond the individual and provide a sense of self through historical time and in relation to family members, and thus may facilitate positive identity (Fivush, 2011). From a broader perspective, stories told by the elderly are treasured intangible source of cultural heritage. When individuals regard that they approach the end of their lives, they tend to document segments of their personal history and issues of generativity and knowledge transmission to younger generations are considered as significant to seniors (Unruh, 1983).

Practices of older adults’ story sharing

Given that one of the most precious characteristics of older adults is their memory of events, people and places during their childhood and adolescence (Dryjanska, 2015), older adults could be deemed as story content producers. Jenny Waycott et al. further investigate the nature and role of digital content that has been created by older adults in the care facilities, for the purpose of forging new relationships, and their findings demonstrate that older adults are willing to express themselves creatively through digital content production (Waycott et al., 2013). We build on this idea and extend it into intergenerational story sharing.

Applications of storytelling for the elderly

On the application side, in terms of applications and tools for the storytelling for the elderly, there is a system aiming to helps residents in care facilities make connections through sharing stories (Linnemeier, Lin, Laput, & Vijjapurapu, 2012), game-based reminiscence service that enables elders to capture memories and annotate photos(Lee et al., 2014), design of encouraging reminiscence and storytelling with objects, as a tool for building connections of older residents in care facilities(Bennett et al., 2015), an interactive table for sharing memories, skills and demands(Giorgi, Ceriani, Bottoni, Talamo, & Ruggiero, 2013), and a system aims to make the elders feel more connected to the outside environment, and further facilitate their sharing of stories with citizens from local communities(Li, Lin, et al., 2018).

In terms of intergenerational storytelling, current applications are mostly smartphone applications or website, which are inaccessible for elderly users. There are smartphone applications or webs for creating multimedia stories (Druin, Bederson, & Quinn, 2009) (Bentley, Basapur, & Chowdhury, 2011b), a software of managing family stories(Marcus, 2015), software for videos to be saved in user-specified real-world locations, shared with friends and family(Bentley, Basapur, & Chowdhury, 2011a), and a software support digital reminiscing of the elderly(Thiry & Rosson, 2012).

Since TUI (Tangible user interface) has been identified by Spreicer as having great potential to improve older adults’ acceptance of technology acceptance (Spreicer, 2011), applications that support story sharing for non-tech-savvy older adults mostly adopt tangible interface. There are applications focus on improving older adults’ connections with other fellow residents: a tangible system aiming to help residents in the care facilities

make connections with their fellow residents through sharing stories (Linnemeier et al., 2012). Using landscape tangibles as proxy objects to aid storytelling and reminiscence for older people in care facilities (Bennett et al., 2015). There are applications focusing on improving their connections with people outside: *Interactive Gallery*, a tangible installation placed in care facilities aims to facilitate story sharing between older adults and citizens from local communities (Li, Lin, et al., 2018).

Summary

The literature indicates that storytelling benefits the elderly from the physiological, social, and a broader perspective. We focus on older adults' life stories, and we particularly adopt trigger questions as memory cues. We probe how to provide the older adults explicit memory trigger questions through a tangible device and bring them an enjoyable using experience. Since our target group is non-tech-savvy older adults in the care facilities, we also build on tangible interface to bridge the technological gap for older users. In the next section, we introduce our prototype in details.

Design intervention

We based the design of Slots-story on our previous work-in-progress work (Li, Hu, Hengeveld, & Hummels, 2018). Its design process included an interview study. The following is a summary of the interview. We found the elderly were unfamiliar with digital devices and lack of using experience. They had regular contact with children, who were almost the only people that the elderly could really tell personal things to. Nostalgia was prevalent among the elderly and they would like to share their life stories, but they were rarely asked specifically, which made the stories hard to preserve. Currently, life story sharing was fragmented and happened unconsciously. The younger generation was lack awareness of the elderly's stories. Memory triggers were necessary to facilitate life storytelling, and their life memories were recalled by conversation topics, family mementos, etc. Given that the meeting time of the young and the elderly was limited every week, we could also consider separating the process of storytelling and story listening. We then conducted brainstorm, sketch and mock-up, and user consultation, and the resulting design was Slots-story (Figure 1).

Prototype: Slots-Story

Based on the above design requirements, Slots-Story is designed. The metaphor of slots-machine is applied in it. Slots machine is operated by one lever on the side of the machine and is familiar to most elderly people. When the user pulls the lever, a trigger question is displayed in a similar fashion as slots-machines. It consists of a slots-machine-like device and a flash disk, and it could either be used face to face or independently by the elderly and their family members.

Appearance: For ease of use and ergonomic purposes Slots- Story is wedge-shaped, making the display easy to see, and lever and buttons easy to access. A 7-inch display and a microphone are arranged on the upside and a button is on the front side. The handle on the back, together with a portable dimension, makes it easy to carry. The MDF material is covered with a wooden laminate texture, making it look slightly old-fashioned, which is in line with the aesthetic taste of the elderly.

Figure 1: Slots-Story prototype, and question and recording interfaces

Display Interfaces: Slots-story includes two display interfaces: the "Question interface" and "Recoding interface". Vintage style is also applied both in the interface elements and fonts. Considering fading eyesight of the elderly, bold and huge fonts are used for the text. There are also usage tips at the bottom: Press "REC/STOP button before/after recording.

The "Question interface" displays one specific question, which could be switched to Next/Previous question by pulling down/pushing up the lever. The "Question interface" will be switched to "Recoding interface" if the

REC/STOP button is pressed. In the “Recoding interface”, a dynamic recording icon is placed to provide real-time feedback.

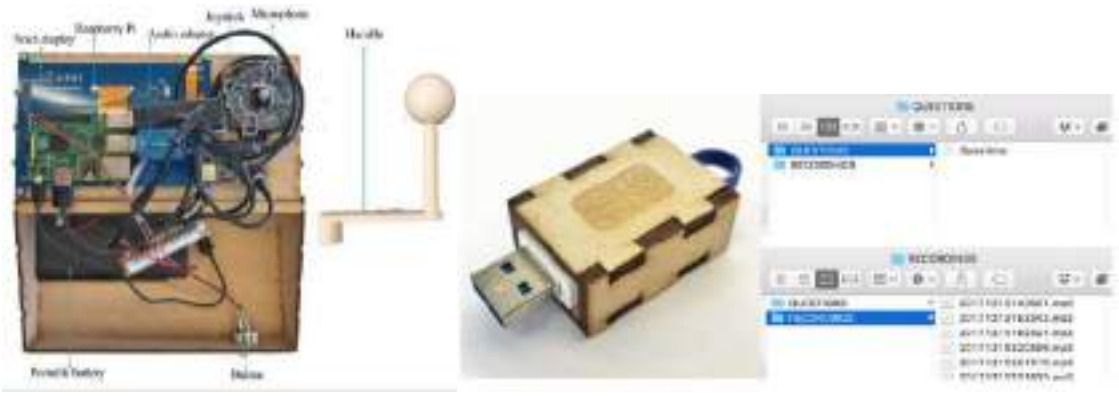

Figure 2: Hardware of Slots-Story prototype, Flash disk and question and folders inside

Interaction: The interaction process is: (1) The young inserts flash disk into the prototype and gives it to the elderly. (2) The elderly operates the lever to switch trigger questions. (3) The elderly pushes the button to start recording. (4) The elderly pushes the button again to save the recording. (5) Stories told by the elderly now are in the flash disk. (6) The young Plugs the flash disk into a computer to listen and keep stories, and further modifies trigger questions. (7) The slots-story could also be used face to face.

USB Flash Disk: The flash disk is not only used to store the trigger questions and preserve the story audios. There are two folders in it: “QUESTIONS” and “RECORDINGS”, the former contains a text formatting document, the latter contains all the story audios told by the elderly.

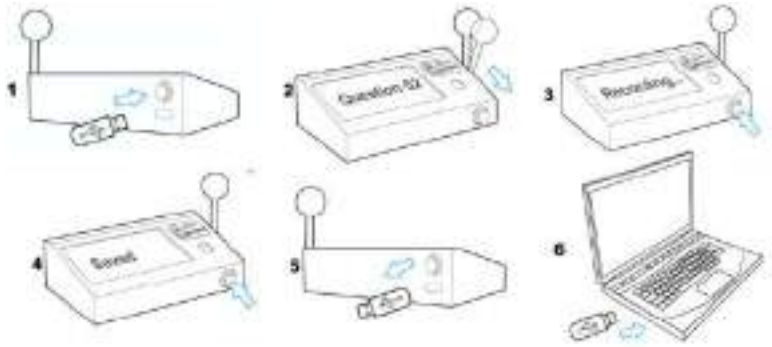

Figure 3: Operating procedures

Trigger Questions of Different Themes: Explicit questions are employed as memory cues (Table 1). Compared with other types of memory cues, questions are more explicit and straightforward, and targeted answers will be triggered. Trigger questions in our case are from The Life Story Interview(Atkinson, 1998), questions cover most aspects of an entire life course, including childhood, family, school, work, friend, historical events, and others, which are arranged within a thematic framework chronologically. Additionally, considering the emotional consequences when recalling deep memories, we avoid adopting negative topics.

Table 1: Trigger questions in Slots- Story

Childhood	***Friends and Fun***
Were you ever told anything unusual about your birth?	What childhood or teenage friendships were important to you?
What is your earliest memory?	Did you make friends easily?
What was the most significant event in your life up to age 12?	What special people have you known in your life?
What clubs, groups, or organizations did you join?	Did you have a steady boy or girlfriend in high school?
Did you have any dreams as a child? As an adolescent?	How do you use leisure time?
Family	What did you do for fun or entertainment?
What was going on in your family and the world at the time of your birth?	***Historical Events***
What beliefs or ideals your parents tried to teach you?	What historical events did you participate in?
Are there any family stories told about you as a baby?	What is the most important historical event given to you by your family?
What characteristics do you remember about your grandparent?	What has your life contributed to history of your community?
How would you describe your parents?	Do you remember what you were doing on the days in World War II?
Did your parents spend enough time with you? What did you do with them?	Do you recall any legends, tales, or songs in your community?
School and Work	***Others***
What is your first memory of attending school?	Do you remember your first date? Your first kiss?
What was your first experience of leaving home like?	What gifts (tangible or intangible) are still important to you?
What are your best memories of school?	What were the crucial decisions in your life?
What accomplishments in school are you most proud of?	What has been the happiest time in your life?
Is there anything that you miss about your work?	How would you describe your worldview?
What is the best part about being retired?	What have been your greatest accomplishments?

Field Study

As previously mentioned, we want to explore the possibilities of facilitating the elderly to tell life stories through the implementation of the Slots-Story. Therefore, the research questions addressed in this paper are: *RQ1: What life stories would the older adults like to share?* And *RQ2: How to facilitate older adults to tell stories with their children?*

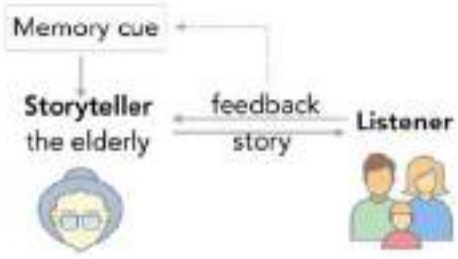

Figure 4: The process of story sharing

Procedure

Overview: In the field study, three same prototypes were made and were distributed to participants. Each set of the prototype was provided with an instruction for use. Eight pairs of participants (each pair consisted of an old adult and his/her children) were recruited. The older adults were from local Dutch care facilities. Purpose, functions, and operation procedure were first introduced to them, and then they were interviewed. After that, each pair used the prototype for around five days. After they used the prototype, interviews were conducted with them again. All the interviews were audio-recorded with the interviewees' consent. Interviews and story audios were then transcribed and analyzed.

Participants: eight families, the age of the older adults ranged from 63 to 86. There were four females and four males, and their marital status were: five married, living with a spouse; three widowed. They agreed to share their audio recordings. None of them reported any significant physical impairments. The age of their children ranged from 38 to 43.

The first round semi-structured interview

Interview questions: Semi-structured interviews were conducted twice, before and after the implementation of the prototype. The aim of the first interview was to understand the actuality of intergenerational storytelling of the elderly. All interviews were analyzed by a qualitative, grounded theoretical approach, informed by situational analysis, to inductively analyze our data and generate the findings (Charmaz, 2014). Interview questions of the first round were as follows. **Basic Information:** Age, gender, physical condition. **Communication with family:** Way of keeping in touch (face-to-face, phone, skype, etc.). **Current story sharing situation:** Whether they like to share stories, and why. **Situations and reasons for sharing stories:** Who, when, how to share stories (face-to-face, phone, skype, etc.). Topics, duration, and frequency of story sharing. The trigger of life story sharing. Problems encountering during story sharing.

Findings

Communication with Family Members: Firstly, they had regular contact with children, but wanted more: "Sometimes they eat here when they visit me, it is the coziest moment, and I like that." "I want they could visit me more often, but I don't call my children very often because I don't want to disturb them, they have to work after all." Secondly, Family members were almost the only people that the elderly could really tell personal things to. Although talking topics were various: daily lives, sports, weather, politics, etc., and they were mainly about the family that was private and personal.

Current life story sharing situation: Firstly, nostalgia was prevalent among them: The elderly interviewee became emotional and depressed, and would like to recall their past. The first reason was that they could not do some things they could before. The second reason was they tended to be nostalgic naturally when aged: "Past things come to my minds somehow. After I grew old, I often look back to my life and feel life is short." "I don't understand the society of today, and I miss the past." Secondly, the elderly would like to share their life stories, but they were rarely asked specifically: The elderly would like to recall their past, but they were not asked very often, nor did they have many chances to tell the stories. "I myself would like to recall the past. My children almost never ask about that specifically." However, the younger were to lack awareness of the importance of elderly's stories: Life stories of the elderly were seemingly ignored by their children. It was not the young were uninterested in the past of the elderly, but that they were lack of awareness of it. The young realized its importance only when the elderly passed away. Thirdly, currently life story sharing was fragmented and happens unconsciously: The elderly didn't share life stories specifically and deliberately in daily lives. Situations and reasons for sharing life stories were various. For example, when the conversation topics were related to their past, it acted as memory triggers to remind them. In brief, Life story sharing was fragmented and happened casually and unnoticeably, making life stories hard to preserve.

Problems encountering when sharing life stories: The biggest problem for storytelling was lack of topics. Secondly, as most elderly interviewees felt their lives were ordinary and nothing special, their concern was that others might not be interested in their life stories: "I guess those successful or rich people would like to tell their life stories. For us ordinary people, there is nothing worth telling." Next, some of them were emotional, and they might weep when recalling deep memories, which would be embarrassing. Finally, the interviewees were suffering from memory decline.

The second round semi-structured interview

Interview questions: The aim of the second interview was to evaluate the prototype. The interviews were semi-structured and based loosely on the following questions.

Validity: Would you like to use it? Who would you like to share with? Do you think it could facilitate sharing stories? Why?

Contents: Preference for questions A. Childhood B. Family C. School and work D. Friend and Fun E. Historical Events G. Others

Interaction: Do you understand the concept of the prototype? Do you find it easy to use? What is the most difficult part? Which part do you like/dislike most of the prototype? Why? Do you find it easy to use? What is the most difficult part? Which part do you like/dislike most of the prototype? Why? **Other**: Would you like to use it face to face/over a distance?

Comments for improvements: While the interviews with the young were based loosely on the following questions: What's your feeling after listening to the stories? Did you contact parents after listening to the stories? Preference for stories: A. Childhood B. Family C. School and work D. Friend and Fun E. Historical Events G.

Findings of interview the older adults

Validity of the prototype: With respect to validity, the interviewees thought it could facilitate life story sharing. The prototype helped them to remember what they almost forgot, as well as giving them a chance to save memory. One interviewee said:*" It helps me to reflect on my own life again. I could remember something I've nearly forgotten."* They also enjoyed the process of recalling: *"I had a lot of fun recalling and telling my own memories, experiences, and feelings."* The elderly also benefited a lot from recalling the past as they got insights from it:" *The questions give me insights into the past as well as mistakes and reactions of people who are very close to me."* The elderly also thought the story recordings also benefited next generations:" *I would like to have such a device for my grandfather, because I don't even know his name."*

Preferences for the topics: Most of them would like to talk about their childhood, especially the interesting and funny things. As one elderly interviewee said:" Recalling the past makes me feel go back to the past." "Telling happy things itself is a happy thing, which also brings happiness to others." The second was their achievements and those they were proud of. Part of the reason was they could not do some things they could before:" I felt happy when recalling happy things, the memories brought me back."

Interaction of the prototype: They showed great interests in it, especially its intuitive operation. The metaphor of the slots-machine was understood and accepted by them. According to the elderly, sharing stories and handle operation were the most interesting functions. "The slots-machine-like operation raises me a sense of expecting and curiosity for the unknown." Most elderly interviewees felt the directly telling stories behavior was convenient compared with writing stories. Especially some of them had difficulty in writing: "Without good eyesight, you cannot do much alone, even if you are mentally totally fit."

Comments for improvements: Personalization: Questions were fixed in the prototype, and how to set personalized questions needs to be considered. Sustainability: There were only 35 questions in the porotype, how to sustain the story sharing process in a long-term way after all the questions are answered need to be considered in the future iteration. Usability: Some participants suggested that the sensitivity of operation should be reduced as their hands were clumsy. One participant thought the prototype could be friendlier by displaying "Thanks for your story" after stories are told.

Findings of Interview with the elderly's children

Learned new things they didn't know before, and knew more about parents/grandparents: Most of the young participants said they learned completely new things from the recordings, and also they were surprised that there were lots of things they didn't know about their parents after listening to the stories. *"I never know my mother's infant name, and she told the origin of her infant name." "I didn't know too much about my great grandfather because he had passed away before I was born. I heard a lot about him through my mother's recordings." "I think the trigger questions have been thought of for me, in case I didn't ask the elderly."*

The recordings were a treasure to pass on to next generation: Some young participants thought the recordings could be kept and passed down for generations, as the recordings were like biography

encapsulating the life of the storyteller. *"Our parents and grandparents are guardians of a very personal memory treasure, which need to be preserved. I think that is the meaning of the prototype."* Another young participant said*:" I think I can play the recording to the next generation and talk about how it was with her grandmother back then, great idea for recording memories to be handed down the generations."* Recordings would also be a consolation if the elderly passed away: *"If mom once died, these recordings with many heartfelt memories can certainly give a little consolation."*

A good way to ask some embarrassing questions: Some young participants felt listening the recordings was different from listening to the elderly talking face to face, as the former was a good way to know some embarrassing questions they wanted to know. The prototype provided a way of avoiding awkward situations.

Enabled the young to be aware of the importance of preservation of life stories of their parents: Some of the young participants agreed it enabled them to be aware of the importance of life stories of their parents. The first reason was that they learned new things that they didn't know before. The second reason was, there were some that the elderly couldn't remember, so the sooner they tell their stories, the more they could remember:" When we were young, we might be not interested in stories of parents, but later when we would like to ask them, they might already pass away, and we couldn't ask anything longer. I will keep all these memories well and will learn much more."

Voice contained real familiarity and emotions: Most participants felt familiarity with the voice. The voice contained emotions, personalities, and feelings. One young interviewee said: "I even hear the meow of her cat. I could imagine the scenes of she telling her stories." Compared with text, voice contains real familiarity and emotions. "I could even hear her laughter when recalling happy memories. the happy stories made me happy too, and that was also nice to remember."

Developed conversations when using face-to-face: Trigger questions that Slots-story provided were of different themes. It acted as a conversation topic generator when they used face-to-face.:" It helps to develop conversations that we would never have had before." "It can serve as a conduit for discussion, and one gets to know each other differently."

Thematic analysis of stories

Stories told by the elderly were conducted the thematic analysis. Thematic analysis is a method for identifying, analyzing and reporting patterns (themes) within data. It minimally organizes and describes the data set in (rich) detail (Braun & Clarke, 2006). The thematic analysis emphasizes on the content, as grounded theorists do, investigators collect many stories and inductively create conceptual groupings from the data. Data in the form of personal experience offers the opportunity to uncover topics and themes to study participants would have remained unknown and consequently unanalysed by the researcher using a fixed interview to gather data.

Method

Transcription of the stories: There is considerable variation in definitions of life story, which leads to different methods of analysis, but all the methods require constructing texts for further analysis, which is the transcriptions (Riessman, 1993). In our case, transcription conventions and guidelines were based on Robert L. Miller's method (Miller, 1999). We didn't choose what to preserve and what to discard, and all the audios were retained and transcribed.

Thematic analysis: Following (Sanderson & McKeough, 2005), the themes of the stories were defined, and were labelled according to categories.

Table 2: A snippet of transcription

Transcription	*Theme*	*Label*
The first question is 'were you ever told anything unusual about your birth'. When I see this question um.....Naturally, I am reminded of when I was little, my mother told me: "My girl, you will be a lucky girl. "I said: "I certainly hope so, but why do you say so?" And she said: "It is because you were born in autumn, and we had a harvest that year. At that time, thousands of people died of famine. We didn't know where our next meal come. But when you were born, we had an autumn harvest. So, I believe you will be a lucky girl."	Her mother believed she was a lucky girl as when she was born in autumn harvest	Birth

Results: proportion of the life story themes

Themes of the stories could be roughly divided into descriptions and perceptions. The former mainly includes descriptions of the event, object, or people. The latter mainly includes feelings, self-evaluations, and life insights.

All the themes were generalized into 14 main categories and 38 sub-categories. Proportions of story themes the elderly told are calculated, as it could reflect the preference of talking topics, from an objective perspective.

Themes they talked most were about **Childhood**, among which “funny things” and “historical events" were they talked the most, which was in line with the result of the interview: they would like to talk about happy, positive, and funny things, especially childhood. The next main category was related to **Family**, among which the most is about “family members”. Followed by “parent’s teachings”, which are beliefs and ideal parents taught them. 13.7% of themes were about **Perception**, in descending order it includes “feelings”, “insights”, “self-evaluation”, “world-view”, “belief”, and “regret”. Next is **School** (10.5%), among which “proud things” are they talk the most, which is in line with the interview: they would like to tell stories they were proud of. The category of **Impressive things** includes is complex, mainly about memorable stories: for example, important life decision, mysterious thing, dangerous things, etc.

One thing to note is the “skill instructions” are interspersed in their narratives. For example, making hand-made shoes, chess skills, skills of writing articles. These are also intangible treasure worth preserving. Additionally, in the theme of “**Memento**”, photographs, mementos are important visual clues to help the elderly recall. These kinds of memory cues also need to be explored in the next iteration.

Stories told by the elderly weren’t limited to the trigger questions provided

Results also showed that stories told by the participates were not limited to the 35 trigger questions, and the older participants didn’t slavishly follow the topics of the trigger questions and dutifully record corresponding stories. Three aspects could account for this: Firstly, the narrative was not always linear. The trigger questions acted as jumping-off points which sparked broader memories, and gradually the narrative becomes non-directive and unfocused. One story might remind the elderly of the other related story. Secondly, some participants got used to using it to tell stories gradually, when a story suddenly came to his mind, he would like to use the prototype to record. Thirdly, the process of recalling gave the storyteller an opportunity to review his/her life. After a life review process, the elderly acquired a new sense of personal authorship and life reflections in their life journey, more and new insights on lives emerged.

Discussion

Designing for older adults’ storytelling

Memory trigger is essential to storytelling, trigger questions should be open-ended, concrete, and in everyday language: During our interview, we found one of the problems for older adults’ storytelling was the apparent lack of topics. Therefore, memory trigger is necessary: A memory trigger is a circumstance or piece of information which aids the memory in retrieving details not recalled spontaneously (Dictionary, 2008). Secondly, unlike the close-ended question, the open-ended question needs to be answered with more thought and more than a simple one-word answer. Tigger questions should be open-ended. Secondly, according to the interview, most of them pointed out that trigger questions provided in Slots-Story were easy to answer as they

were concrete and in everyday language. Concrete trigger question is easy to answer as it facilitates reminiscence and prompts a specific story.

Tangible interface employing metaphor makes technology accessible for the elderly, acts as a physical reminder to encourage the elderly to tell stories: According to our interview study, most elderly interviewees still relied heavily on paper and preferred physical interaction and operation. As such, tangible interface could be adopted to provide physical feedback and overcome the limitations of screen-based interfaces. Literature has reported tangible interfaces are more accessible and suitable for the needs of the elderly, and interactions that remind them of familiar devices have a higher acceptance (Rodríguez, Karyda, Lucero, & Herskovic, 2018). Metaphor in the interface could reduce barriers of the elderly to use as well as reduce learning time (Irizarry, Downing, & West, 2002). In our case, the metaphor of slots-machine was understood and accepted by the participants. They showed great interests in its intuitive operation. From the perspective of design, Slots-story device is an interactive device with a tangible interface. The classic aesthetic of the Slots-story makes it unobtrusive when putting it at home, which would encourage and attract the elderly user to use it. Slots-story not only makes the digital content accessible and visible, and it also serves as a tangible reminder for the elderly of what it holds. Research has revealed that tangible materials produce deeper engagement, evoke deep emotional responses. Tangible reminders could be powerful tools in encouraging positive behaviors and thought patterns (Brown, 2009).

Using audios as the storage medium could lower the cost of narrative for the elderly, which could also retain information to the maximum degree. Given that the elderly felt difficulty in writing gradually, using audios as storage medium could lower the cost of narrative for them, compared with handwriting. Moreover, stories in audio forms could retain information to the maximum degree compared with stories in text form: the audios involve real emotions, feelings, ambient sounds, etc.)In our context, audio also shows advantages over video: A study points out that video is too real to allow room for thinking about the past with others (Chalfen, 1987).

Slots-story contributed to personal content acquisition and preservation: Autobiography is defined as the history of a life story, written by the person who has lived and experienced that life (Birren & Cochran, 2001). The importance of audio recorder has been emphasized by Millet: without it to preserve the very sound of language, we should have no idea of how people really talk: their pauses, inflections, emphases, unfinished sentences, short periods (Millett, 1975). In this sense, story audios collected by Slots-story are an audio version of an autobiography. Slots-story contributes to personal content acquisition and preservation, and helps the young generation to acquire and preserve stories of their parents/grandparents, and the stories could even be kept and passed down for generations.

Designing for intergenerational communication

There exist differences between using Slots-story face-to-face and separately. In our case, Slots-Story could be used face-to-face or separately by the elderly and the young. The reason was as follows: Despite that sitting together to communicate face-to-face is the most common and enjoyable way to share stories (Lindley & Monk, 2008), most older adults lived apart from their children, and duration of each visiting was limited. The older adults and their children's lives were also usually unsynchronized. Hence, the prototype should be able to be used both face-to-face and separately. When the elderly and the young use the prototype face-to-face, trigger questions that Slots-story provide are of different themes, and it acts as a conversation topic generator. While when the elderly use the prototype by themselves, they could be fully concentrated to tell the past things with deeper insights, and needn't care about the other's attitude or expressions. In this case, the stories they told are complete and integrated. Also, using the prototype separately is a good way to ask some embarrassing questions.

The story sharing process is not solitary but a collaboration process, as in addition to the storyteller, the responsive receiver is also needed. Process of storytelling could be formulated (Figure 4): triggered by the memory cues, the elderly tell stories and which are then conveyed to the young, the young provide feedback to the elderly, feedback from the young could effectively encourage the storytellers to tell more, also the feedback may also act as new memory cue. The story sharing circulation could be sustainable when all the above factors are integrated.

Facilitate life story share in a sustainable way: In the design of Slots-story, the memory trigger questions are fixed, and the whole story sharing system is not sustainable. We could close the loop of story sharing process by actively involving the young generation. In the current iteration, the young are passive participants. Efforts

should be made in the aspects of the young to turn them into active participants through personalization of trigger questions: Trigger questions could be raised and edited by the young.

Conclusion and future work

In this paper, we have a better understanding of the elderly's life stories. To be specific, we understand older adults' preference for story topics through thematic analysis. Insights on RQ1 are discussed in the section of thematic analysis. The field study indicated that Slots-story facilitated the storytelling and preservation for the elderly. We further conclude the implications of designing for facilitating elderly's life storytelling through their reflection during using our prototype. Insights on *RQ2* could be concluded as Memory trigger is essential to storytelling, trigger questions should be open-ended, concrete, and in everyday language. Using audios as a storage medium could lower the cost of narrative for the elderly, which could also retain information to the maximum degree. Tangible interface employing metaphor makes technology accessible for the elderly, acts as a physical reminder to encourage the elderly to tell stories. Separating the process of storytelling and story listening could make the stories complete and integrated. Personalization of trigger questions, and trigger questions could be raised and edited by the young. The loop of story sharing process should be closed to make the sharing process sustainable.

As some of the stories told by the elderly were related to their mementos, such as album, souvenir, artwork, etc. Photographs, mementos are also ideal memory trigger as they provide visual clues, which help the elderly recall events, even long-forgotten stories. This inspired us to explore their mementos and related stories in the next iteration.

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Research Perspectives IN THE ERA OF Transformations

Co-refining Interactive Systems with Older Adults from Function, Form and Interaction

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Designing interactive systems that are pragmatic, attractive and easy to use for older adults is challenging. Participatory design, as an approach to enhance the mutual understanding between designers and end users, has been proved to be useful to improve the quality of design for older people. However, PD research has long been criticized for extensively dealing with the early-phase design while putting less emphasis on the later stages. In this paper, we argue for the importance of collaborative refinement when designing interactive systems for older adults. Through a case study, we describe our experience of co-refining the preliminary design of an interactive system with older participants from three perspectives: function, form and interaction. We also explored to adopt some potential PD methods and conclude by discussing the effectiveness of the chosen approach and methods.

Keywords: participatory design, older adults, interactive systems, refine

Introduction

Global population aging and the rapid development of novel technology lead to an increasing demand for interactive systems to enhance older adults' quality of life by promoting their independence and social wellbeing. However, designing interactive systems that are pragmatic, attractive and easy to use for older people could be challenging due to the lack of mutual understanding. In the past decades, we have witnessed a new design movement shifting from designing for users to designing with users (Sanoff & Henry, 1990). Participatory design (PD) was initially proposed as a set of approaches to involve workers in the development of technology to increase worker autonomy, skill and task variety (Tollmar & Konrad, 2001). Since many PD approaches put low requirements on users' ability and beforehand knowledge, they have been extended and increasingly adopted in designing with marginalized groups such as older people. Although it is hard to find a fixed methodological description, most PD methods are often characterized as a multi-phase process that includes three key stages (Kaulio & Matti, 1998; Vink et al., 2008): the early phases (exploration, idea generation, etc.), the middle phases (concept refinement, detailed design, etc.) and the later phases (user trial, assessment, finalization, etc.). Theoretically, the end-users are expected to be involved throughout the whole process. However, many PD studies and practices have long been criticized for extensively dealing with the early phases while putting less emphasis on the later stages, especially the refining process (Tollmar & Konrad, 2001). Most research only slightly mentioned the refinement from a holistic perspective. It is reasonable because general participants can actively engage in the early-phase PD activities and contribute their ideas clearly, so the refinement is usually treated as an effortless transition from ideation to evaluation. However, we believe the refining process would be much more important when designing interactive systems with older adults. First of all, the early-phase PD techniques that are available for older people are limited. Haigh (1993)

described the design challenges caused by the aging process of vision, hearing, hand function and mental aspects. Many PD techniques that used to be effective to generate concepts could be difficult for many older people such as sketching, drama and paper modelling. Secondly, many interactive systems to be designed are unfamiliar to older users, so the design subjects in the early phases are usually difficult for them to understand or propose clear ideas. Therefore, the contributions of the early phases would be much less than collaborating with younger participants. In most cases, designers need to collect older participants' related demands and interpret them into system specifications. It is not a smooth process because these proposals are usually ambiguous or even in conflict with each other. Designers need to screen them and make assumptions to develop preliminary concepts. However, the process of interpretation and screening is mainly based on designers' own cognitive and physical ability (Wilkinson, Christopher, & Antonella, 2014), which might lead to a deviation from older users' real needs. Therefore, the refining process is very important to maintain the consistency between designers and older users in the PD process of interactive systems. Moreover, it would be much easier and efficient for older participants to criticize existing proposals than imagining a future design. However, few PD studies focused on how to effectively refine the early-phase design with older people. Related knowledge about the methods and techniques are also limited. Through a case study, this paper describes the refining process of an interactive system designed for nursing home residents to support their independence and social interaction. We explored to adopt a model proposed by Frens, et al. (2003) as a general principle to collect and analyse the data from the perspectives of function, form and interaction. We also explored to use some potential PD techniques to involve older users in the refinement. The findings of this study can demonstrate the effectiveness of the selected PD approach and techniques. They also provide new insights into some key features of interactive systems that are valued by older users.

Related work

There have been many studies in the area of participatory design involving older people, most of which were described as case studies. Šabanović et al. (2015) presented a project to develop socially assistive robots with the elderly diagnosed with depression. They found that older adults were willing and have the ability to engage in PD process, but conventional hands-on participation might be a challenge. Wilkinson et al. (2014) explored how to apply PD approaches in the process of commercial product development through designing an intelligent mobility aid and wheelchair. They addressed the importance of including elderly users during the early discussions to facilitate new concept generation. Veldhoven et al. (2008) focused on designing acceptable assisted living services for the elderly and presented a design vision by illustrating three cases. They summarized three main barriers for elderly users to use new technology as complexity and learnability, lack of perceived benefit, compatibility issues. Seale et al. (2008) explored the use of the focus-group method to help older adults identify their mobility-related problems and put forward new ideas. They found that the participants were able to propose existing and new solutions, but the composition and process of the methodology should be further developed by validating the choice of tools. Kanis et al. (2011) conducted a preliminary study to design ambient assisted living systems for monitoring the daily activities of elderly residents, which proved that traditional use-centred design methods could hardly help older adults to visualize ambient assisted living scenarios. Regarding specific techniques, organizing group design activities such as future workshops and brainstorms were common solutions. Besides, video demonstration was frequently used to quickly provide a concrete vision for older people via showing existing solutions and illustrating future scenarios (Šabanović et al., 2015; Iacono et al., 2014). It can also provoke creative responses and critical discussions (Raijmakers et al., 2006; Lindsay et al., 2012). Some studies also found that hands-on techniques, though some of which were challenging for older adults, were more successful than verbal explanations or demonstrations. Conventional hands-on techniques include sketching, card sorting, collage, paper prototyping, etc. Some studies also explored novel techniques by providing live demos and creating interactive simulated scenarios to actively engage the participants (Kanis et al., 2011). These studies, as mentioned above, mainly focused on elaborating the early phase to generate initial insights and concepts.

As mentioned above, limited studies mentioned how to involve older people in the refinement of preliminary design. Even fewer described it in detail. Prototyping was reported as one of the most common techniques in this phase, especially sketching and paper prototyping (Vanden et al., 2006; Muller & Michael, 1992; Massimi et al., 2007). Demirbilek and Demirkan (2004) conducted a series of research to involve elderly end users in housing design and proposed the USAP (Usability, Safety, Attractiveness Participatory) design model with 5 phases. The second phase is defined as concept refinement in which elderly users are invited to criticize, correct and modify the sketches of the early-phase design. But there were also studies reported that the

seniors had trouble to draw or engage in paper prototyping activities (Vanden et al., 2006). Besides, digital mock-ups were often used to refine interactive products and systems. Ellis, et al. (2000) described their refining work with older users to increase the usability of an existing website. They used the cooperative prototyping method to engage the participant in a circle of page viewing, discussion and comments, reformatting, and further viewing by using a HTML editor and browser. Massimi (2006) and Botero (2013) translated paper designs of an interactive memory aid into digital ones with PowerPoint for the adjustment of elderly users. Different from the early phase, the adjustments were conducted in individual sessions for in-depth feedbacks. Hands-on activities were also proved to be effective to refine the interactive systems for older people. Stappers et al. (2009) presented preliminary ideas to the participants in the form of storyboards, play-acting, and low-profile prototypes to encourage spontaneous suggestions.

By looking at the prior work, we found that some PD methods that are effective to generate preliminary concepts also have potential to be applied in the refining process. However, given the different emphases between the two stages, there is still a need to further explore and develop proper techniques and methods to co-refine interactive systems with older people.

The preliminary design

This paper aims to explore how to collaborate with older users in the refinement of interactive systems through a case study. The preliminary design was from an ongoing project aiming to involve older users in the design process of an interactive system in public spaces of nursing homes. The purpose of the system was to support residents' self-entertainment and promote their social interaction by digitally augmenting residents' newspaper-reading experience. In the early phase, we collaborated with eight residents and developed a preliminary design and a prototype. As shown in Figure 1, the system comprises multiple units installed on different tables in the public space of nursing homes. Each unit consists of newspapers with special marks (coloured circles), a tangible tool and a nearby digital display. The marks indicate the interactive areas on the newspapers. These areas are specially enhanced by modern technologies for printed matter recognition. By placing the tangible tool on the marks, residents could get access to corresponding digital content from the screen. The digital contents are real-time images or videos searched from related websites. The digital interface is very simple. It directly displays digital videos or images with brief descriptions in digital texts. When no one uses the system, the screens would display nothing to avoid disturbing. As shown in the storyboard, the envisioned system was designed not only to support individual entertainment ('After 01' in Figure 1) but also to encourage communication and enhance mutual understanding ('After 02' in Figure 1). Although most features were designed based on participants' reflections in the early phase, the preliminary system was constructed with many assumptions and indefinite features that need to be confirmed or challenged in the refining phase.

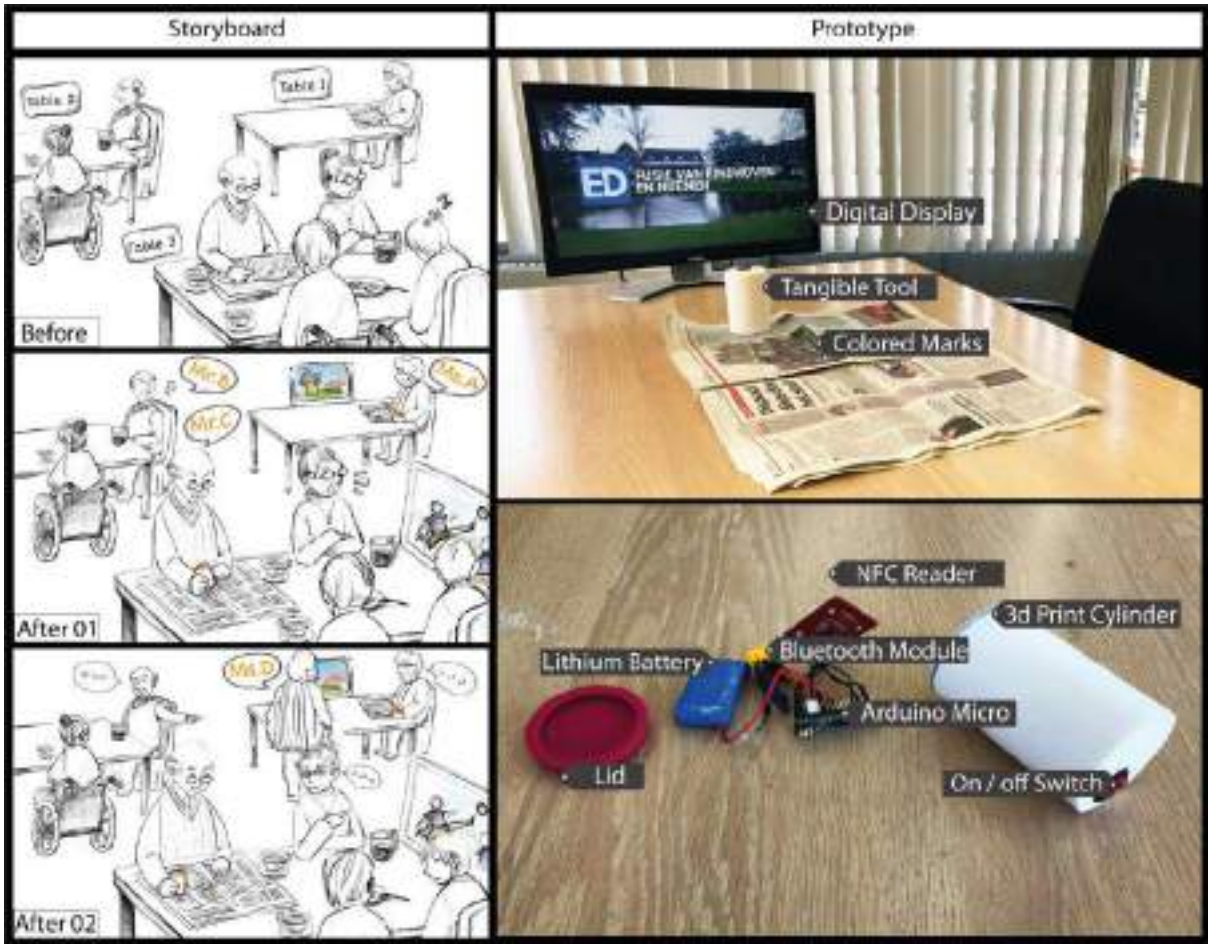


Figure 1: The preliminary design is presented as a functional prototype and a storyboard (the first scenario depicts the current situation in care homes. The last two scenarios illustrate the situations after the system is applied.)

Method

We used the combination of potential PD techniques and social research methods suggested by Pilemalm (2007). The PD techniques include critical discussions on video demonstrations, storytelling, hands-on experience, collaborative prototyping and sketching. The social research methods include semi-structured interviews and observations. Given the difficulties for many older participants to understand and propose suggestions on system specifications from technological perspectives, we used the model proposed by Frens, et al. (2003) as a general principle to guide the design of interview questions, data collection and analysis. This model defines the interactive products through its form, interaction and function, and has also been used to design interactive systems that are pragmatic, attractive and easy to use (Frens et al., 2009; Hengeveld, 2011). For a better understanding, we converted this model into three questions from older users' perspective: "*What should the system be able to do?*" "*What should the system be like?*" and "*How would I use the system?*" According to the model, these questions could not only correspond to different system specifications, but also inherently relate to each other. The data collected included audio-recordings of the interviews, the sketches and the photos taken during each session. The data were transcribed and analysed using thematic analysis techniques, and the findings can guide the refinement of the preliminary design from the three dimensions of the model.

Settings & Participants

This study was conducted in the canteen of a nursing home in Eindhoven. It belongs to a national caring organization that has set up 22 similar nursing homes distributed in this city. The canteen is the main public area where most residents would like to stay when they go out of their private rooms. We firstly acquired permission from the managers, and then the residents were randomly invited individually in the canteen.

Given many participants' reading or writing difficulties, consent was given orally before each session. Five residents agreed to participate. Table 1 gives an overview of their basic information. Reading Frequency refers to their frequency of reading newspapers in public spaces in the nursing home. All of them had the basic hand function to eat independently, but only P5 could walk independently.

Table 1: the basic information of the participants (reading frequency: frequency of reading newspapers in public spaces. Sometimes: 3-4 times a week; rarely: 1-2 times a week.)

Participant	*Gender*	*Age*	*Length of Residence*	*News Source*	*Reading Frequency*
P1	F	82	9 years	TV, newspapers	Always
P2	F	92	11 years	TV	Never
P3	M	65	1.5 years	TV, newspapers	Always
P4	F	70	2 years	TV, newspapers, smart phones	Rarely
P5	M	84	5 years	TV, newspaper	Sometimes

Procedure

Figure 2: the materials used in this case study

1.Introduction (5 minutes)

We started each session with a brief verbal introduction to inform the participants that we hope they could help us to further develop and refine our preliminary design of an interactive system that could present related digital information when they were reading newspapers in public spaces. They were encouraged to express any comments, suggestions and questions at any time.

2. Demonstrations of related existing solutions (10 minutes)

After the short introduction, we showed the participants six videos of some existing technologies or systems to augment paper interfaces and ask their opinions during each demonstration. The purpose was to enhance their understanding of such systems and give the participants a wider vision of current solutions to avoid restricting their minds within our own design. The six videos presented three kinds of solutions that were

already available on the market but designed for other contexts. Table 2 gives an overview of the solutions from the three aspects mentioned above. After showing all the videos, the participants were asked to compare them, choose the solution they like or dislike, and then describe the reasons. During this, we presented six cards that represent each video to help them recall.

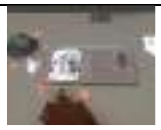
3. Demonstration and experience of the preliminary design (15 minutes)

In this stage, we presented the preliminary design by showing the participants a 1-minute animation converted from the sketched storyboard (Figure 1). The video demonstrated the different scenarios before and after the design applied. We explained the details and asked their opinions simultaneously. After this, we offered the participants the functional prototype to experience for 10 minutes and provide further feedback. We prepared four pieces of digital content related to the printed content from a local newspaper according to the residents' preferences reflected from the early phase. They were a piece of entertainment news, a current event that took place in their neighborhood, real-time weather information and an image of crossword puzzles.

4. Collaborative refinement (30 minutes)

In the final step, the participants were asked: "*if you could change anything about the design, what and how would you like to change?*" Then, they were encouraged to describe their ideas from function, form and interaction. The designers would help to quickly embody their proposals by sketching. In addition, we prepared three boxes of design references to facilitate their refinement on physical interfaces (Figure 2). The first box contains some daily objects that are often used on paper including a stapler, a magnifier, a stamp, a glue tape roller, a marker and a glue stick. The second box contains some physical electronic interfaces such as a mouse, a remote controller, a small gamepad with a joystick, a pen-like scanner and a gun-like scanner. In the third box, we prepared some electronic components such as some buttons, dials, joysticks in different forms and sizes that can be added to other devices. The participants could select their preferred forms, describe functions they liked to add and show the designer how they would use them. Regarding digital interface and interaction of the system, we used a media player and a live-programming environment (VVVV in this case) that is characterized by real-time rendering and simulation to quickly visualize the participants' proposals on the screen. In this step, the participants and the designers interactively engaged in a cycle of discussion, revising and previewing.

Table 2: the demonstrated existing solutions

Solution	*Form*	*Function*	*Interaction*	
			With physical interface	*With digital interface*
Interactive tabletop with projection		Recognize pages by codes, track paper position, project interactive animations on the page and table	Flip the pages, move the papers	Touch and drag projected elements
Interactive tabletop with multi-touch table		Recognize cards by code, track card position, display interactive information around cards on the screen	Put the cards on the screen, move the cards	Touch and drag digital elements on the screen
Augmented Reality book with PC and camera		Recognize pages by the camera above, track paper position, display digital effects above the page on the screen	Put the book under the camera, flip pages, move the book	None
Augmented Reality book with tablet		Recognize printed images with the embedded camera, track image position, display interactive animations above the image on the screen	Hold the device, point it at the page, flip papers, move the book	Touch and drag digital elements on the screen

Pen-like handheld scanner		Recognize printed texts, display interactive information on the screen	Hold the scanner, slide it on the paper, press the button	Touch digital buttons on the screen
Gun-like handheld scanner		Recognize printed codes, display interactive information on the screen	Hold the scanner, point it at the code, press the button	Select functions with the mouse, input information with the keyboard

Findings

What should the system be able to do?

In Step 2, the participants' function-related feedbacks were very limited. The videos of the existing solutions were more likely to trigger their comments about form and interaction because it was much more direct and vivid to understand. Even though we kept explaining during each demonstration, it still seemed to be difficult for the participants to understand what these applications could actually do because they were designed for the younger generations and other contexts. "*I am too old for this. I can't learn this*." P2 said. Their reflections were mainly about different ways to recognize printed content. When watching the videos of the augmented reality books, P5 said people living here were not familiar with computers and smart phones, but it might have future because the dynamic digital contents would attract more people and could save the time of reading. He also said: "*However, people here would not like the cameras pointed at their tables. They would feel their privacy (has) been violated*." P4 liked the solution of handheld scanners and said it reminded her of the barcode scanner from the supermarkets. "*People here can use this to select the articles they like and project them on the screen*."

In Step 3, the participants could propose more ideas on content selection especially after they experienced the prototype. Local news was their common interest, which was consistent with the insights from the early phase. They also had some personal interests that could represent the preferences of similar groups. P1 liked puzzles and she thought the system was helpful for her to solve puzzles together with her friends. P2 addressed the importance of real-time content because many people here liked to read and talk about sports news. P3 thought the design was suitable to be used in small groups, and people could choose their preferred subjects. P4 preferred entertainment news because sometimes there were live performances in this canteen. Many People liked it, but they need to pay for them. P4 also suggested that the system could be used not only on newspapers, but also on magazines, photos, flyers of advertisements and even postcards. "*I have a sister living abroad. She sometimes sent me postcards. Maybe I can see her with this!*" P4 said. P5 said the preliminary design was much easier for him to understand than the videos of other solutions. "*Of course, it relates to personal preferences. Some people like reading newspapers. Some people don't*." He said, "*But I think such thing is important to provide different things for people here to spend their time. Their life is too structured. No future, no challenges. They don't know how to spend their days and the next days.*"

In Step 4, the collaborative explorations could trigger the participants to explore what else the system could do besides the very basic functions of the preliminary design. They tended to compare it with the devices that they were familiar with such as televisions and radios. The result showed that all of them wanted to control the volume of digital content. P1 said the canteen was too noisy to hear the videos sometimes. "*I cannot hear it unless I sit close to the screen*." She said. P2 emphasized the importance of sound due to her poor sight. She said it was also very important when using the design in groups. " *The volume needs to be loud if the group is watching it, but it may disturb others if it is too loud*." P4 also expressed her need to adjust the sound personally. She suggested the system could connect to some personal hearing devices so that everyone could set their own volume. P3 and P5 hoped they could control the volume with very low efforts. "*I lost one leg last year. I don't want to walk to the screen and bent over to control the sound if I can do it sitting here*." P3 said. The participants also proposed other potential functions to meet their various needs. P1 and P4 were inspired by the remote control and thought it would be nice if they could pause the video. P1 thought the pause function would trigger people to discuss. P4 though the pause could let her take a break if there was too much

digital information. Besides, P1 also wanted to switch the images displayed because she was curious about all the details. P4 asked if she could zoom in and zoom out the images. P5 suggested that partly rewind would be useful because people would easily miss the interesting part due to their sensory impairments and unstable environmental conditions. However, although we encouraged them to propose as many ideas as they could, all the participants repeatedly reminded us not to add too many functions. "*You must keep it simple. Just basic functions or people here will not use it.*" P2 said.

What should the system be like?

In Step 2, the participants' form-related comments were very general and similar to what P4 said: "*It is beautiful! I like it.*" But when we asked how they would feel if we applied these solutions in this area, their attitudes changed. All of them held the view that the videos looked very nice, but people here do not like things look technical here. "*They look too futuristic. People may get curious, but most of them always keep a distance from the innovations*." P5 said. Most of their critical comments focused on physical interfaces. All of them thought the devices in the videos were too complicated, including P4 who could use smart phones. P1 thought the interactive tabletops could be useful when the caregivers host activities, which could develop their brains, but it would not be suitable to use independently. P1 and P4 reflected that the screens of smart phones were too small to watch. Tablets were much better, but they were too heavy to hold. Comparing with interactive tabletops and augmented reality books, the handheld scanners were easier for them to understand because they had seen them before. However, they did not like the technical appearance. Besides, they were not friendly to older adults. P3 and P5 said that it was difficult for many people here to keep holding devices. Besides, P5 said he did not like the barcodes on the paper, which looks too abstract. "*I don't like it and don't trust it.*" He directly said. P2 said she could speak for most residents because she has lived here for a long time. She emphasized that people here fear unfamiliar things. They would not use or share it if it looked too technical.

In Step 3, the animated storyboard and our simultaneous explanations provided them a general understanding of the design. They all agreed that the canteen was the ideal location to install it because this was the most popular space in this nursing home. P1 suggested the information should be displayed on bigger screens than the laptop we used. P2, P3 and P4 liked the idea of distributed units because they used to share one big display in the whole space when there were some activities. But many people could not watch or hear it very clearly, and different people had different interests. These complaints also reflected in the early phase, which further confirmed our design decisions. P4 also suggested that these displays could be folded under the table when not being used. Most of their feedbacks still focused on physical interfaces. Although we asked them about digital interfaces, most of them only wanted to watch images or videos from the display. They hoped to keep digital information as simple as possible. When experiencing the prototype, all of the participants except P3 had difficulties to find the marks on the newspaper when they were holding the tangible tool. But they could quickly understand and use independently when we pointed them out. They suggested that the marks should be clearer and more obvious. P5 said: "*Maybe a different colour. Maybe a different shape.*" Regarding the tangible tool, most participants were basically satisfied with its current form, especially its size and weight. Some participants also propose their opinions for improvement. P1 said the tool looked too much like a coffee cup, which would easily lead to residents' confusion. Besides, the size should not be too small, otherwise people would not notice it or feel difficult to find it. P2 hoped it could be more attractive because the current form was too ordinary.

In Step 4, we encouraged the participants to propose specific solutions to refine the current physical and digital form based on their requirements in previous steps. However, it seemed they had little enthusiasm on the digital aspects. All their feedbacks still focused on keeping them as simple as possible or use their familiar interface like televisions. P1 suggested there could be some simple instructions on the screen to guide people to use it. Regarding the physical aspects, it also seemed difficult and stressful for them to describe their own solutions than criticizing videos or the preliminary design. The reference objects turned out to be very helpful to facilitate the process of the collaborative refinement of the physical interface. After trying the objects, they selected their favourite form. As shown in Figure 3, P4 thought the tangible tool could be like a pen while the other four participants selected stamp as an ideal shape. P4 made the choice because she was attracted by the video in Step 2. She thought the shape was very comfortable and easy for her to use. Besides, if the system were installed on many tables, it would be convenient to carry it to other places. However, P2 and P5 hold a different view that there were usually normal pens on the tables, which would make people mix them up and feel confused. P2 also expressed her concerns about security:" *The pen was too small to be found on the table,*

and people will easily take it away." P3 remarked that many people could not properly use pens due to shaking hands. P1 was satisfied with the shape and size of the stamp. She thought it was important to freely move it around like playing chess. In addition, it was easy to draw residents' attention because they had never seen stamps on the tables before. P2 thought the shape of the stamp could motivate people to place the tool on papers. P3 and P5 also liked the shape because it was effortless to pick up and drop down than other objects. Furthermore, P1 and P5 thought the stamp looked much nicer because the most tools related to paper were for work or study. "*It is strange to use these because people here do not study or work anymore.*" P5 said. He also pointed out that no residents would prefer assistive tools like the magnifier that might make them feel stigmatized. None of the participants proposed material-related requirements unless we asked. Most of them preferred plastic tools than wooden ones because the plastic was easier to clean if it would be used by many people. P2 and P5 also thought using wood was too old-fashioned.

How would I use the system?

In Step 2, the participants' interaction-related comments were very similar to each other. All of them claimed that touching or dragging on digital screens was too complicated for them. P1 said:" *My granddaughter taught me many times, but I still cannot use it (tablet).*" The tangible scanners were much easier for them to accept and understand. The interaction with the pen-like scanner was more preferable because holding the gun-like scanner in the air was very difficult for many older people, not to mention they needed to point the scanner at a certain area on the paper.

In Step 3, all the participants could quickly understand the basic interaction of the system from the storyboard animation. After quick instruction, they all could use the prototype independently although some of them have difficulties to find the marks. They agreed that the interaction was friendly for older people because it was effortless and required much less accuracy than the scanners in Step 2. However, when asked to develop more interactions that could integrate the functions and forms that they proposed previously, none of them could propose solutions by themselves.

In Step 4, given the participants' difficulties to design interactions, we had to play a more leading role in this part by proposing more possibilities and visualizing their ideas by sketching. We found the participants relied on the objects in the boxes very much for inspiration and reference. As shown in Figure 3, adding big buttons were the most common solution for the functions like "on-off", "play-pause" and "switch images". Most of them preferred to put the buttons near the handles so that they could easily press them when holding the tool. But P5 thought it would cause many maloperations when picking up and moving the tool around, so he chose to put the button at the bottom. As for the linear functions such as controlling the volume and rewind, P1 and P3 were inspired by the mouse wheel and proposed to adjust the volume by scrolling a gear embedded in the handle. P5 also wanted to add a wheel at the side of the pedestal of the stamp to rewind the videos. P4 suggested adding a special button. People could press its two ends to turn up / down the volume. P2 was inspired by her experience of using old radios. She thought it would be nice to rotate the handle like a knob. Besides sketching, we also simulated the digital feedbacks with fast programming tools (VVVV in this case) and media players to create more concrete scenarios for the participants. P5 gave up adding the rewind function after he watched the simulated effects. "*It is too sensitive. The images are always changing. I guess people may not like this*." He said.

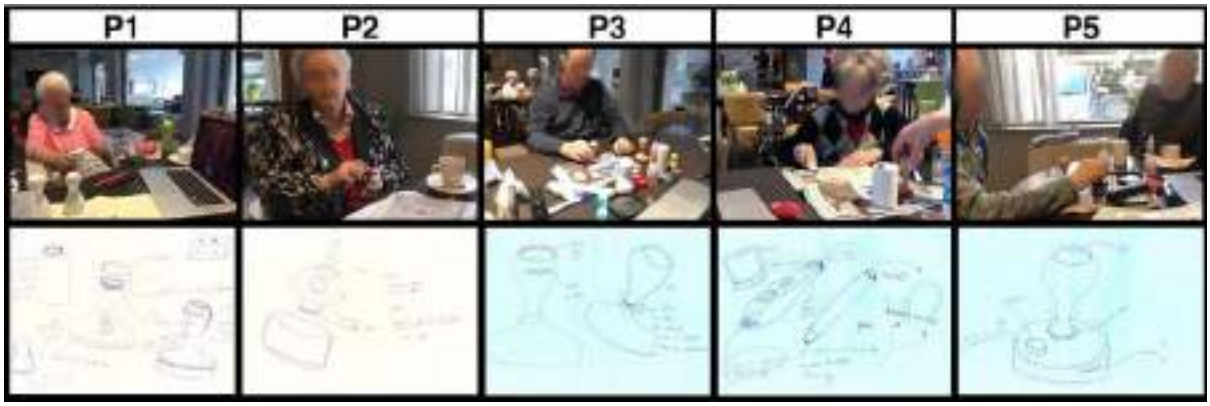


Figure 3: All the participants tend to refine the system through its physical features.

Discussion

Our findings demonstrated that the participants were willing and had the ability to collaborate with designers in the refinement of interactive systems. The three perspectives were not only easy to be accepted by older participants but also useful to be a general guidance for the designers.

Overall, this study showed the importance of the selection of the site. Robins (1999) proposed two approaches: "*Bring the designers to the workplace and bring the workers to the design room*." Although design room has the advantage of easier access to equipment and technical experts, we believe participatory activities with older people should take place where the system will be applied because the real-life settings can reduce their efforts of imagination and take the environmental factors into account. Furthermore, researchers indicated that older people were more vulnerable to their surroundings (Fowles, 2000; Carstensen et al., 1986), so it is important to create a free and comfortable atmosphere given their physical inconveniences. In addition, although this study could not prove individual activities were better than group activities, we agree with Neustaedter (2006) and Sanders' (2010) studies indicating that individual sessions are more appropriate to design completely new systems and work better in detailing stages. It mainly because the refinement requires older participants' in-depth involvement rather than collecting parallel ideas, which is hard to be ensured through group sessions. Our prior work also revealed the problem that older people with better health and stronger personalities would easily be dominant in conversations and influence other group members. If it has to involve multiple participants simultaneously, we suggest involving more designers and experts to support each participant. In addition, we found it is very important for the designers to keep paying attention to the participants' energy consumption. The duration of each step should be more flexible according to participants' different physical situations, which could also show the superiority of individual sessions.

This study also provides detailed implications of the methods for collaborative refinement with older people. Although the video demonstrations of existing solutions have been frequently used in the early-phase PD activities, we believe it would easily create preconceived impressions that might constrain older participants' creativity due to their limited understanding of novel technologies. This study demonstrated that showing existing solutions was more appropriate in collaborative refinement with older adults. We found that the videos were able to broaden participants' minds and provoke their critical discussions. The key was to make simultaneous explanations and ask open questions during the demonstrations because it was very difficult for them to remember the details even though we prepared cards to help them recall. Besides, we learned that it was important to control the length and number of videos. Designers should select the most representative solutions and keep each video short. We presented 6 videos in this case, which seemed to be beyond some participants' ability to process the new information. They appeared to be uncomfortable when watching the last few videos, which certainly affected their contributions in this step. From the data we collected, we found the videos were more likely to trigger participants' comments on the form and interaction than the function of the systems. The reasons could be that they were unfamiliar with the technologies or the contexts, and some functions could not be directly shown through videos even though we explained. The animated storyboard was very useful to help the participants quickly understand the usage scenarios of the preliminary design. However, such understanding still seemed to be very superficial. It might because the storyboard could not fully illustrate some functions and details. It might also because sketched animations are not as easy to

understand as live-action videos. The hands-on experience of functional prototype proved to be very effective for the participants to fully understand the concept and facilitate them to refine the system. We could tell the obvious differences between the participants' facial, verbal and bodily reactions before and after they experienced the prototype. We also found that using functional prototypes was more likely to trigger participants' ideas on functions. It seemed that such prototypes could effectively reduce the participants' efforts of imagination and increase the fun of creativity. In Step 4, the participants' major efforts were spent on embodying their preferred functions in suitable form and interaction, which was very challenging even for younger people. Although there was no fixed procedure, we found that all participants started with refining physical interfaces because they thought it was the most important and familiar part. The design references turned out to be very useful, even though we had concerns about the side effects to constrain their ideas. To minimize the side effects, we suggested that the selected related design references should be representative and have diverse features. As for refining digital features, the participants showed little interest and confidence. Although sketching has long been a widely accepted technique in participatory design, we found it was not as effective as expected when refining the digital aspects of interactive systems for older people because it is abstract, static and non-interactive. The live-programming platform (VVVV) that we used to simulate some digital feedbacks and effects proved to be helpful for the participants to preview the result. Therefore, we identified the need to develop more related hardware-software toolkits for rapidly visualize concrete, dynamic and interactive design proposals for older adults.

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Research Perspectives IN THE ERA OF Transformations

Through service design to improve the HRQOL (Health-Related Quality of Life) in the treatment and rehabilitation of elderly women with breast cancer in Shanghai

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Breast cancer is the most common cancer among women in the world. As China enters the aging society, elderly breast cancer presents the characteristics of high incidence, late detection and long treatment time. This is related to the imperfect services that elderly women receive in the treatment and rehabilitation. Eventually, the HRQOL (health-related quality of life) in their later years has declined. By using service design tools, the authors conducted field research and in-depth interviews in Shanghai hospitals and developed service strategy to improve the Health-Related Quality of Life (HRQOL) in the treatment and rehabilitation of elderly women with breast cancer. The paper presents three design contents: (1) smart healthcare service system; (2) improvement of service scenarios in the hospital; (3) a life-long service that links communities, families, and individuals to transform breast cancer into "chronic disease". In this paper, the authors also discuss the next step and prospects.

Keywords: aging society, breast cancer, service design, smart healthcare, health-related quality of life

Introduction

Breast cancer is the most common cancer among women in the world, with an incidence of 24.2% (Bray et al., 2018). In China, the incidence of breast cancer ranks first among female malignant neoplasms, and Shanghai has the highest incidence of breast cancer among all cities (Huang et al., 2012). Elderly women with breast cancer in the survival period, due to the decline of physical function brought by the loss of health, often accompanied by the decline of physiological, emotional, social functions (Hu & Huang, 2008). They need to bear huge pressure from family and society.

As China enters the aging society, elderly breast cancer presents the characteristics of high incidence and late detection and long treatment time. According to relevant predictions, the number of elderly people in China will reach 270 million in 2023 (Qiu, Tian, Zheng, Cheng & Qin, 2015). Studies have shown that women aged 60 to 79 are 13 times more likely to have breast cancer than women under 39 (Wu, 2013). With the increase in the elderly population, there will be more and more elderly breast cancer patients.

Developed countries, such as the United States and the United Kingdom have developed smart medical care, involving electronic medical records, doctor-patient communication, personalization, and continuous medical care (Qiu et al., 2015). Shanghai, as a representative city of medical treatment in China, has formulated a

blueprint for smart medical care covering medical security, public health, medical services and drug security (Gong, Sun, Lin & Gu, 2013).

The specificity of pathology of elderly women with breast cancer in Shanghai

In Shanghai, the elderly breast cancer presents the characteristics of high incidence, late detection, long treatment time and low survival rate.

Firstly, the elderly breast cancer presents the characteristics of high incidence and late detection. Elderly women have poor alertness to their own physical conditions, and do not have a strong sense of health examination (Wei, Qin, Yu, Tang & Pan, 2007). Many elderly people do not go to the doctor until they have serious physical symptoms, which leads to the late detection of elderly breast cancer patients. By analysing 99 elderly patients with breast cancer, Cai found that the average disease duration of elderly breast cancer patients before treatment was 2 years, and the clinical stage was mostly staged II and III (77.9%) (Cai, Shao, Gao & Hu, 2000).

Secondly, elderly women with breast cancer have longer treatment time than young patients. Many elderly women discover breast cancer in the late period which leads to their long treatment time. According to the statistics, 45% of elderly patients with breast cancer have a course of more than 6 months (Wei et al., 2007).

Furthermore, the rehabilitation of breast cancer in elderly women is difficult. Elderly breast cancer patients often coexist with chronic diseases such as cardiovascular disease, diabetes, chronic lung disease, hypertension, and cerebral infarction. The data of Qiu showed that the overall 10-year survival rate of elderly patients is 40.8%, lower than 50.8% of young patients (Qiu, Wu & Guo, 2019). Therefore, it is necessary to take into account the treatment of these comorbidities in the treatment of breast cancer, otherwise, it will affect the quality of life of patients.

Elderly women who live in first-tier cities, such as Shanghai, tend to have strong negative psychology and uncertainty about the disease at the psychological level. A psychological study of 58 elderly cancer patients found that the depression rate of elderly patients was 32.76%, much higher than that of young patients (Diao, Niu & Li, 2002). This is because the social role of the elderly has undergone a huge transformation, from the "caregiver" to "people who need to be cared for", which leads to a stronger sense of loneliness and dependence. Especially after suffering from cancer, elderly patients hope to get more intimate and lasting interpersonal relationships (Li, Shi, Shen & Shen, 2015). By analysing the data of 348 elderly women with breast cancer in the literature of the paper, the research team found that the scores were low in physiological status, social and family status, emotional status and additional attention (Li, Sun & Yan, 2015; Fang et al., 2010).

Service design for treatment and rehabilitation of breast cancer

Service design has been introduced into the medical and health fields in recent years. Mayo Clinic has achieved great success with the use of HealthKit service to share health data among patients, healthcare workers and medical institutions. Design schools and companies already have done some service research and service design on improving the treatment and rehabilitation of the elderly. They help breast cancer patients with treatment and rehabilitation from four aspects: (1) cognitive education, (2) patient care, (3) community support, (4) smart health care.

Service design in cognitive education

In 2013, the project “Staying the Course” from the Royal College of Art (RCA) aims to help breast cancer patients to take medication at home. The study revealed that education is the most important factor affecting compliance, also that smartphone technology is useful in people's lifestyle and routines. They found that most patients learn about their medications only in one initial session with the cancer care nurse. This session covers the different drugs, when and how they need to be taken, as well as the side effects that may be experienced. The patients need to remember a lot of things which make them feel stressed and worried. The main research output is a smartphone app, developed to support patients during the education session with the nurse. This provides relevant information about their specific treatment, and patients can review the different elements of their treatment that are confusing or unclear (Riadigos, 2013).

Service design in patient care

National Breast Cancer Foundation (NBCF) develop HOPE Kits which are filled with thoughtful items: unscented lotion, fuzzy socks, tea, “Hope is Stronger than Fear” bracelet, hope journal, lip balm, education resources, etc. The patients would feel comforting and encouraging while undergoing breast cancer treatment after they receive this kit. Because NBCF is a public welfare organization, it offers five ways to get involved: (1) donate, sponsor a Hope kit for a woman with breast cancer; (2) send, send a HOPE Kit to a loved one facing breast cancer; (3) volunteer, pack or prepare contents for HOPE Kits; (4) fundraise, raise funds and deliver HOPE Kits locally; (5) partner, support HOPE Kits through gift-in-kind and sponsorship.

Figure 1: HOPE Kit (Source: National Breast Cancer Foundation website)

Service design in community support

In 2018, North-eastern Illinois University presents a mobile application named My Guide to improve symptom burden and health-related quality of life among Hispanic women who have completed active treatment for breast cancer by increasing their health literacy (Iacobelli et al., 2018). They developed a community-supported approach to building the application, which involved eliciting feedback from community leaders, conducting a formal evaluation of design principles based on previous interaction design research and user responses and incorporating feedback from potential future users.

Figure 2: My Guide (Source: Iacobelli et al., 2018)

In China, the application “Breast Cancer Home” has three main functions: the circle of patients, the establishment of a communication platform for breast cancer patients; anti-cancer knowledge, pushing the authority of anti-cancer knowledge; similar medical records, finding similar patients, and viewing the relevant treatment programs.

Figure 3: The interface of application 'Breast Cancer Home' (Source: the application "Breast Cancer Home")

1. Service design in smart health care

Mayo Clinic Application has revolutionized the relationship between health applications and users in the past. In the past, the data provided by health applications were isolated and one-sided, so users could not get a comprehensive understanding of their health status. By using the research results of Mayo Clinic in patient education for many years, and using the application software of Healthkit, it provided patients with customized health management programs. In the hospital treatment scenario, each department will make the consultation seamless by the way of intelligent collaboration. In the course of breast cancer treatment, Mayo Clinic doctors will coordinate with the local doctors in the patient's location, invite local doctors to provide chemotherapy and other medication to save patient time.

Figure 4: Mayo Clinic (Source: Mayo Clinic website)

In China, there are some cases of smart medical care, such as the wisdom hospital of Beijing University People's Hospital, the Shaoyifu Hospital of Zhejiang University, etc. The smart medical care mainly focuses on the internal management of the hospital and the electronification of the patient's medical treatment process.

All of these designs show that service design plays an important role in improving the treatment, rehabilitation and quality of life of the patients. In addition, a large number of studies have shown that the health-related quality of life of breast cancer patients can be improved through patient care psychological intervention and community support (Zhang & Tong, 2008; Peng, 2016).

Research purpose

Existing researches have proven that service design can improve the physical and psychological discomfort of elderly patients during treatment and rehabilitation. Therefore, in this research, the research team hopes to

combine the new technology and social trends through service design to enhance the health-related quality of life of elderly breast cancer patients in Shanghai during treatment and rehabilitation.

Design Process and Methodology

In 2018, the research team conducted field research on three hospitals and serval neighbouring residential communities in Shanghai. And then the research team conducted in-depth interviews and did records with 17 people from Shanghai, including 6 elderly women with breast cancer, 7 family members, and 4 breast surgeons.

Service design allows us to not only focus on the data, but also through in-depth interviews, insights, role-playing, and the establishment of empathy and other service design methods to understand the real needs and perspectives of patients. As Wendy Perchick from ZGF company said:

> *Patients have the power of choice—they own this facility and design their own experience. A patient told me that he felt the healing intensified here because he felt so relaxed. (Perchick, 2018)*

Research standard based on HRQOL system

In this study, the research team adopted the standard system of Health-Related Quality of Life. Health-Related Quality of Life (HRQOL) refers to the assessment of health status and subjective satisfaction associated with personal life events under the influence of illness, accidental injury and medical intervention. Centers for Disease Control and Prevention defines HRQOL as:

> *Health-related quality of life (HRQOL) is a multi-dimensional concept that includes domains related to physical, mental, emotional, and social functioning. It goes beyond direct measures of population health, life expectancy, and causes of death, and focuses on the impact health status has on quality of life. A related concept of HRQOL is well-being, which assesses the positive aspects of a person's life, such as positive emotions and life satisfaction. (Centers for Disease Control and Prevention)*

HRQOL is an important refinement that plays to the needs of elderly people. Medical workers have generally accepted the view that "for cancer patients, survival or disease-free survival is an important evaluation index, and health-related quality of life is the basis". The evaluation of the health-related quality of life of cancer patients has become one of the endpoints of cancer clinical research (Zheng et al., 2007).

Through the analysis and refinement of HRQOL, we can conduct research and insight into service design from a medical point of view, and also provide direction for subsequent service output. Patients of different cultures and values have different experiences of their life goals, expectations and standards, and the state of life-related to the things they care about, including physical function, mental function, role function, social function, and overall feeling of health.

Figure 5: Health-related quality of life (Source: authors)

1. Physical function refers to individual activity and physical strength. It mainly includes physical activity, self-care ability, and physical strength.
2. Psychological function mainly refers to emotional reactions (anxiety, depression, stress, etc.) and cognitive function (attention, memory, thinking ability, etc.). Both disease and environmental factors can bring psychological changes to patients.
3. Role function refers to the effect of disease on the work or study or housework of the patient.
4. Social function refers to the quality and quantity of an individual's social network, such as the frequency of contact with family, friends and other intimate relationship.
5. The overall feeling of health status is self-evaluation by the patient's satisfaction with his or her health status, reflecting the patient's subjective feelings about his or her life.

Under the systematic standard of HRQOL, the research team members developed the research strategy: Through the observation and tracking of the behaviors of elderly breast cancer patients in different scenes to find their behaviors and processes. Afterwards, conducting in-depth interviews and guide narration with stakeholders such as elderly breast cancer patients, family members and medical staff to help them recall the problems (physical, psychological, social, role and overall feelings) in the process of treatment and rehabilitation. In this way, we can find insights about their explicit and implicit needs, and then determine the service design directions to improve patients' health-related life quality, and the touchpoints to improve patients' emotional experience, so as to provide a basis for the proposal of later service strategies.

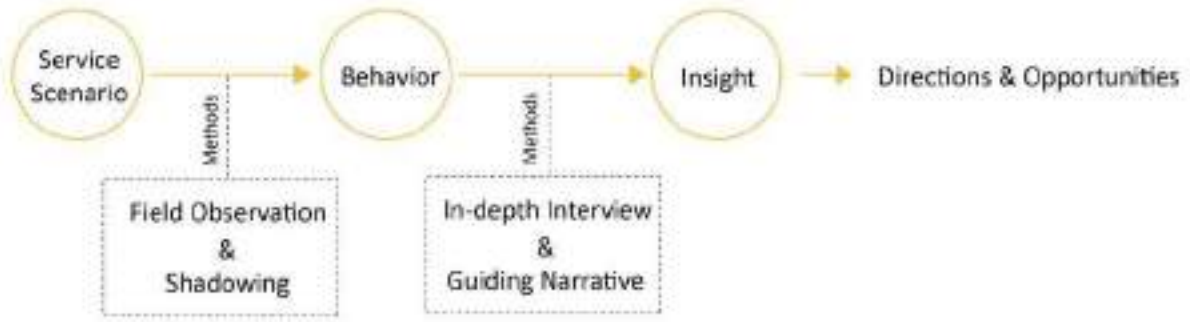

Figure 6 ： Research strategy (Source: authors)

Field observation

According to the treatment and rehabilitation process of elderly patients, the research team divided the scene into three parts: medical service scenario in hospital, family care scenario, community mutual assistance scenario.

In 2018, the research team conducted field research on three hospitals and serval neighbouring residential communities in Shanghai. The research team members observed the three service scenarios and took pictures of relevant service scenarios. Then we corresponded the service scenarios photos with user behaviour and conducted in-depth interviews and follow-up observations with stakeholders (elderly breast cancer patients, family members, doctors, and nurses).

Medical service scenario in hospital:

The hospital's treatment scenario is the most important scenario for patient treatment. In the investigation of hospitals in Shanghai, the research team divided the hospital treatment scene into three parts: hospitalization, surgery and daytime chemotherapy.

Figure 7: Medical service scenario in hospital (Source: photos taken by authors)

After diagnosis, according to different levels of cancer, elderly patients need to undergo hospitalization, chemotherapy and surgery. Through field observation, the research team found that the phenomena in the hospitalization scenario: (1) The accompanying staff were mostly children or husbands, but they rarely chatted with each other, (2) The patient's activities were limited to walking in the corridor, rarely going downstairs, (3) It's difficult for patients to go to the bathroom when they were infused, and they need help from others, (4) The wards were two-person or three-person rooms, sometimes patients would be disturbed by others (lights, sounds), (5) Chemotherapy led to hair loss, loss of appetite, vomiting, sweating and other physical discomfort.

After the condition is stable, the patient would start daytime chemotherapy. In the service scenario of daytime chemotherapy, the research team found that: (1) The patient need to wait for 1-2 hours before infusion. The waiting time was long. (2) It took one day for patients to do daytime chemotherapy, but because of the limitation of hospital space, they can only sit. (3) It's inconvenient for patients to check infusion progress.

Family care scenario:

In the nursing environment of the family, the degree of tension of the patient is low, and the mood tends to be gentle. Home nursing has an important influence on follow-up treatment, rehabilitation exercise and psychological recovery. The current phenomena were as follows :(1) the rehabilitation exercises were monotone and hard to insist on; (2) the elderly patients were retired people, who often stay at home and seldom communicate with others.

Community mutual assistance scenario:

At present, community mutual assistance is mainly divided into online community mutual assistance and offline real community mutual assistance. By investigating online communities (breast cancer homes, breast cancer control, and health-loving businesses), the research team found that few elderly women are active on online communication platforms.

Regarding the offline real community mutual assistance, the research team investigated the hospital-based patient support community. The members of the platform are breast cancer patients who have been treated in Shanghai hospital and volunteers from all walks of life. The platform regularly organizes activities and lectures to help doctors and patients, patients and patients communicate with each other. It is a targeted and efficient mutual help platform. The phenomena in this scene were: (1) the patient was willing to communicate with people who have the same condition and the same feelings. (2) Compared with the hospital scene, the offline community scene was warmer and the patient was more relaxed.

Figure 8: Offline community mutual assistance scenario (Source: Yankang organization)

In-depth interviews

The research team conducted in-depth interviews and did records with 17 people from Shanghai, including 6 breast cancer patients, 7 family members, and 4 breast surgeons. We summarized the problems of HRQOL, interviewed elderly women patients, family members and doctors, and displayed pictures in detail to arouse their memory in the course of treatment and rehabilitation.

Elderly breast cancer patients: In terms of treatment, many patients said that they would consider choosing a hospital close to the community for treatment. The main reason was that it was convenient to arrive, but there was also the fear that “the big hospital was better than the community hospital”. During the treatment, the problems were mainly due to the lack of understanding of related technical terms and strong physical response during chemotherapy.

On the psychological side, most of the elderly had shown an optimistic attitude and actively cooperate with the treatment, but sometimes they still felt sad and anxious. Ms. Hu (62-year-old) said: " On the day before the operation, I told the patient who next to me, ‘After taking the shower today, I will not be complete tomorrow.’ I cried in the toilet for a long time that night."

When it comes to the problems of rehabilitation at home, many elderly people said that it was difficult to perform rehabilitation training at home, which caused arm edema. Most elderly patients expressed their willingness to chat and engage in activities with people who were similar to themselves. They thought that "they had the same illness, they felt the same way, and I was willing to listen to them."

Family members: In the care of the treatment, most of the family members said that the feeling of accompanying the night was poor, mainly due to the limited space of the hospital and the need to check the patient's situation at any time. At the stage of home rehabilitation, many family members said that sometimes they would be too nervous about the physical condition of the patients, and some families became full-time "free carer" because of their restlessness.

Breast doctors: In terms of treatment, doctors said that some patients or their families would frequently ask them about the patients’ situation because of fear, causing trouble in their normal work. Doctors also said that they were very willing to care about the patient's physical condition and would do their best to help patients. About the rehabilitation, one doctor said that the patient would be told to do rehabilitation exercise every day, but due to the limited space, they cannot be carried out in the hospital.

Figure 9: In-depth interviews & guiding narrative & journey map (Source: photos taken by authors)

Journey map and stakeholder map

Through field observation, in-depth interviews and analysis, the research team came up with journey map and stakeholder map to clarify the impact at each stage in the service.

The journey map mainly describes three aspects: (1) the behaviours of elderly breast cancer patients during treatment (2) the corresponding scenes (3) mood curve.

Figure 10: Journey map – Treatment of elderly patients with breast cancer in hospital in Shanghai (Source: authors)

The stakeholder map primarily illustrates existing and potential relationships of elderly breast cancer patients. The different distances on this map represent different relationships among them. The bigger the distance between them, the smaller the relationship, the smaller the distance, the bigger the relationship.

Figure 11: Stakeholder map (Source: authors)

Insight

The main reasons for the decline in HRQOL in breast cancer patients during treatment and rehabilitation are as follows:

Physical function:

1. After the operation, the ability of self-care and activity is limited.
1. Patients need to endure cancer pain and chemotherapy radiotherapy. There will be physical discomfort such as vomiting, hair loss, constipation, sweating, numbness or stinging of hands and feet, skin changes, nausea, loss of appetite, tightness or difficulty breathing.
2. Elderly patients often have complications such as diabetes and high blood pressure.

Role function and social function:

1. Physical discomforts and some complications make elderly patients cannot carry out the normal living and social activities. These problems affect the role and social function of patients to a certain extent.
3. The ability of knowledge acceptance, understanding, and learning of elderly patients is weaker than that of young people. They may not understand the efficacy of drugs and the rehabilitation manual.
4. Nurses in hospitals often neglect the needs of patients' spouses for disease knowledge and rehabilitation knowledge. Patients' spouses sometimes don't know how to communicate with patients.
5. Most breast cancer patients without special complications will choose to go home for rehabilitation. It takes half a year or more time for patients to recover. Patients and their families are plagued by "adaptation" and "care".

Psychological function:

1. Elderly patients are more traditional in ideology, but they have to bear the tremendous pressure brought by physical changes, which cause them to have negative emotions such as anxiety, depression, pessimism, and inferiority.
6. Social roles changing make elderly patients more dependent on their families, which brings loneliness and frustration to the patients.

Through the collation and analysis, the research team got the corresponding direction of service design. In the physical function part, because mainly problems are caused by medical problems such as surgery, service design is difficult to directly intervene. As to role function, social function and psychological function, elderly women cannot live and socialize normally because of physical pain or change. They need to bear great psychological pressure. Service design can create a high-quality living environment for elderly women with breast cancer by introducing products, interaction, experience and other design.

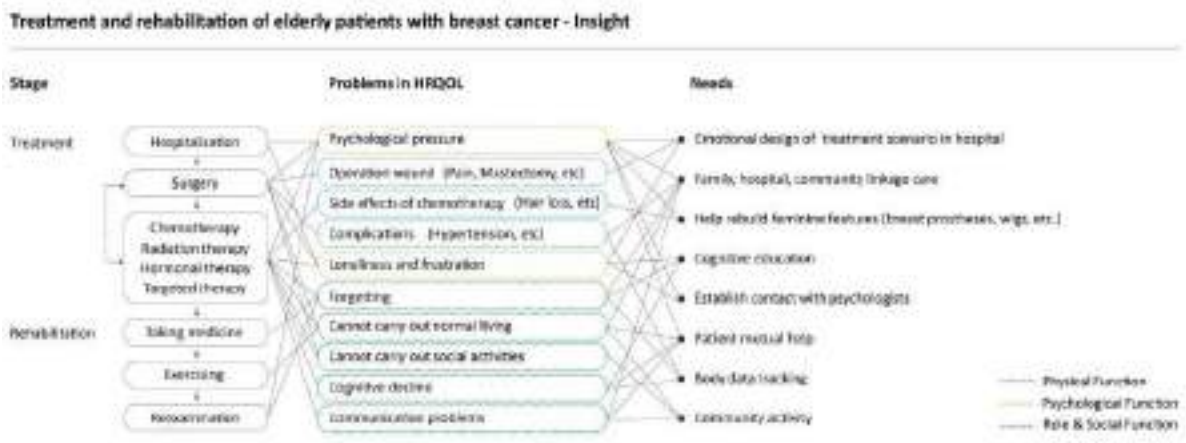

Figure 12: Insight – Problems in elderly women with breast cancer's HRQOL in Shanghai (Source: authors)

Findings and Discussion

Through literature collation and analysis, research and co-creation, the research team carry out service design in the following aspects to help elderly women with breast cancer improve health-related quality of life.

Internet +

At present, the number of elderly Internet users in China has reached as high as 8.28 million, accounting for 20% of the elderly population (Tencent, 2018). That means, one in five elderly people use mobile phones to access the Internet. In the past five years, the speed of Internet access for the elderly is 1.6 times faster than the overall speed of mobile Internet popularization. The elderly people are embracing mobile Internet life with smart phones. Breast cancer treatment and rehabilitation is a long-term, dynamic and professional practice process. There are many nursing problems and needs of patients, including post-operative rehabilitation, symptoms management during chemotherapy. It is urgent to have long-term and timely guidance from professionals. Mobile medicine, which has sprung up in recent years, is the best way to meet this need.

In December 2013, American authors Jacqueline Lorene Bender jointly evaluated 295 mobile phone apps for cancer. The study found that most apps are about raising awareness of cancer (32% of the total number of apps), followed by information about cancer education (26%), and some apps to raise money (Bender, Yue, To, Deacken & Jadad, 2013). In the Internet + breast cancer related applications, the application of mobile intervention technology in the field of breast cancer care penetrates from the disease prevention stage to the disease rehabilitation stage. Comprehensive analysis of mobile applications, websites and WeChat public accounts at home and abroad found that their functions and characteristics are mainly distributed in four aspects: patient self-management, online consultation, patient community, and medical information.

Smart health care for hospital service scenarios

As the core component of traditional health care service industry, all kinds of institutions providing professional health care services (medical groups, large general hospitals, specialized hospitals, community hospitals, physical examination centres, etc.) are also using their own high-quality resources combined with Internet +.

Elderly women with breast cancer have strong needs in the treatment and rehabilitation of diseases and psychological state. The Mobile Medical Ecosystem Model designed by Meng fully mobilizes the enthusiasm of all stakeholders and realizes the transformation from doctor-led situational service to patient-centred continuous service (Meng, Hu, Qu & Li, 2013). This ecosystem emphasizes the interaction of various stakeholders, including the environment, individual attributes and social relations, cultural level, technology and medical resources that affect individual health. Through this ecosystem, patients can better manage their own health and make better decisions when diseases occur, thereby improving the health-related quality of life.

Family and community care

At present, there are 130,000 cancer patients in Shanghai. About 100,000 of them have returned to their families and lived in communities after completing clinical treatment and stabilizing their condition (Zheng et al., 2007). Cancer, unlike other diseases, is closely related to pain and death. Psychological problems of many patients may replace physiological problems and become the main problems faced by patients themselves, their families and community doctors.

In order to improve the curative effect and quality of life of elderly female breast cancer patients in their later years, it is necessary not only for the hospital to put forward a more individual diagnosis and treatment plan, but also for the cooperation of family, society and the overall environment. Through service design to build a life-long service system, focus on the whole life cycle, through community hospitals as the centre of health care services, to make it become chronic diseases.

The home care services should consist of three elements: (1) Homecare plan, (2) Patient homework execution form, (3) Returning visit and telephone consultation.

1. Homecare plan: After treatment, the smart platform will automatically generate evaluation results and suggestions. The analysis table of breast cancer patient evaluation and management was generated through the smart system platform, and the home care plan was developed by the medical staff and community nurses.

7. Patient homework execution form: The community nurses guide the patient to carry on the family rehabilitation training, so the patient can get better home rehabilitation with the help of family and community nurses.
8. Returning visit and telephone consultation: After every returning visit and telephone consultation, the community nurse fills in the relevant information of the questionnaire and summarize the assessment results. Then, feedback the information to the medical staff in time.

Community nurses provide one-to-one health education for breast cancer patients through information management of chronic diseases and home care services and record the health indicators of breast cancer patients into health records. Individualized rehabilitation training programs and health intervention programs were generated through information-based chronic disease management platform, which gave the feedback to breast cancer patients for the new plan.

A life-long service system for elderly women with breast cancer

In the life-long service system for elderly breast cancer patients, the researchers corresponded the functions of HRQOL to the main stakeholders: The elderly breast cancer patients are located in the centre, including their physical and psychological characteristics; the second level is the interpersonal relationship, including family members, friends and social workers who communicate with elderly breast cancer patients; the third level is organizational factors, including hospitals and professional organizations related to the diagnosis and treatment process of elderly breast cancer patients; the fourth level is community, representing the small size of elderly breast cancer patients. The scope of the environment, including community support agencies, community media and so on; the fifth level is related to elderly breast cancer policies and laws, including breast cancer screening policies.

With the cooperation of stakeholders (elderly breast cancer patients, patients' families, community personnel, attending physicians, nurses), under the new situation of family-hospital-community and smart healthcare, we design a system map to enhance patients' HRQOL by collecting data, cooperating with hospital and community. The details of a life-long service design system are as follows:

1. By creating a warm treatment environment to reduce the psychological pressure of patients during treatment.
2. Creating nursing services through Family, hospital and community linkage care to help patients with daily activities when they suffer from surgical wounds or pain. At the same time, enrich patients' social activities and establish certain social connections for patients.
3. By helping patients rebuild breast and other female characteristics to help patients improve self-identity, reduce psychological burden.
4. Through cognitive education, patients' awareness of the disease can be improved, and their panic caused by not understanding the disease can be alleviated. At the same time, it can also lay a foundation for the follow-up treatment of patients.
5. Reduce the psychological stress of patients by establishing contact with psychological experts.
6. Enhance patients' confidence in treatment and rehabilitation through mutual assistance and encouragement.
7. Enhance the patient's understanding of their situation through body data tracking.

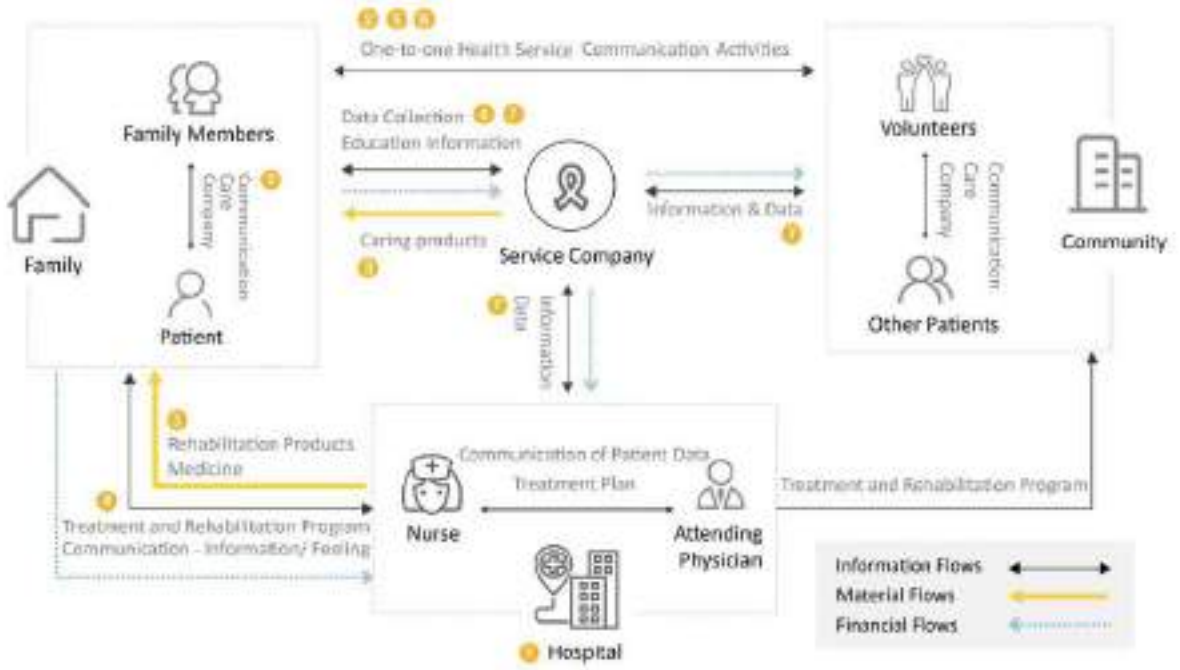

Figure 13: A life-long service system for elderly women with breast cancer (Source: authors)

Based on this service system and co-creation with stakeholders, the research team carried out the first step of touchpoints design. The research team created an emotional medical service scenario in a hospital in Shanghai, including wayfinding system for patient and family, corridors for families and patients to rest during treatment, and rest areas are designed to make doctors and patients communicate better.

Figure 14: Emotional medical service scenario in a hospital in Shanghai (Source: authors)

Conclusions and Suggestions

This paper reviews the literature on the decline of HRQOL (health-related quality of life) in elderly patients with breast cancer during treatment and rehabilitation. Through field observation, user tracking, in-depth

interviews and co-creation, the research team summarized the treatment needs, information needs and emotional needs that can improve patients' physical functions, social functions, role functions, psychological functions and overall feelings during treatment and rehabilitation. Patients, medical staff and designers discuss the details of the service experience and draw the following conclusions:

Under the system standard of HRQOL, the research team developed the research strategy to study the special needs of elderly breast cancer patients. Through behavioural tracking, guiding narrative and other service design research methods, the research team found the physiological needs, role needs, social needs and psychological needs of elderly female breast cancer patients.

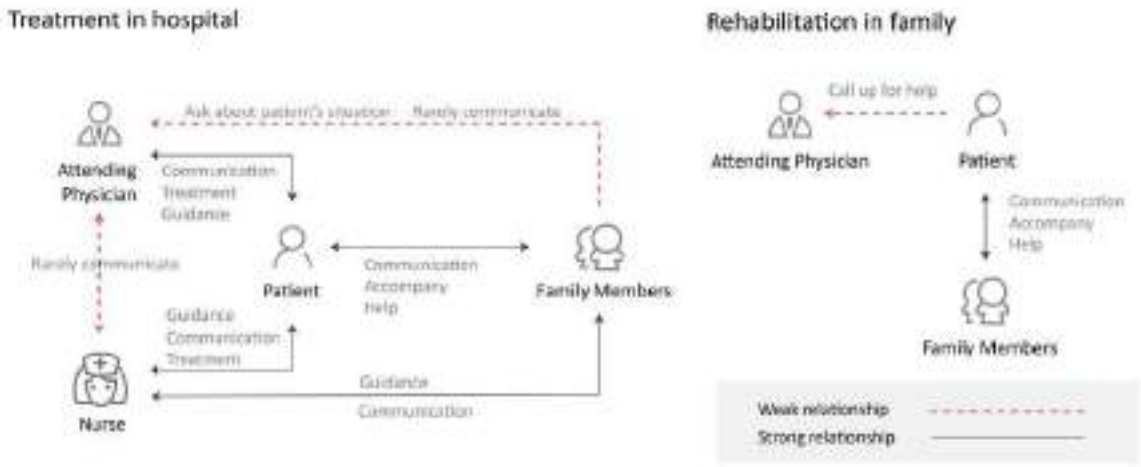

Figure 15: The existing model for elderly breast cancer patients' treatment and rehabilitation (Source: authors)

Based on the research, the authors build a life-long service system and design emotional hospital service scenarios to improve the health-related quality of life in the treatment and rehabilitation of elderly women with breast cancer in Shanghai:

1. Families, nurses, doctors and community workers cooperate with each other to help patients when they are unable to live a normal life.
2. By communicating with patients, family members and professionals, patients can enhance their enthusiasm and alleviate psychological pressure.
3. Community staff and nurses plan and guide patients' home-based rehabilitation, help patients correctly carry out rehabilitation training and follow-up treatment, reduce the possibility of complications caused by diseases, and make patients return to normal life faster.
4. Real-time interaction and connection with hospitals (doctors, nurses) and smart city medical services through data tracking of products such as smart wear can play the role of monitoring and treatment to the greatest extent, and enhance patients' sense of security and control of their own body.
5. Community is an important field of patients' daily life, and also a service place to learn scientific treatment concepts and correct treatment methods. It provides a platform for patients to learn and communicate daily.

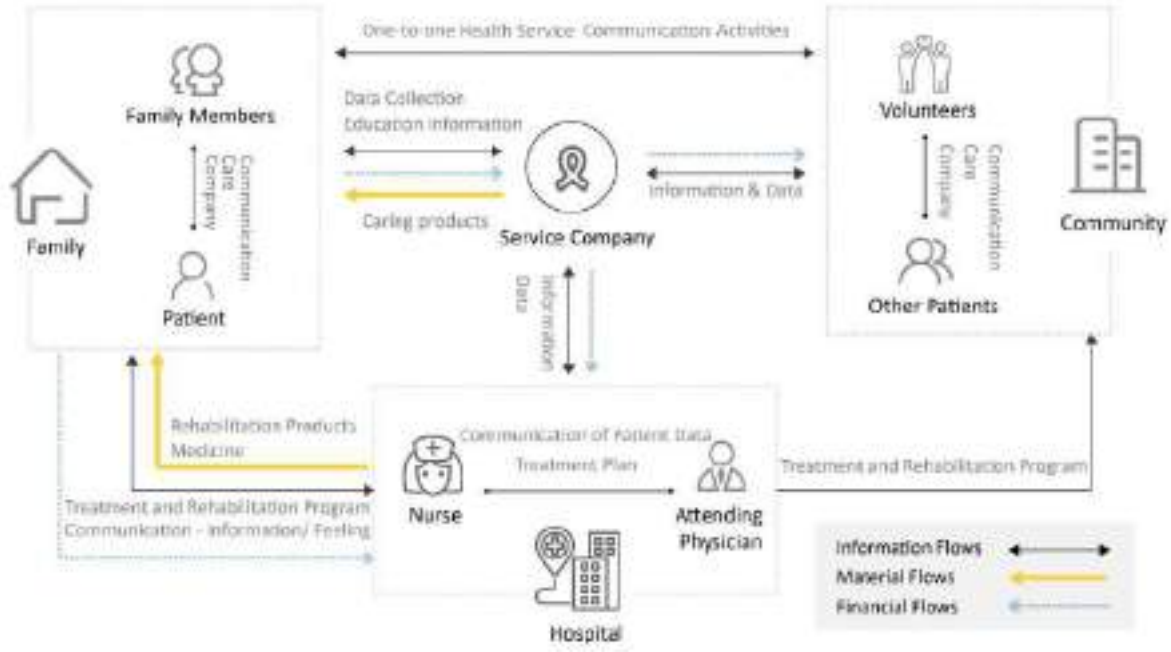

Figure 16: A life-long service system for elderly women with breast cancer (Source: authors)

The development of Internet technology, artificial intelligence and big data provides a technical foundation for building a life-long service. In the treatment and rehabilitation of breast cancer, surgery and chemotherapy are still the most important treatment methods. In the next step, the treatment and rehabilitation of elderly breast cancer patients need the joint efforts of multiple stakeholders (family members, nurses, attending physician, community workers), multiple departments (social insurance and government), and multiple services (social network communication and smart healthcare) in order to achieve good results and ensure the quality of life after treatment.

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Research Perspectives IN THE ERA OF Transformations

Engaging Senior Adults with Technology for Behavior Change

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Amidst today's ever-expanding waistlines there is a clear need to investigate technology's potential to support behavior change and stimulate increased physical activity. Physical activity has also been shown to increase the independence and well-being of older adults, yet an important segment of this community is often excluded from the necessary in-context research due to the barriers they face to technology acceptance. Currently, there is limited knowledge on how to overcome these barriers to participation. We created a specific Product Service System that supports older adults to engage with the proposed technological interventions to enable important in-context behavior change research. Our approach converges knowledge from the domains of living laboratories, co-design, and existing experience of design research with older adults. From our experiences with this Product Service System, we provide guidelines to support other researchers setting-up a living laboratory study with older adults to explore technology's potential to motivate behavior change.

Keywords Older adults, Behavior change, Living labs, technology acceptance, Physical activity

Introduction

The benefits of physical activity are well recognized. According to Bauman et al. (2016), physical activity can not only reduce the risk of chronic disease among older adults but also reverse symptoms of frailty, by, e.g., making physical activity instrumental to fall prevention (Bangsbo et al., 2019; Bauman, Merom, Bull, Buchner, & Singh, 2016; Chodzko-Zajko, Schwingel, & Park, 2009; Lopez et al., 2018). Most importantly, physical activity supports older adult's independence and overall quality of life.

The domain of behavior change (BC) focuses on understanding and facilitating the process of changing habits; from current behavior patterns to the adoption of new target behaviors. Personalized BC strategies can be implemented to spark, facilitate or support the process of adopting new habits. Technologies, such as wearable activity trackers and smart phones, have the potential to offer personalized BC solutions to motivate sedentary people to live more actively (Al Ayubi, Parmanto, Branch, & Ding, 2014; Mitzner et al., 2010; Valenzuela et al., 2018). Research into BC strategies can support a better understanding of how we can take advantage of these new technologies to motivate older adults who could benefit from increased physical activity to adopt a more active lifestyle. However, BC is a dynamic process which is susceptible to changes in time and place or context and thus challenging to investigate without an appropriate approach. Living Laboratories (labs) are valuable methods for in-context research and vital to investigate BC strategies (Eriksson, Niitamo, Oyj, & Kulkki, 2005; Wu, 2018).

Though it is clear that older adults have much to gain from the development of technologies which motivate BC towards a more active lifestyle, there is an important sub-group of older adults who are barred from participating in the necessary in-context research due to their relatively low level of technology acceptance (Anderson, Perrin, Smith, & Page, 2017; EuroStat, 2019). It is important to enable this group of people to participate in the development of personalized BC solutions not only because they offer a unique perspective but also be because excluding them from development of these solutions will likely also exclude them from the benefit of these solutions and missing out on the support they need to attain more active, healthy, independent and happy lives. Therefore, researchers should be aware of specific considerations to involve older adults in the living lab research process (Eisma et al., 2004), necessary to investigate how to use BC strategies to support active living.

Initially, our aim was to conduct an in-context investigation, using mobile technologies to compare the effectiveness of two different BC strategies. Though this initial plan yielded interesting results, we found that the setup and execution of this research resulted in insights which would be useful to share with members of the community interested in conducting similar investigations.

In this paper, we report on our study design, setup and execution in order to share how we were able to address barriers to technology acceptance and facilitate an inclusive study to compare BC strategies. To this end, we will present some guidelines to set up a platform to design BC studies for older adults in a living lab context. With knowledge gathered on this topic from various areas of literature, we tailored an existing Product Service System (PSS) to enable BC research in a living lab context with older adult participants. This PSS was implemented to do a research study comparing motivational strategies. A reflection on our implementation of this PSS suggested that a PSS approach to a living lab research study design has potential to overcome the barriers preventing older adults from participating in such researches. The purpose of this paper is to share our reflections on our process to provide inspiration to other practitioners who aim to conduct related studies.

Related Work

To best position our contribution in this paper, we will discuss certain areas of related work pertaining to the advantages of using a living lab research method for behavior change research, technology acceptance as a barrier many older adults face to participate in these living lab studies and a review of the guidelines other authors suggest to address for this topic.

Research toward the development of behavior change solutions

Behavior change (BC) is a dynamic process describing the adoption of new habits and routines sometimes in the place of old ones. Due to the dynamic nature of this process it is important to conduct research about BC in the context of use of the intervention. Often the behaviors in question cannot be simulated in a lab environment and nor could the complex web of naturally occurring facilitators and barriers to adoption of the new behaviors. Thus, in-context BC research into how to motivate older adults to live healthy and active lives has become increasingly important, however there are few examples of this kind. Authors Wu Munteanu, 2018, write about a study they did in which they co-created and then field tested a fall risk assessment belt with older adults (Wu & Munteanu, 2018). However, they report that their five study participants were chosen on convenience and likely do not represent a good cross-section of the very diverse older adult population as all of them had either high or medium familiarity with mobile devices (Wu & Munteanu, 2018). The use of a living lab in BC research is accepted as a valuable method for the necessary in-context research. The advantage to living lab investigations is that living labs can offer a more realistic view of how an intervention will be used (and possibly misused) in the user's regular day to day context (Hopfgartner et al., 2014). In "Benchmarking News Recommendations in a Living Lab" author Hopfgartner et al. found living lab studies and studies conducted in a laboratory setting had different outcomes. This paper supports the view that living labs can offer a more realistic view of how an intervention will be used in the user's regular day-to-day context. In Hopfgartner's discussion speaks to the "various issues" that need to be addressed in order to do living lab research (Hopfgartner, et al., 2014). The limited examples of studies which do follow up co-design of new technologies with implementation and field testing, might not address but rather avoid barriers like lack of technology acceptance among older adult participants.

Barriers to research engagement

The increased availability of smart phones and wearable activity trackers pose intriguing new opportunities for personal health monitoring. In a systematic review of 26 articles about the viability of smartphone use for measuring and influencing physical activity, Bort-Roig et al. found that though these articles reported generally positive accuracy measurements, novel diversity and users' impression of usability, illustrate the potential wearable technologies have to promote physical activity (Bort-Roig, Gilson, Puig-Ribera, Contreras, & Trost, 2014). Vollmerdahlke and Ory report that mobile applications have already been used for a variety of kinds of health promotion goals including increasing physical activity, to show that mobile technology for health promotion has the potential to be embraced by older adults, however the authors express the need for a better understanding of usability, accessibility, perceived benefit, and relevance to the older adult individuals specific socio-demographics (Vollmer Dahlke & Ory, 2016). Though, mobile health applications already show potential to support healthy and active ageing, more research is required to adapt these developing technologies to make them appropriate to address the needs of older adults (Helbostad et al., 2017). It is clear that mobile technology's propensity to support BC toward increased physical activity is worth investigating. Moreover, in order to take full advantage of this potential more research needs to be conducted into how we can develop technological solutions, which address the older adult end user in valuable ways.

Despite the clear potential technology offers, there are still barriers to technology acceptance to address. The older adult population is comprised of highly diverse individuals, but there are some important factors that present barriers to a subgroup of older adults preventing them from engaging in design research, which should not go unnoticed nor unaddressed. In particular, the barriers to technology acceptance many older adults experience, present barriers to research engagement (K. Chen & Chan, 2011; Mitzner et al., 2010; Valenzuela et al., 2018). While 93% of Europeans aged 25 to 54 reported having used the internet in the last three months, for people aged 55 to 64 this was 73% and for people aged 65 to 74 this percentage was even lower; 52% (EuroStat, 2018). Besides a lack of experience with technologies many new technologies do not adequately consider the mental and physical challenges some older adults may face when using this technology, such as decreased dexterity or lack of procedural knowledge (Holzinger, Searle, & Nischelwitzer, 2007; Vollmer Dahlke & Ory, 2016). It can be challenging to engage older adults who have limited experience with digital devices to join research studies centered around exploring technology's potential (Eisma et al., 2004; Kopeć, Nielek, & Wierzbicki, 2018). Though co-designing technological interventions, and in context testing, can support technology acceptance among older adults, barriers exist preventing researchers from taking advantage of these valuable research methods (Binda, Wang, & Carroll, 2018; Eisma et al., 2004; Harrington, Wilcox, Rogers, & Connelly, 2018; Holroyd-leduc et al., 2016).

It is vital to overcome the barriers to technology acceptance in order to make research of technologies to support BC more inclusive, because exclusion from development results in exclusion from these projected benefits. The important challenge which needs to be addressed is; how can we enable older adults with low technology acceptance to engage in research about technologies potential to support BC?

Review of existing guidelines

Experienced authors have already contributed to the body of knowledge of how to set up design research with older adults. Holroyd-Leduc, et al. reported on six points to consider when designing a research study to include older adults with frailty (Holroyd-leduc et al., 2016) while Eisma et al. 2004, provided a more extensive list of recommendations including advice on different methods to obtain information (Eisma et al., 2004). Though it was not our purpose to conduct a literary review, below we share guidelines from some other authors who's work and recommendations inspired our research setup for this investigation.

List of guidelines, which inspired our approach:

- Researchers should be in practical arrangements, adaptable during workshops in accordance with user needs and open to new ways to perceive, define and think about ageing (Binda et al., 2018; Holroyd-Leduc et al., 2016; Malmborg, Werner, Grönvall, Messeter, & Raben, 2015)
- Researcher should consider the participants specific needs including, but not limited to, impaired visibility (Binda et al., 2018; Holroyd-Leduc et al., 2016)

- Take the time to facilitate use of technology in context, to understand and respect every day practices, which ad hoc infrastructures constitute a community and what tools can be used in the co-design sessions (Harrington et al., 2018; Malmborg et al., 2015)
- Consider education or training of care providers and researchers on engagement practices (Holroyd-leduc et al., 2016)
- Leverage experience with technology even if gained prior to study (Harrington et al., 2018)
- There may be a need to incentivize participation (Holroyd-leduc et al., 2016)
- Actively engage the older adult participants by breaking the ice, playing games, doing workshops, and find ways to facilitate participants to actively engage with each other (Binda et al., 2018; Harrington et al., 2018)

This body of knowledge describes how to interact with participants and stakeholders during the test, yet provides little clarity on how to design the setup of in-context study of technology intervention toward BC.

In this paper, we describe how we facilitated in-context research to enable older adults with limited technology acceptance overcome barriers to research participation. The purpose of sharing our experiences is to enter the conversation on how to design meaningful products and services which motivate the increased physical activity, with and for older adults.

Initial Study Setup: In-context research to compare BC strategies

In the REACH Horizon 2020 project case, we aimed to conduct a random control trial to evaluate the effects of two different persuasive strategies on BC through a mobile application with older adults. For this investigation we planned to make two very similar mobile applications one of which would use the BC strategy self-reflection and the other application would use social reflection (these participants would work together with one partnering participant towards a common activity goal). As seen in figure 1, we allowed for a four-week baseline to allow participants to get used to the activity tracker and the smart phone. In workshop two we introduced the intervention applications. After workshop two participants were asked to use the mobile application throughout a period of 5 weeks in their natural home context. In total, 65 older adult participants were recruited via a local senior community center and onboarded in workshop one (figure 1). Of the 58 participants who finished the entire trial period, 43 were female and 15 were male and together their average age was 72.47 and the median age was 73.

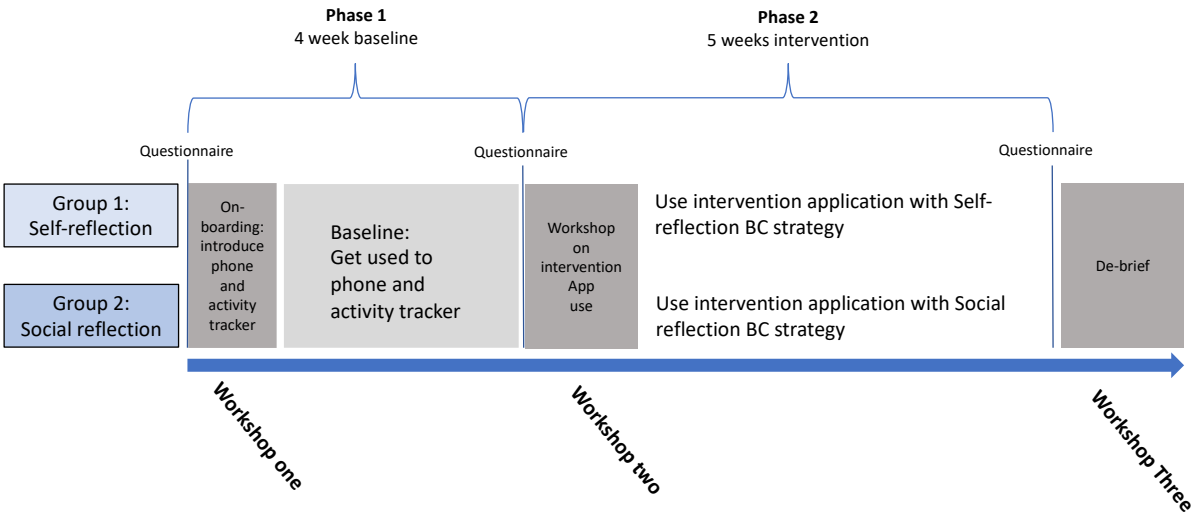

Figure 1. Simple outline of In-context research to compare BC strategies study

Setting up valuable research of this kind requires overcoming barriers to technology so that the interventions in question are acceptable for use to the participants, and collaboration between the stakeholders involved in this context. We aimed to design a study to engage older adults with limited technology acceptance with in-context BC research. First, we needed to develop the two intervention applications in such a way that these

were appropriate and usable for participants with limited expertise with technology. Next, we needed to find ways to deliver on-going facilitation to support the in-context use of the intervention applications over the course of study duration.

Results

The resulting study design aimed to engage older adults with limited technology acceptance with in-context BC research. We overcame barriers to technology in part by re-designing existing test applications through a co-design study with a panel of older adult participants. In order to compare the intervention application in-context we set up a living lab with a local senior community activity center. To deliver on-going facilitation throughout the duration of the study it was necessary for us to take a Product Service System (PSS) approach to the set up and execution of this research study. We used Lee and Kim's, 2010, modified service blueprint to consider the following important aspects of our PSS approach:

- **Product and service elements layer** refers to the elements that participants interacted with during the entire research study period.
- **Service receiver study participant layer** refers to activities that the participants undertook during the entire research study period.
- **Function interactions layer** refers to the activities that the design researchers conducted to create the activities of the participants.
- **Onstage service provider activities layer** refers to the activities that the living lab volunteers performed to support the on-going research study such as recruiting participating and technological support.
- **Backstage service provider activity layer** refers to the activities performed by design researchers in supporting the execution of the research study.
- **Support processes layer** refer to the data storage and management process in the background to support the execution of the research study.

Figure 2 shows how the resulted product service system platform for design research study. In the following, the detailed results per layer are discussed.

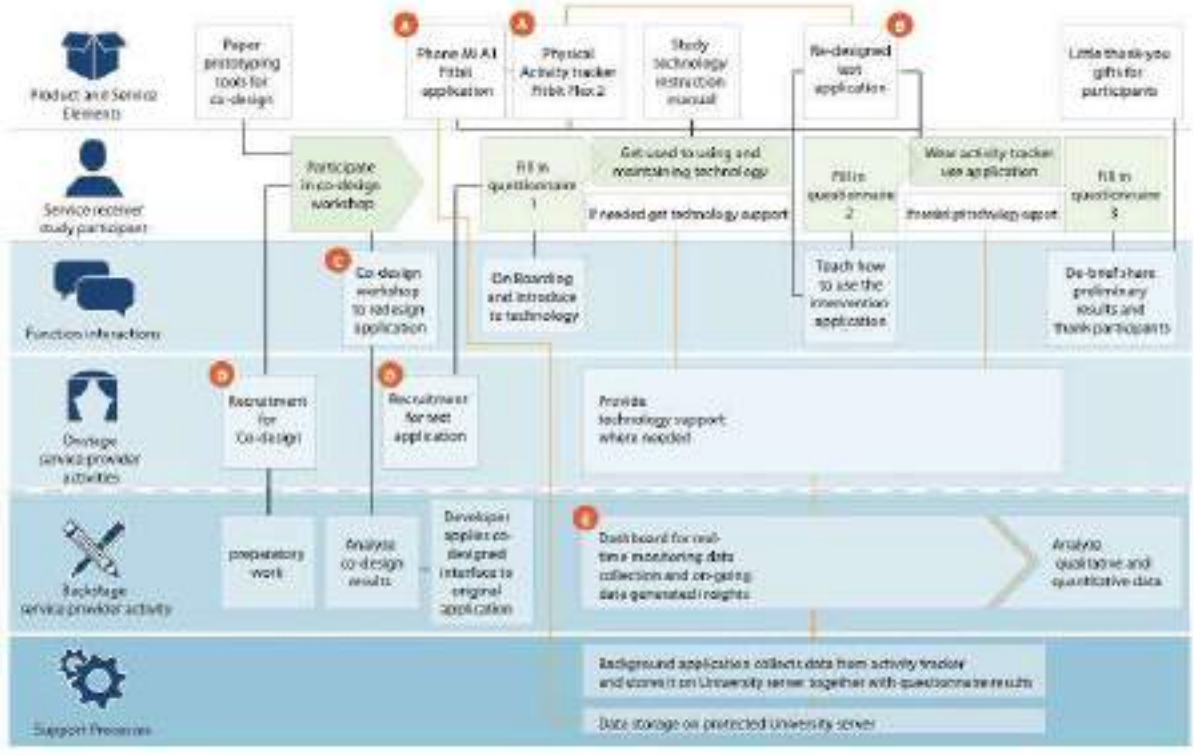

Figure 2. The product service system blueprint enabling living lab investigations to test BC strategies.

Functions Interactions layer

In this study, the function interactions can be seen as the main activities of the researchers in creating activities for the participants. It consists of four main activities: Co-design, on boarding, teach how to use the intervention applications and de-briefing. These activities are explained in detail below.

Co-design

Before the intervention application could be introduced to all the study participants, researchers collaborated with a focus group of five older adults with various degrees of experience with technology to re-design a test application through co-design process, refer to figure 2, C. It has been shown that co-designing mobile application with older adults has the potential to yield ideas that are creative and perceived as useful (Davidson & Jensen, 2013). In addition, Valk et al. (2018) has shown that end-user participating in the design process can contribute to technology acceptance (Valk, Lu, Randriambelonoro, & Jessen, 2018). This process provided researchers with a better understanding of the accessibility and usability of the technological probes used in this study and to ensure participants had a voice in the design/decision process for this research study. Figure 3 shows some results of the co-design session. This co-design study resulted in the design of the intervention applications used in this investigation, shown in figure 4.

Figure 3. Some results from the application re-design session

Figure 4. Resulting intervention application for investigation

On-boarding and introduction to technology

For this living lab study, in addition to regular on-boarding, participants were given a workshop to introduce them to all of the technological elements used in this investigation. In this workshop, researchers guided participants through all the necessary interaction steps of the study's baseline period using the study's custom manual. This thorough introduction was important to make the research inclusive for those with no or very limited prior knowledge on smartphone technology.

Teach how to use the application

To prevent overwhelming participants who might have limited experience with technology, participants were introduced to the intervention application after the baseline period of the test was done. During this informative session participants received the second chapter of the study specific visual manual and walked through all the functions of the application.

De-brief

During the De-brief session, participants were surprised with a little token of thanks, and a sneak-peek into preliminary findings made possible by the real time monitoring of the research dashboard. While this session allowed participants to provide useful feedback to researchers which will improve future studies. Most importantly, it was a moment for our research team to express their gratitude to participants and reiterate the importance of their contribution.

Service receiver activity layer

In this PSS the service receivers were the older adult participants of this living lab research study. Older adult participants were all community dwelling members of a local senior community center. It was advertised that prior experience with a smart phone was not a pre-requisite to participation, in order to recruit participants with various levels of technology acceptance.

Product and service elements layer

We used several different product and service elements to support the functions of this PSS.

Paper products

Paper prototyping tools were used during the co-design workshop, to prevent any barriers participating end-users may face using digital prototyping tools from hampering their input. In addition, a detailed visual manual was created, and provided in print, specifically for each condition in this study to support participants who had limited experience with technology. This manual was provided to each participant together with a letter detailing actions required during this study. The letter was included because we acknowledge that many participants might want to talk about their participation with friends and family, and this might facilitate these conversations.

Hardware elements

The product and service elements we used for this research study included an off-the-shelf phone, Mi A1, an off-the-shelf wearable activity tracker, Fitbit Flex2, and we tailored an existing probe to test motivational strategies, see figure 2, A. The existing probe was a mobile application initially designed to test motivational strategies by researchers from École Polytechnique Fédérale de Lausanne (Y. Chen & Pu, 2014), figure 2, B. We redesigned this mobile application, through a co-design session with older adults, figure 2, C. While developers implemented changes suggested by the analysis of the results of the co-design re-design session, other members of the research team created detailed visual manuals for the phone and wearable tracker, inspired by the co-design session.

Onstage service provider activity layer

Existing close positive relationships with a senior community center also partnering in the REACH consortium allowed us to delegate most of the recruitment for the larger study, though researchers did provide flyers clearly explaining the goal of the research, and the expected commitment for participation, figure 2, D.

During the participant on-boarding process, the research team created an open and inviting atmosphere. They explained the study protocol, aim and various privacy security measures that were taken. Researchers often reminded participants of why their contributions are so valuable and worked to show participants their appreciation, by thanking them for their feedback at the end of every session, sharing preliminary insights during a debrief meeting and giving them a small gift as a token of appreciation at the end of the study. We feel the open atmosphere is key to allowing participants to feel comfortable enough to openly share their feedback with us.

Backstage service provider activity layer

Before testing researchers re-designed and then prototyped an intervention application for testing BC strategies to make this application useable for older adult users through a co-design process. Researchers used a custom developed research dashboard for real-time insight into incoming participant data, figure 2, E. Time was set aside by members of the research team to check the incoming data and reach out to participants who seemed not to be transmitting data regularly. In addition, there was an on-call researcher who participants could call or email if they had questions about the study or use of any of the technologies provided by the research team. If, during these monitoring sessions, we noticed that there was little or no data coming in from a particular participant that participant would be contacted by phone. Usually, any problems could be solved by trouble shooting over the phone but sometimes an in-person meeting was planned to assist participants. This real-time monitoring was instrumental in preventing data loss as many participants needed to be called and helped with relatively simple things such as re-opening the background applications which transmit the physical activity data collection.

Support processes layer

A background application collected data from the wearable activity tracker in real-time and stored it on a protected server at the Eindhoven University of Technology. Other data from questionnaires provided to the participants was also kept on this protected server, allowing the research dashboard to generate visualization by drawing information from both data sets. The analysis of this data is still ongoing and will be the subject matter of a different paper. In this paper however, we can recommend the use of software which allows researchers to integrate data of different kinds, such as open access weather information, questionnaire data, measured activity data etc. This insight into on-going data collection can be especially valuable to gain insight into the dynamic process of BC in a living lab.

Analysis

From the use of the PSS described above we can draw some early conclusions about how taking a PSS approach to a living lab investigation increases older adult engagement in important in-context research about BC toward a more active lifestyle. This promising increase in engagement is evident in how this study supported technology acceptance, this study's low dropout rate and anecdotes collected by the research team.

In order to support participation, it was necessary to address the barriers to technology acceptance older adults face. In order to do so, the PSS described above, initially called for a co-design session to re-design the intervention application and provided means of on-going technology support. Throughout this investigation, participant's self-reported confidence with mobile smart phone technology improved. Of the 48 participants who responded to this item on all questionnaires, 18.6% responded that they felt "very confident" about smart phone use to the onboarding questionnaire, while by the debriefing session this percentage had risen to 30.6%.

In addition to the increase in self-reported confidence about technology use, participants showed engagement through their use of the intervention technology presented during this research. Out of the 58 people who participated in this investigation 55 used the messaging (in the social reflection application) or personal log (in the self-reflection application) functions to send messages. Overall a total of 896 messages were sent over the 5 weeks in which the intervention applications were deployed.

Supporting technology acceptance and confidence in smart-phone-use in our method, seemed to lead to increased engagement as we enjoyed a relatively low participant dropout rate during this 9-week study. In this study, the participant drop-out rate from on-boarding till the de-brief session was 11.5%. Other sources describing physical activity promoting research studies with older adults cite drop-out rate between 6 - 36% (Schmidt, Gruman, King, & Wolfson, 2000). Though some drop out do to unforeseen or medical reasons in nearly unavoidable, this relatively low participant dropout rate and the overall willingness of participants to continue to participants in the study points to a relatively high level of participant engagement.

Throughout this investigation, participants made ample use of the 'on-call' technology support our team provided. To the researchers this illustrated that participants were concerned with making sure all their devices worked. Participants who reached out for technology support wanted help so they would be able to use the intervention application again. One participant who was unable to fix their problem with guidance over the phone, immediately came over to the university for an in-person meeting, because they did not want to make an appointment and wait to meet the researchers at the senior community center. This showed great motivation to want to take part in the study. At the end of the trial some participants asked if they could download the application and if the hardware was for sale, indicating an interest for continued use. Some participants mentioned talking about their physical activity information displayed in the intervention application and on at least one occasion, participants arranged to meet each other outside of the planned workshops, specially to look at the application together. In this case one participant who was more experienced with technology, took the time to explain it to another participant how the provided mobile devices worked. This anecdotal evidence combined with this study's low participant dropout rate and the indication toward increased technology acceptance, suggest that participants felt engaged in the living lab research about BC strategies.

Discussion and Reflections

Our living lab research study addresses all of the concerns Hopfgartner et al. mention in their "Benchmarking News Recommendations in a Living Lab", through our implementation of the PSS. Hopfgartner et al., support living labs as a good approach to the evaluation of a product or service, while we use the living lab as a test bed to investigate BC strategies and to develop technologies potential. A living lab is a valuable method however, it is not adequate to overcome the barriers to technology, nor address the needs of older adults with limited technology acceptance.

Though previous work has shown the merits of co-design, living labs, and even presented guidelines for research with older adults, rarely have these domains converged as we propose here. While Liedtke et al. advocate a living lab approach to test product services systems (Liedtke et al., 2015) we advocate a product service system approach to enable living lab research to test BC strategies. Davidson and Jensen, 2013, provide an example of how we can co-design digital interfaces with older adults, yet did not report on developing the proposed ideas into working applications and then testing them in a living lab setting. In their suggestion for future work, they suggest taking the experiment further to the development of the applications (Davidson & Jensen, 2013), as our PSS approach has allowed us to do here. Implementing the above-described PSS approach to the setup of living lab design research can provide the necessary support to older adult participants, by providing means of on-going engagement.

The benefit of our PSS is that it has allowed our research team to consider the user experience of being a participant in living lab research. In the past, the use of PSS have been limited to either user testing a PSS (Liedtke et al., 2015) or describing PSS development methodology for business (MOON, OH, KIM, & HWANG, 2013). Here we advocate for the use of PSS approach to design research.

While our research is still on-going, our reflections on this work so far have yielded guidelines we would like to share:

1) Use a Product Service System approach to set up living lab research
2) Foster relationships to build a living lab community
3) Communicate intentions and expectations ahead of time
4) Co-design necessary interfaces and interventions
5) Show appreciation for their contribution
6) Use best practice policies to ensure privacy and data security
7) Offer tech support
8) Take your time: allow time for questions and for people to get used to the new technologies
9) Facilitate continuous data monitoring
10) Share your findings

Though the preliminary evidence presented here is not conclusive, using the product service approach to create living lab environments for in-context behavior change research shows promise to increase engagement, as indicated by the relatively low participant dropouts and potential to overcome, at least in part, barriers to technology, as demonstrated by this increase in confidence with mobile devices.

Conclusion

In this paper, we describe the PSS we created to overcome barriers older adults face to participating in living lab research for behavior change. A PSS approach to design research allows us to build on the knowledge from many different research domains which has clear benefits for the research team and participants alike. The PSS we designed enables researchers to engage older adults in living lab research about how technology can support behavior change towards a more active lifestyle, by delivering on-going support to the participants beyond the workshop moments and throughout the several weeks of the study. In our PSS concept, detailed in figure 2, we built on existing guidelines for engaging older adults in research. Like Harrington et al. 2018, we made sure to provide users with relatively limited experience with mobile technologies time to use and get used to the new devices (Harrington et al., 2018). We continued to build a close working relationship with the older adult organization where we conducted our living lab study, in line with the guidelines provided by Eisma et al. (2004) (Eisma et al., 2004). Marin-Hammond et al. (2018) also suggests working with relevant organizations to recruit participants (Martin-Hammond, Vemireddy, & Rao, 2018). The service provider is an important partner and expert in facilitating this necessary living lab research. Therefore, we would like to encourage other design researchers to follow up the PSS idea by teaming up with expertise outside design field to engage and empower older adults to contribute to behavior change research in living labs.

The purpose of this paper is to share our reflections on our process to provide inspiration to other practitioners who aim to conduct related studies. With this contribution we hope to build a more inclusive research environment to include members of more difficult to access communities toward a better understanding of behavior change strategies.

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Research Perspectives IN THE ERA OF Transformations

Building an Age-friendly City for Elderly Citizens through Co-designing an Urban Walkable Scenario

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This paper is based on the research project – "*LONGEVICITY*" - carried out in the Metropolitan Area of Milan, which looks at the cities of the future as highly populated by long-living active people and innovative technological facilities. The project is conducted by a multidisciplinary research approach to study how to support social inclusion of elderlies' living in urban environments by enhancing their active walking. The whole process will engage participants (senior citizens) and stakeholders in a human-centred design approach. In this paper we will present the results from the preliminary research activities carried out: case studies and territorial observations. The first activity was oriented to investigate and select innovative solutions to enhance the mobility of elderly pedestrians and to improve their (social) lives. The second one helped us in better framing the design context of action and assessing at, a microscopic level, the degree of walkability of specific territorial areas.

Keywords: Age-friendly city, Walkability, Social inclusion, Human-centred design

Introduction

Population ageing is one of the most significant global trends of the present times (UNWTO, 2017): older adults comprise the fastest growing segment of the population (i.e. ageing society). According to a recent forecast (WPA, 2015) by 2025 the number of people aged 65 and over will represents the 20% of the population in most of the OECD Members Countries. In particular, Italy and Japan hold the world record for longevity of the population, due to the decline of birth rate and the increase of life expectancy. This trend is even more relevant considering that by 2025 the 59% of the global population will live in cities and urban agglomerates. It's definitely necessary to take elderly into consideration of building future cities, where all citizens will be inclusively cared, supported and even empowered. This is especially crucial for managing and planning of urban environments.

"Walkability" is an idea that is increasingly popular for "smart growth" and sustainability in the city. (Glicksman,Ring, Kleban, & Hoffman, 2013). Research has tied measures of Walkability to health outcomes such as reduced obesity (Brown, et. al., 2009), lower rates of depressive symptoms (Berke, Gottlieb, Oudon, Vernez, & Larson, 2007), and even greater longevity (Tkano, Nakamura, & Watanabe, 2002). And "walkability" is also becoming an important concept in the field of ageing, especially among advocates for programs that encourage active aging and helping older adults remain in their homes and communities.

This research, founded by a national foundation for three years, is conducted by a multi-disciplinary research team: 1) information, system and communication research team, 2) design research team, 3) the regional volunteer association for the elderly and 4) advanced science and technology research team. In this research,

the authors address the question of how to facilitate the urban neighbourhood to be more walkable for senior citizens in a specific European city. The research project aims at better understanding what elderly people perceive as criticalities or valuable elements while walking/crossing in the city and at improving the situation by means of practical interventions on the comfort, safety and attractiveness of urban environments. This study will focus on the co-creation of urban spaces, which will act as a “social centre” of the neighbourhoods that increase the possibility and the willingness of elderly citizens to participate in social activities and have social interactions. Existing checklists and guidelines for the design of age-friendly cities do not often take into account the needs of sociality among the elderly, which is instead the truly intrinsic motivation for them to navigate the city. The investigation of innovative design solutions for the outdoor urban areas will foster the walkability and accessibility of the environments, more significantly, will induce spontaneous aggregation and appropriation of public spaces by elderly citizens. This will be promoted by conducting a human-centred approach for creating new meaning of age-friendly cities. The results of the project will provide knowledge, data and experiences useful for city managers and policy makers involved in the design of innovative and technological solutions (ICT, IoT) for the management of mobility in future smart and sustainable cities, characterized by the presence of active long-living inhabitants interacting with multiple technology-based services.

Methodology

Based on the research questions identified in the previous part, the research strategy for the whole project is explained below.

Cross-disciplinary methodology: the proposed methodology is based on the integration between quantitative data collection techniques and qualitative co-design methods. On one side, there is a combination between collecting data of pedestrian locomotion behaviour (i.e. analysis) and the power of computer-based pedestrian simulations (i.e. synthesis). On the other side, a human-centred approach guides different actors to collectively participate in the whole research process. The results obtained from the representational observation and the experimental investigation of pedestrian behaviour give the basis for the following co-design phase, validation of computer-based simulation systems, testing the adherence of the simulation results on realistic behavioural dynamics. A GIS-based territorial analysis identified those areas in the city of Milan that are characterized by the highest presence of elderly inhabitants and by the poorest level of pedestrian safety. These areas will be exploited as “living labs”. Outdoor and indoor activities involving a large sample of senior citizens will be undertaken to foster their mobility and inclusive sociality. Senior participants will also be engaged in participatory design laboratories to express their needs and desires. A series of empirical studies will allow to: 1) assess the degree of walkability by means of questionnaires; 2) study age-driven walking and road crossing behaviours by means of observations and experiments; 3) testing and prototyping initial co-design solutions. The results of the project will provide first-hand feedbacks, ideas and proposals for the design policy and guidelines for the management of age-friendly pedestrian mobility in future cities.

Under the general defined methodology, the design research team specified the research strategy and activities based on its interests and its role in this project. In order to build a basis to start this research project, literature review was conducted to create framework and criteria for data collection activities. Case study, onsite observation and interview were organised to collect both first-hand and second-hand research data for shaping promising and situated design opportunities. After defining the design challenges, focus groups and participatory laboratories will be carried out to generate and test new solutions (new product, spatial and service ideas). The whole design research process has been illustrated below (figure 1).

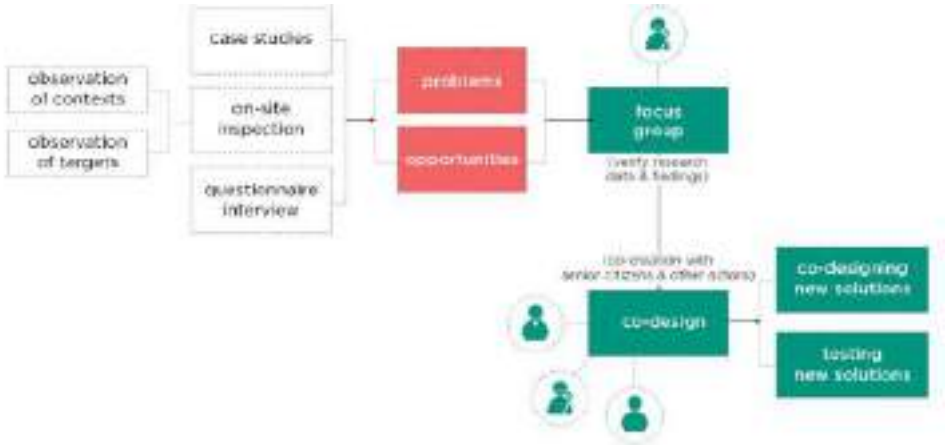

Figure 1: Research process of design research team in this project. Illustrated by authors.

Literature review

The literature review activity has been addressed to three main topics: age-friendly city, definition of walkability for elderly and collaborative design approach.

Developing age-friendly city

WHO (2002) stressed that the notion of 'active' refers to the idea that older people should be able to continue to participate in social, cultural, spiritual, economic and civic fields and issues. Then in 2007, the concept of "Age-friendly City" (WHO, 2007) was introduced: a framework for urban development encouraging Active Ageing, the promotion of physical activity of ageing people recognized as a priority for public health actions. Many countries responded through the development of policies and interventions supporting physical activity as a key challenge for future actions and calls to support vulnerable population groups, encouraging the active inclusion/participation of people in urban areas. An age-friendly city is a city that "encourages active ageing by optimizing opportunities for health, participation and security in order to enhance quality of life as people age. In practical terms, an age-friendly city adapts its structures and services to be accessible to and inclusive of older people with varying needs and capacities" (WHO, 2007). An age-friendly city: 1) recognizes the great diversity among older persons, 2) promotes their inclusion and contribution in all areas of community life, 3) respects their decisions and lifestyle choices, and 4) anticipates and flexibly responds to aging-related needs and preferences. Making age-friendly cities is one of the most effective instruments to respond to demographic ageing, enabling people to actively live the urban environment while the cities themselves will benefit from people involvement and well-being.

There are mainly two aspects to consider when developing an age-friendly city. Firstly, the physical environments, the city's infrastructures, have significant impacts upon the elderly citizens. Older people might be especially sensitive to the change of built and physical environments. For example, some urban development models have focused more on physical infrastructure and design (Atlanta Regional Commission, 2009) for the elderly, and the safety of older pedestrians is identified as a major issue in many cities (Buffel et al, 2012). WHO released a checklist of essential features of age-friendly cities (2007) to guide policy makers, public institutions, groups and even individuals to make their cities more age-friendly. The checklist mainly includes the following aspects: for example, the outdoor space and buildings are set as one of the principle elements to consider and control for designing cities to be more age-friendly. There are different ways in which urban environments might be accessible and satisfying for older citizens: models are emphasizing on the physical/social environment and also on from top-down to bottom-up governance. Other models focus on physical infrastructure and design (Atlanta Regional Commission, 2009), while some else (e.g. the UK model of Lifetime Neighbourhoods) pay more attention towards social aspects of the environment. Physical accessibility, proximity, security, affordability, and inclusiveness appeared as important characteristics in all locations for developing age-friendly cities (Plouffe & Kalache, 2010). Buffel et al. (2012) has also stated other main issues as challenging for developing age-friendly cities: the safety of older pedestrians, rates of crime and environmental changes. Besides, he suggested to treat the resources associated with urban communities and networks generated in the neighbourhood as opportunities.

Secondly, the software of the city, e.g. offered services, relationships and networks relevant to specific contexts, is equally important to transform a city to be age-friendly. Hirsch et al. (2000) identified two major factors affecting the quality of life of an elder individual: independence (the capacity to care for oneself making one's own decisions) and engagement (the possibility to communicate and share experience and friendship). Research on age-friendly city also investigated the quality of social relations that promote social participation (Lui, Everingham, Warburton, Cuthill, & Bartlett, 2009; Scharlach, 2012). Some have studied the formal and informal relationships, participation and inclusion (Department for Communities and Local Government, 2008). The relationships between elderly citizens and cities could be positively leveraged through forming a lively and dynamic age-friendly community. Social participation is strongly associated with physical and psychological well- being, in older life as during the entire lifetime; it refers to people's interaction and engagement with other people within a society, whether it is a defined association of people or the neighbourhood in a city. Activities such as working, volunteering, engaging in recreational activities and living with the community, is the heart of social participation. Sense of belonging and trust on people and places enforce social networks and spring new ties.

During the 1990s and early 2000s, WHO introduced the concept of "Active Ageing": the word "active" refers to "continuing participating in social, economic, cultural, spiritual and civic affairs, not just the ability to be physically active or to participate in the labour force", having as a final and highest goal to "extend healthy life expectancy and quality of life for all people as they age" (WHO, 2002). Mobility and accessibility are also key factors in the discourse of Active Ageing as they presume the capacity to move independently and safely from one place to another. From another perspective, Active Aging also promotes the recognition that older adults are not just the beneficiaries of age-friendly communities: they also have a key role to play in defining and shaping their distinctive features (Menec, Means, Keating, Parkhurst, & Eales, 2011; Buffel, 2015). The development of age-friendly city should involve elderly citizens in actively reforming, together with other actors, the city for all citizens.

Walkability assessment for senior citizens

The attention around the issue of walking in the city grew considerably at the end of the '80s. Designers and urban planners focused on strategies for the development of pedestrian areas and, in general, on promoting walking in urban territories. The European Charter of Pedestrian Rights (1988) highlighted the need to ensure the comfort and safety of pedestrians in urban areas, including the elderlies and people with impaired mobility:

- Art. I - "The pedestrian has the right to live in a healthy environment and freely to enjoy the amenities offered by public areas under conditions that adequately safeguard his physical and psychological well-being"
- Art. III - "Children, the elderly and the disabled have the right to expect towns to be places of easy social contact and not places that aggravate their inherent weakness"

Jeff Speck (2013) has recently defined a general theory of Walkability, which explains how, in order to be favoured, a walk has to satisfy four main condition: it must be *useful*, *safe*, *comfortable* and *interesting*. As stated in "Proposed Walkability Strategy" by Stantec Consulting Ltd. (2009), "walkability is the measure of the overall walking and living conditions in an area and is defined as the extent to which the built environment is friendly to the presence of people walking, living, shopping, visiting, enjoying, or spending time in an area". Reid Ewing (2009) defined three characteristics for a pedestrian-friendly environment:

- Essential features: Urban density, mixed use of the territory, relatively small neighbourhoods, safe and recurring pedestrian crossing (every 150 meters), continuous sidewalks wide enough for dyads, separate walkaways from vehicles-dedicated lanes.
- Highly desirable features: Proximity to commercial activities and green areas, harmony of big and small buildings in the same area, right proportion of space dedicated to the vehicle traffic and pedestrian flow.
- Nice additional features: Street and public space furniture such as benches, effective signals and urban elements aiming at enriching urban decor and cultural features.

Improving mobility implies barrier-free buildings, streets maintenance, perceived safety and, in general, making secure for children to play, for women to venture outside and for elderly to find place in outdoor activities. The whole community would benefit from an age-friendly environment and, in particular, from the

participation of its older members. An age-friendly city is also a city able to develop a "walkable community" (Jacobs, 2011), that is, to design a human scale environment where safety is promoted, and people can enjoy walking and gathering in comfort.

Starting from the general theory of walkability proposed by Speck (2013), this research redefined a set of walkability assessment criteria specifically focussed on the needs of senior citizens who walk in urban neighbourhoods. As explained in the previous part, senior citizens have more sensitive feelings about urban environments and infrastructures. According to this preliminary consideration, below a set of walkability indicators for the evaluation of the level friendliness of urban areas for senior citizens is proposed and explained:

- **Usefulness**: the urban environment should be designed and planned with an adequate level of land-use mix, street connectivity and commercial density, to guarantee the presence of numerous and diverse public services and facilities within a walkable distance (e.g. public transport services, residential facilities, commercial activities).
- **Comfort**: urban infrastructures should be designed according to a series of standard criteria of quality and accessibility which accommodate the needs of all pedestrians, especially the senior citizens (e.g. pavement type and continuity on sidewalks, installation of ramps for people with reduced mobility, adequate width of sidewalks to avoid crowds in rush hours), but also according to a set of highly recommended elements which support the comfort while walking (e.g. installation of dedicated urban furniture for resting for the elderly, such as green areas with trees, benches, tables and fountain; installation of waste baskets for separate collection of rubbish to maintain the cleanliness of the city; typologies of public spaces, e.g. playground to meet others) (Gorrini & Bertini, 2018).
- **Safety**: urban environment should be planned to assure the safety of senior citizens while walking and crossing the roads (e.g. absence of barriers, obstacles and pothole on side-walks to avoid the occurrence of injuries; proper design of road intersection layouts to avoid pedestrian-car accidents; installation of speed bumpers to reduce the speed of vehicles; installation of traffic light and illumination systems at intersections to guarantee visibility of pedestrians while crossing; specific crossing aids to support senior citizens). This is most crucial element when evaluating the walkability for the elderly.
- **Attractiveness**: the city should be designed to have with several and distinctive areas of attraction to promoting walking activities; this is based on the presence of points of interest and events, the quality of the architectural appearances (e.g. enclosure, amenities, public spaces, green areas) and the vitality of the social context. Also, the emotional aspects (e.g. hearing and smell) should be considered as a part of attractiveness.
- **Legibility**: streets should be designed to support way-finding activities. Most senior citizens are familiar with the neighbourhood where they are walking, however, the urban environment should be designed to be legible, interpretable, memorable, or navigable by itself considering its architectural and infrastructure features (Gorrini & Bertini, 2018).

The proposed criteria represent a general guideline towards the design of age-friendly urban environments. To be successfully used as supports to city managers' activities, every specific item should be listed in a better organised protocol for further steps. According to Pearce (1985) and Blečić et al (2016): socio-demographic characteristics in terms of age and grouping (e.g. the decline of motor abilities linked to ageing make elderly people walking slower than adults); the purposes and frequency of walking (e.g. the walking behaviour of senior citizens for leisure is different from those with specific task to complete).

Design shapes a new meaning of "elderly"

Design, as a discipline, is increasingly crucial to play an irreplaceable role in understanding complex social issues and solving social problems. When Papanek (1972) firstly mentioned the importance for designers, architects and city planners, to consider the social and environmental impacts of products and raised the concept of humanitarian design movements, which emerged over during the following decades. Looking at the social impacts of most products, which do not take ageing and its peculiarities into consideration or simply avoid the consciousness of getting old. The products are well designed with a beautiful appearance, but they don't consider the seniors' needs and behaviour habits. Often in the world of products, as well as marketing, it does not seem to notice the availability and predisposition for consumption of the seniors. When there is attention to the problems (physical, cognitive, psychological, emotional) of the elderly, the creation of

artefacts is often excessively stigmatizing. The products that respond to a specific function, almost a mechanical translation without any attention to the aesthetic and emotional aspects, the user-friendly interaction and the right meanings. The problem is that a certain type of design (but also a certain approach of marketing) forgets that an artefact must, above all, be able to transfer meanings and emotions, not only the function.

The concept of involving design discipline and methods in this research is naturally linked to some significant design issues: design for all (EIDD, 2004), universal design (Mace, 1996) and inclusive design (Myerson & Lee, 2010; Clarkson et al, 2013; Shipley, 2014). Especially, when design solutions should be applied for a wider range of users (e.g. in urban public spaces), the design principles and guidelines need to guarantee the equality of different types of users and targets. This is the basis of designing for an age-friendly city. From another perspective, there's the so-called "hospitalization approach" which is constituted by very stigmatising products and services, usually characterized by little attention paid to attractiveness. Design, in this situation, could and should not forget a design solution (product, service or spatial design) has to transfer a new meaning to users and consumers (Verganti, 2009). Therefore, an attention to the senior users with meaningful product, spatial and service solutions should be payed when designing for them. Attractiveness and usefulness are two equally significant aspects to consider. In a Human-Centred Design process (Norman and Draper, 1986; Norman 1988), a design activity have to start from gathering a better understanding of senior users' needs. This approach has its origin in ethnography and participant observation methods: the user should be put at the centre of the observation and designers could get important insights derived from the identification of customer needs in order to generate innovative products (Zurlo, Sedini & Vignati, 2015). However, human-centred design approach alone doesn't work effectively to read and tell behaviours, actions, interactions and relations. Designers should be able to reveal the hidden needs, interpret and transform them into new solutions, which provide more than what users think and feel they want.

Jacobs (1961) has stated that cities have the capability of providing something for everybody, only because, and only when, they are created by everybody. This idea claimed the importance of involving citizens in a co-think and co-doing process of creating a city for all. In this research, in order to shape an age-friendly space for elderly to walk, it's necessary to engage senior citizens in the whole design process. Designers are facilitators to bring the voices of the elderly and to create a condition in which they could participate in discussing and decision-making processes. The design process is a creative conversation, in which different actors are going to negotiate on ideas, strategies and implementation as well. Another element to highlight is that the design process doesn't end up with ideas on the paper with well-illustrated graphics. The advantages of involving senior citizens in a co-creation process lies also in prototyping the initial solutions and getting feedbacks in order to make adjustment quickly and effectively. However, the balance between listening to final users and making interpretations should be controlled by designers. Radical innovation comes through meaning change and, as we already stressed, design for seniors must, first of all, change its approach to its meaning and contents (Verganti, 2009).

Case study

The literature review has helped to create the research boundary and focus. Afterwards, the case study phase collected international inspiring cases useful also for the following ideation phase.

Case collection

The case collection activity started from the three key topics identified in the literature review phase, and mainly four categories/main areas have been selected to guide this step:

- New concept of urban living for elderly (with a focus on "mobility")
- Smart aids for elderly (with a focus on technologies' impact)
- Active social life (community-based solutions)
- Explorative/visioning solutions (conceptual and experimental projects)

The firs category is focused on finding solutions (products and services) providing new concepts of urban living for senior citizens. In this direction, mobility is a highly relevant issue to consider. The second category looks at solutions that are enabled by applying specific technology to answer to specific needs of senior citizens. The technology, especially digital technology, has been playing more active role in the lives of the elderly. The third group of cases includes solutions that involve senior citizens to actively participate in social life within their

communities or interact with other communities (e.g. Millennial or children). The last category has the interest to search for provocative and critical cases which reflect on thoughts and ideas that have been taken for granted about aging and elderly.

Case analysis

Finally, 31 international cases were collected and analysed. According to the research objectives and previous literature review, the primary case analysis activity was conducted to understand the scenario context and the role of senior citizens. Different cases proposed quite different scenarios, in which solutions have been provided to senior citizens. Some of them are contextualised in specific spaces, other solutions could be adapted to different spaces, from indoor to outdoor contexts. For instance, adaptability is shown in the case "crosswalk[1]", an App for senior citizens to digitally interact with traffic lights to assure the safety of walking and crossing in public spaces; this case is proposing a solution to reshape city infrastructures "strategically" according to senior citizens' needs.

Another aspect we looked for, in all the cases, is how senior citizens have been "designed" to respond to the solutions. We found two different models among all the cases: some of them are "enabling solutions", others are "relieving solutions". For example, the case "ShineSenior[2]" from Singapore, enables elderly Singaporeans to age-in-place, whereby the elderly can stay within the comfort of their homes and familiarity of their neighbourhoods. This service about sensor-equipped home enables the elderly to live independently and have the possibility to take more social actions and even take care of other seniors in the community; they could be both the service receivers and service givers. Therefore, this case presents the idea about how the solution could enable and support a more independent and community-based life for seniors. Another case we have analysed called "responsive street furniture[3]": uses digital technology to make streets work better for people (the elderly included) who find moving around difficult for several reasons. The solution has been designed to help the users completing their way-finding tasks. Thanks to the technology, senior users have been relieved and fully guided and assisted. The result of mapping all the 31 cases in the matrix is presented below (figure 2).

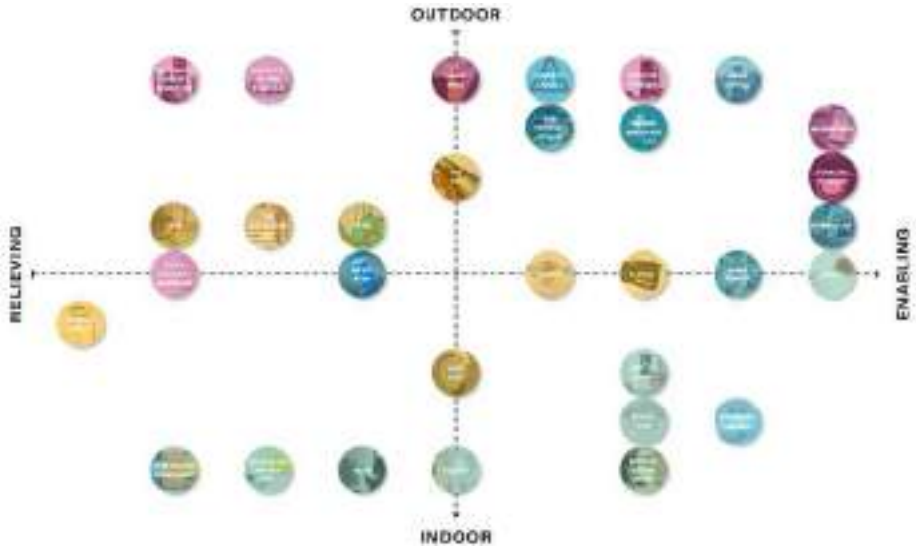

Figure 2: Case study matrix. Illustrated by authors.

Onsite observation

A series of onsite inspections were carried out as a microscopic territorial analysis of the areas identified by the previous GIS analysis in two selected and specific neighbourhoods (one in an urban area, one in a suburban

[1] http://www.yankodesign.com/tag/eldudy/CROSSWALK2017

[2] https://icity.smu.edu.sg/shinesenior-home

[3] http://www.rossatkin.com/wp/?portfolio=responsive-street-furniture#WALKABILTY

area). The selection process considered a series of indicators (e.g., quality of sidewalks, safety of crosswalks, presence of public services), and this selection was decided together with all the partners.

Designing observation protocol

Based on the walkability framework for elderly identified from literature review, the research team developed a protocol for conducting onsite observations in selected neighbourhoods. The observation protocol includes six main indicators: usefulness, comfort, safety, attractiveness, legibility and population. The first five elements have been explained in detail in the previous part. The last indicator: population, has been added in the protocol with the consideration of getting comprehensive picture about the observed area. During the observation process, researchers paid attention not only on the hardware: urban infrastructure, but also on the software: typology of people, who are living and carrying out their daily activities in that neighbourhood, etc. For each element, specific questions were designed to get sufficient data for producing a walkability assessment. Each question has generally four levels: low, medium, high and excellent.

The areas to observe were selected starting from the service centre for elderly located in that area as the main central point of interest. There is higher density of senior citizens who are walking in those areas. Moreover, the protocol is highly standardized in order to register neutral-enough results without personal preferences.

Conducting walkability assessment

Two researchers conducted the on-site observations. They went to the first selected area about 7 times and conducted the observations both during the day (in the morning or in the early afternoon) and during the late afternoon (around 16:30 to 18:00). In winter during these hours the sun goes down, therefore, it's the right period to observe the effectiveness of the lighting system. Data were collected thanks to the implementation of a shared online protocol. The choice of using a digital online tool was due to the possibility to standardize the observation process and give the researchers a common tool. In addition to that, this tool allowed to easily analyse and compare data. We carried out 15 observations. The data were analysed using excel and assigning scores for each elements according to their presence or absence. In this research, the walkability assessment formula has been designed as: Walkability =Usefulness (20%) + Comfort (20%) + Safety (30%) + Attractiveness (20%) + Legibility (10%). At the end, we calculated a score for each observation and based on the formula, we generated the final walkability score for each street and then for the whole area of interest.

Results from preliminary research data

Thank to observations, carried out initially in the central area of the city of Sesto San Giovanni, and then in the area of Gorla-via Padova of Milan, we investigated different aspects which concur in the evaluation of walkability. We both analysed the levels of walkability for each street taken into consideration and for the whole area of interest.

We present here only the results from the observations carried out in Sesto San Giovanni (because the observations in Gorla-via Padova were made afterwards). In particular, looking at the general scores of the area:

- Usefulness: registered a medium score (0.32). Indeed, this area offers several important services which are at a walking distance from our main point of interest, such as Post offices, banks, grocery shops, recreational places, etc.
- Comfort: registered a high score (0.52). This area presents pretty good conditions of accessibility especially for elderlies and it is constituted by elements which favour to experience the area by foot. This means, for example, that sidewalks are wide enough and not too steep to be easily walked and that there are not many obstacles which impede the passage of a person. In addition to that, public spaces and urban furniture are generally satisfying in terms of pleasantness and they basically answer people needs to rest and be informed.
- Safety: also this indicator registered a high score (0.57). This indicator is very important in order to favour both the perceived and the actual security in walking around the area both during day and night. It does not refer only to personal security but for example it includes the presence of safe pedestrian crossings.
- Attractiveness: a high score it was registered (0.58). In a different way from the usefulness indicators, attractiveness points out the vocation of an area. A mixed vocation is preferable than a unique one

and our area of interest is indeed mainly both residential and commercial, offering also educational and others' service activities. In addition to that, attractiveness measure also the presence of litter, noise and unpleasant odours, which in our case are all limited to those present in an average but well-maintained urban street.

- Legibility: even if this is the least important indicator, we registered a high score as well (0.64). This means that signs and street indications are readable enough also for people who might have some sight issues.

As the total walkability is concerned, the area registered a high score (0.52). This is an important result to evaluate also the possibility for us to easily conduct the following research activities, such as shadowing of senior citizens who walk in this area, organize outdoor group walking activities with the senior citizens who agree to participate in the project, etc.

Figure 3: The visualised result of walkability assessment through onsite observation. Illustrated by authors.

As explained in the methodology, from the case studies selection and observations, it was possible to identify different scenarios that are going to drive our future steps of research. In particular, we are going to focus on the square "outdoor-enabling" of our matrix. Moreover, the research team has also tried to use the five indicators identified from literature review to re-analyse 31 cases collected in the previous step. With the objective of absorbing useful inspirations, the re-analysis process has selected the most relevant cases to generate direct insights for next phases. Regarding to "*usefulness*", one case has presented a new service typology of community-living for elderly. A case about responsive urban furniture provides ideas about how an open space could be transformed by technology to provide useful information for citizens, especially those have limited accesses. This is a way to increase the "*comfort*" level. Besides, a number of product design have offered solutions to elderly people to ensure the "*safety"* of daily activities and to encourage their active walking. For example, a pair of shoes have been designed to prevent elderly falling down while walking. Regarding to "attractiveness", one case has shown the possibility to change a neighbourhood through artistic intervention to retell the historic stories relevant to elderly citizens.

In addition to that, next steps of field research, which has been already planned, will consider a new field of observation in a more critical area of the city of Milan in terms of walkability (Gorla-via Padova). As in the case of Sesto San Giovanni' observations, we are going to collaborate with another centre of support for elderlies. Starting from the centre, which constitutes our point of interest, a surrounding area of observation has been identified. This second phase will be used to assess and refine the observation protocol. Moreover, these primary results will be also evaluated according to:

1. A series of qualitative interviews with senior citizens;
2. The design-orienting scenarios identified.

The first activity (interviews) will be oriented to the assessment of walkability' indicators since the perception of our target might be different (better or worst) from what we actually observed. In addition to that, we are going to gather information about different levels of social inclusions thanks to questions about their daily life. The second activity will be oriented to identify and develop design solutions able to address and eventually solve walkability issues. Indeed, the exploratory research phase (case studies) will be interpreted in accordance with observations and interviews results in order to select even more specific areas of interest. The following phase will expect the conduction of co-design activities where the senior citizens will be involved in order to design a more walkable and therefore inclusive neighbourhoods.

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Track 1.b Introduction: Re-Designing Health: Transforming Systems, Practices and Care

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The *Re-Designing Health: Transforming Systems, Practices and Care* track explores the increasing role and possibility for a wide range of design practices and methods to contribute to health care products, provision, and systems.

There is growing recognition of the increasing complexity faced by healthcare systems; critical issues and challenges include ageing populations, chronic diseases, growing drug ineffectiveness, and lack of access to comprehensive services (to name only a few examples). Concurrently design thinking, methods and practices are increasingly recognized as means of addressing complex, multi-levelled and systemic problems.

The track session brought together design academics, researchers and practitioners that are working in—and across—areas of design, medicine and health. Employing design methods, practices, and thinking to address a range of healthcare challenges—from individual product to large-scale policy. This track provided a forum for researchers, practitioners, students, and designers to provide evidence for these relationships, document challenges and successes and to provide theoretical and practical models for healthcare and design to work collaboratively to address complex healthcare problems.

We looked to identify and build research capacity to help address the complex and significant challenges faced by society in the 21st century and to chart new opportunities for the discipline of design.

This *Re-Designing Health: Transforming Systems, Practices and Care* track contains six papers that deal broadly with notions of design and health and document a variety of practices, proposals and ideas.

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Re-Designing Health: Transforming Systems, Practices and Care Track Chairs

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In our first paper, *Reframing Healthcare: Emerging Health Design Opportunities,* design researchers, Aidan Rowe and Michelle Knox, explore the possibilities that design offers—methods, practices and processes—to help address the identified rising complications related to contemporary healthcare provision.

While design and health have a long history of working together, much of this work has been limited. In this paper, the authors make the case for further opportunities for design and health to work together in deep, meaningful and human ways.

They begin by discussing the changing space of design, then articulate the similarities between design and healthcare. The authors then present two health design research projects that employ design methods and processes within healthcare settings, exploring new opportunities for design and health to collaborate. They conclude by summarizing the benefits and challenges of these projects, articulating future possibilities for design and healthcare to collaborate.

In the track's second contribution—*Aesthetic Considerations in the Ortho-Prosthetic Design Process*—Yan Luximon, Parth Shah, and Hassan Iftikhar explore the role and possibility of applying design to the existing functional process of prosthetic creation.

They note that medical products, including prosthetics and orthotics, are designed to partially or completely assist or replace the functionality of specific body parts affected by ailments or medical deformities. People using such devices share similar sensibilities and concerns, such as looking attractive or being able to wear fashionable clothing. However, due to a greater emphasis on function over fashion in designing these medical products, the aesthetic values of the user are not fully considered. This aesthetic paucity may have a strong psychological and cognitive impact, which affects the user experience. Hence, this study aims to explore key parameters affecting the aesthetics of medical products such as prosthetics and orthotics and identify the challenges involved in their design process. Recommendations have also been suggested for the designers with the help of a design example.

Looking at a framework level researchers Jessica Lea Dunn, Keum Hee Kimmi Ko, David Lahoud, Erez Nusem, Karla Straker, and Cara Wrigley explore design innovation and medical devices in *Exploring the Role of Design in the Context of Medical Device Innovation.*

In this third paper the authors recognize that technology is the leading driving force in healthcare and medical device design, however, innovations which emerge from these practices are often driven by clinical requirements. Such innovations are focused on developing products that address current health issues, diseases or medical problems — often lacking consideration of the end-users' needs.

Design innovation advocates that user-centred design happens much earlier in the product development process so that the patient needs are prioritised. However, this emerging field is yet to be defined and explored in a medical context. This paper, therefore, proposes a framework of Medical Device Design Innovation to explore the role of design in medical device innovation through two medical device case studies. The proposed framework suggests a way to navigate the nuances and complexities of the medical device industry in order to put the patient first while ensuring commercial viability.

In *A Collaboration of University and Civil Society Organisation: Development of a Web-Based Platform for Promoting Accessibility in Design* authors Abdusselam Selami Cifter, Ramazan Bas, and Sema Ergonul explore the intersection of inclusive design, collaboration and design.

They state that accessibility is a fundamental element and a basic requirement of our daily lives; however, in many cases, we are not aware of it unless we encounter its absence. Particularly people with disabilities regularly experience accessibility problems in various domains, wherein certain cases these problems even hinder them from accessing their basic needs.

Designers have an important responsibility to design inclusively; however, they need a diverse range of reliable and up-to-date information for this, which also fits with their requirements. This paper presents an example of a collaboration of university-civil society organization within the scope of "I CAN ACCESS" project, which aimed to develop a web-based platform for designers' use in Turkey in an effort to increase their awareness on accessibility and assist them to design inclusively. The paper particularly focuses on the advantages of collaborations between civil society organizations and universities by revealing their specific resources and possibilities.

In the track's fifth paper—*Gaining Patient Experience Insights: An Integrated and Multi-Leveled Framework of Information*—designer researchers Maitane Garcia-Lopez, Ester Val, Ion Iriarte, Raquel Olarte, and Marina Gonzalez-Zubiaurre explore the lived experiences of health care users.

Taking the patient experience as a basis, this paper introduces a theoretical framework, to capture insights leading to new technological healthcare solutions. Targeting a recently diagnosed type 1 diabetes child and her mother (the principal caregiver), the framework showed its potential with effective identification of meaningful insights in a generative session. The framework is based on the patient experience across the continuum of care. It identifies insights from the patient perspective: capturing patients´ emotional and cognitive responses, understanding agents involved in patient experience, uncovering pain moments, identifying their root causes, and/or prioritizing actions for improvement.

The framework deepens understanding of the patient experience by providing an integrated and multi-levelled structure to assist designers to (a) empathize with the patient and the caregiver throughout the continuum of care, (b) understand the interdependencies around the patient and different agents and (c) reveal insights at the interaction level.

In the final paper in our track, *Design As An Agent For Public Policy Innovation*, authors Federico Vaz and Sharon Prendeville explore the intersection of public policy, innovation, design and the rise of policy labs.

Described as units developing public policies in a design-oriented manner, Policy Labs are tasked to innovate to gain in policy effectiveness and efficiency. However, as public policymaking is a context-dependent activity, the way in which these novel organizations operate significantly differs. This study discusses the emergence of design approaches for policy innovation. The purpose is to map how Policy Labs in Europe introduce design approaches at distinct stages of the policymaking cycle.

For this study, 30 organizations in Europe operating at various levels of government were surveyed. Based on the public policymaking process model, it investigates which design methods are Policy Labs deploying to innovate public policies. The study exposed a gap in the awareness of the utilized methods' nature. It also showed that the use of design methods is of less importance than the introduction of design mindsets for public policy innovation, namely ‘user-centredness’, ‘co-creation’, and ‘exploration’.

The collected papers in our track—*Re-Designing Health: Transforming Systems, Practices and Care*—recognize the power and possibility for design to contribute to 21st-century healthcare products, provision, and systems. From higher-level frameworks to diagrammatizing patient experience to specific case studies of practice, the exciting range of research demonstrated articulates how design is addressing the multifaceted and substantial healthcare challenges faced today.

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Reframing Healthcare: Emerging Health Design Opportunities

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Healthcare systems are faced with increasingly complex demands: ageing populations, chronic diseases, growing drug ineffectiveness, and access to comprehensive services are just a few of the challenges we face. Design offers methods, practices and processes to help address these rising complications. While design and health have a long history of working together, much of this work has been limited. In this paper, we make the case for further opportunities for design and health to work together in deep, innovative and human ways. We begin by discussing the transformative space of design, then we articulate the similarities between design and healthcare. We then present two health design research projects that employ design methods and processes within healthcare settings, exploring new opportunities for design and health to collaborate. We conclude by summarizing the benefits and challenges of these projects, articulating future possibilities for design and healthcare to collaborate.

Design for Health, Healthcare Design, Participatory Design, Co-Creation, Design Futures

Introduction

Today's healthcare systems are faced with increasingly complex demands. Aging populations, chronic diseases, growing drug ineffectiveness, and access to comprehensive services are just a few of the challenges we face. In response, governments, health professionals, and the public are rethinking healthcare through new, innovative approaches.

The maker movement is taking on healthcare as providers, patients, and hobbyists hack technology to create new and better health products, education, and systems. Around the globe, social innovation labs are springing up as collaborative spaces for diverse stakeholder groups to rethink 'old ways' of doing things—through dialogue, doing, and making. The general population also feels empowered—and often confused—by access to more and more information concerning healthcare.

Against this backdrop, design is emerging as an important area within the scope of the health professions (Chamberlain & Craig, 2017). More recently, design—as an academic discipline and as a professional field—has continued to expand its practice, with its processes and methods being employed in a range of institutions, scenarios, and organisations to address some of the most complex challenges facing society (Wildevuur, 2017).

Design provides a broad framework of tools, processes, and systems to effect change in the world. Positioning design as an agent of change that takes as its focus the betterment of the human condition aligns design close to—and shares many goals with—medicine, public health and the health humanities.

While design has a long history of working in healthcare, it has often been situated as a service discipline focused on discrete artifacts (e.g. medical tools or devices) positioned at the end of a project (Groeneveld et al, 2019) or concerned with environments (e.g. architecture or interior design) in the abstract or early stages of a project (Noël, 2017). As design researcher Peter Jones (2013) notes “healthcare design does not yet fit into the conventional clinical organization” (p.xv). Moving beyond these traditional roles, this paper discusses the possibilities and opportunities for employing design thinking, methods and processes to enact difference for a 21st century healthcare system. Particularly, it identifies the opportunities for healthcare work in four directions in relation to design for health research: the focus on rich co-design participatory methods; design’s positioning as a future-oriented activity; the grounding of design as interdisciplinary practice, and the expanded scope of possibility provided by and through design.

We begin by describing the changing state of design, noting its progression from a field historically based on outputs to one that is moving to focus on outcomes. We then articulate the relationship and similarities between the fields of design and healthcare, identifying shared histories, goals, and practices.

We next describe and contextualize two recent research projects that have been created to align and employ design practices in healthcare settings. These experiments differ deliberately in scale and scope, from the implementation of focused design systems and practices in specific environments to curricular programs that bring together health students through design to address pressing health issues. Research and feedback are presented to better understand the benefits and challenges of these developments and further contextualized in a broader theoretical framework.

We conclude by discussing some of the dominant challenges and complications faced when working across design and healthcare.

As Jones (2013) notes, we need "new ways to learn, think, and work quickly to make sense of the human, system, and organizational problems that co-occur every day in the morass of healthcare" (p.29). We argue that design offers a powerful array of theories, practices, and ways of thinking to address key and pressing healthcare issues of the 21st century.

In the next section, we briefly discuss the changing space of the discipline of design, articulating its move into academia, changes driven by technology, and, its broadening scope of practice.

Situating Contemporary Design Practice

“The philosophers have only interpreted the world, in various ways; the point is to change it.” Marx, K. 1845 Theses on Feurbach: XI)

Design has evolved from an artisanal, master and apprentice-based system with a historical focus on materials, outputs and artifacts (AIGA, 2017).

Throughout much of the 20th century, design practice—including design education—has often been classified by the end products created (e.g. fashion design, furniture design) or the processes employed (e.g. graphic designer) (Davis, 2017). Designers have frequently worked in a reactive capacity—waiting for a client and responding to a brief—in local design-manufacture-consume scenarios, where they shared common understandings, vocabularies and histories with clients and consumers. Often operating within rigidly defined roles, designers have frequently been seen as detached experts with a very specific set of skills and knowledge (Rowe, 2014).

Over the last 30 years, various factors have dramatically transformed the conception of design and its possible applications.

In the second half of the 20th century, the arrival of personal computers and design software created new ways of working, with a switch from the industrial model to an individual one (Bennet & Vulpinari, 2011). Design was no longer locally restricted, but became a practice that allowed, encouraged, and flourished with global collaboration. Further technological advancement also created new field specialties—e.g. information visualization, user interface, and interactive experience—where designers expanded the scope of their knowledge and skills beyond conventional roles and focus areas.

In the last decade, design processes, and in particular, design thinking have been recognized as powerful tools in other fields. Disciplines like business, marketing, urban studies, anthropology, and human-computer

interaction have begun to borrow and imbibe habits, ideas, and ethos from design and its related practices (Koskinen & Krogh, 2015).

Today, there is a greater need and opportunity for designers to resist confinement in disciplinary silos and venture beyond the production of artifacts—whether logo, table, or garment—towards the realisation of impactful outcomes (Parker, 2009). This transition from tightly-defined roles, identities, and specialisms is what Ward (2015) has called a "post-disciplinary future" (p.229). While design has always concerned itself in engaging with and working for other fields, designers are now more actively involved in identifying and addressing complex challenges across a variety of disciplines, professions, and organisations (Parker, 2009). In order to do this, designers have maximised their knowledge capacities and broadened "traditional design skills to address social and economic issues" (Burns et al, 2006. p.6).

As design issues grow in complexity and breadth, the designer-centric model is continuing to give way to user-centred models, where deeper value is assigned to engagement with the end users of designed artifacts and experiences (Hecht & Maass, 2008; Bennet & Vulpinari, 2011). Despite the widespread use of user-centred design approaches, design academics Sanders and Stappers (2008) declare these to be inadequate in meeting the complexities and opportunities at hand because "we are no longer simply designing products for users. We are designing for the future experiences of people, communities and cultures who now are connected and informed in ways that were unimaginable even 10 years ago" (p.6). There is a greater push towards the need for design to further place users and society at the center of the process in more rich and authentic forms.

Design has had a long history of working within the realm of healthcare, although often in a more traditional service capacity. For example, architects and interior designers are involved in the planning and construction of healthcare facilities and industrial and visual communication designers work on specific healthcare products (e.g. surgical tools or signage) (Chamberlain & Craig, 2017). The role that design plays in these traditional situations is often brief, disconnected from the full range of participants, and limited in impact (Groeneveld et al, 2019; Chamberlain & Craig, 2017). As Noël (2017) observes, design is moving from this historic approach to "the design of situations where people interact with other people, services, products, environments and communications" (p.S2308)

Overall, the field of design has witnessed profound change. As an interdisciplinary field, it is enriched by processes and philosophies absorbed from other disciplines, fields, and ways of working. Designers have continued to develop the scope and reach of their practice to meet the needs of our diverse and dynamically evolving social world. This realigned focus from design outputs to design outcomes has been framed by Ward (2015) as a move from the "politics of production to the production of politics" (p.227).

Although designers have played an active part in the transformation of the practice, design research, theory, and education has often lagged behind in steering the field towards what it can and should be.

In the next section, we discuss some of the existing commonalities between design and healthcare.

Shared Values: Design's Existing Parallels with Healthcare

Design and healthcare share a variety of practices, applications, and methods. As Jones (2013) notes in his publication, *Design for care: innovating healthcare experience,* the "two fields are similar in many ways" and these parallels are a useful starting point for articulating already existing intersections and similarities (p. viii).

Some of key parallels between design and healthcare include:

Central to each of these fields is their service to other humans, groups, and society as a whole; both are **People-Centred Service Professions**. Both fields are extrinsically focused, and are often framed as disciplines which require interactions with others. As design health researchers Chamberlain and Craig (2017) observe, both fields look to "promote quality of life and wellbeing for individuals who access services" (p.3). The classification of design and healthcare as people-centred and service-oriented disciplines opens up how professionals work in these areas, for example, by identifying possibilities for employing co-design and participatory approaches.

Both fields are also characterized as **Informed Skilled Practices**. As Jones (2013) notes, practitioners of both design and healthcare "learn by doing" (p.viii). Education in both fields has a shared history informed by a master and apprentice model where students are educated by doing and skilled learning is continued through professional practice. Informed Skilled Practice in both design and health education often employs experiential

learning methods where students learn by situating work in real-world environments in and out of the classroom—e.g. internships, practicums, residencies—to create more authentic learning (Potter et al, 2018, pp.8-9)

Evidence and Observation guide the fields of design and healthcare. Both fields produce improved outcomes when they are structured and conducted as rigorous, purposeful and measurable activities. While an evidence-based approach is firmly established and apparent within healthcare, there is a widely perceived need for design to progress further towards “a user-centred, evidence-based, and outcomes-oriented practice, where “the user” is everyone involved" (Noël & Frascara, 2016, p.4).

Both fields are **Interventionist**, that is, they seek to change situations, with the goal of making them better. In this goal, they both reflect Herbert Simon’s (1969) higher-level definition of design, in that they intend to “devise courses of action aimed at changing existing situations into preferred ones” (p.130). Additionally, Chamberlain and Craig (2017) note that practitioners in design and health both work to propose interventions that “promote quality of life and wellbeing for individuals who access services" (p.3).

Uncertainty is a key factor in both areas**.** As both design and healthcare deal specifically with people and their individual histories and contexts, every situation is unique and responses need to be tailored to individuals.

While healthcare has often prioritised treating diseases over healing the whole person—recent transitions in healthcare have centred on “the experiences, values, and quality of life of patients and their participation in care and treatment" (Groeneveld et al, 2019, p.2). This renewed focus on patient experience affirms the place of the individual in uncertain and variable health scenarios.

Design and healthcare are also **Rapidly Changing**. These changes are wide-ranging and driven from both internal (e.g. professional roles and responsibilities, skills shortages, etc.) and external (e.g. shifting government priorities, technological advancements, etc.) pressures. Within design, there has been a move to build on traditional design skills to address more complex and interdisciplinary social, political and health issues (Burns et al, 2006). Healthcare is also navigating new quandaries, including questions concerning patient knowledge and engagement. As Chamberlain and Craig (2017) observe, healthcare is distancing itself from the "reductionist view of health that focuses on illness and treatment is being replaced by one where the emphasis is placed on ways of maintaining wellbeing and equipping individuals with the knowledge and tools to live well" (p.4).

Recent issues around **Democratization** are also central to the fields of design and health. As healthcare begins to reject its highly structured and treatment-focused model in favour of one that informs, supports, and empowers patients in many ways, there are further possibilities for achieving a balance of power and forming reciprocal relationships amongst all participants (Groeneveld et al, 2019). While some areas of design have long been involving users in the design process—through user-centred and participatory design—other areas of design have only recently begun to embrace these co-creation practices that blur the line between expert and user. These shifts in both fields represent a flattening of traditional power relations and produce opportunities for engagement aimed at “maintaining wellbeing and equipping individuals with the knowledge and tools to live well" (Chamberlain & Craig, 2017, p.4).

Both fields also have a history of **Interdisciplinary** practice and work—for example, medical treatment protocols might draw upon expertise from multiple healthcare specialists (e.g. nurses, surgeons, physiotherapists, etc). Similarly, design traditionally involves working with clients, experts and users from other fields. Over the years, interdisciplinary practice has continued to grow in tandem with the widening scale and scope of 21st century problems. As design theorist Don Norman (2014) notes, “complex problems require complex solutions” and in order to conceive innovative and effective solutions, teams composed of representatives from relevant disciplines are needed.

These shared values of design and healthcare—while not exhaustive—delineate the many areas where the two fields exhibit overlaps and can formulate common goals and pathways. Chamberlain and Craig (2017) declare that we have seen the two fields move from working independently to where “practitioners in design and health care have sought to work more closely together” to promote enhanced quality of life (p.3).

To situate these shared values and to interrogate how these fields work together in actual practice, in the next section, we present two recent research projects that bring together practitioners from across design and health.

Current Design Research Applications

Project 1: End-of-Life Care through Design: Visualising Places of Death

Michelle Knox, PhD Student, McGill University (Canada)
MDes Thesis, University of Alberta (Canada), Aidan Rowe, (Supervisor)

How can design researchers apply their competencies to healthcare and uncover the ways in which patients, caregivers, and health professionals conceive of care? Can design help generate a humanistic understanding of where and why gaps emerge in health systems, organisations, and services?

In 2017, graduate student Knox formulated this project to explore these possibilities. Utilising design-led inquiry for health research, this Master of Design (MDes) thesis investigated the impact of the designed environment on the experience of dying within palliative sites.

Over the past few decades, the desire to enhance end-of-life care has become a globally relevant social concern, giving rise to new ethical questions about patient choice and end-of-life decision-making—not just in terms of how death occurs—but also where it may be situated. These questions further influence how we might design and build future health environments to cultivate ceremony, communion and ethos in what are often seen as functional and medicalized spaces (Worpole, 2009). While the relationship between built environments and human health has been explored before, relatively little research has applied evidence-based design principles specifically to spaces, processes and social frameworks of death and dying.

Accordingly, this research explored the roles and responsibilities of designers within contexts of end-of-life care in three steps:

> **Literature Review:** Through a discussion of existing literature on the relationship between health and design, it contextualised design thinking and evidence-based design practice within health-related problems. Drawing upon anthropological perspectives on the nature and meaning of places, it distinguished between geographic territory, locations imbued with social relevance, and sites historically associated with illness, death & dying. Next, it identified expectations and needs communicated by scholars working specifically within the subdomains of end-of-life architecture and palliative care design.
>
> **Field Research:** Primary research involved ethnographic observation within two distinct kinds of palliative care locations: a small community-based hospice in suburban Alberta (Canada) and at the intensive palliative unit of a large general hospital in a large city. Site research was conducted using an ethnography-derived model, using observational field notes, immersive walkthroughs, and photographic data. These were supplemented with in-depth, semi-structured interviews with end-of-life care professionals and experts, including health administrators, palliative nurses, bereavement counsellors, and palliative care research leaders. Data was presented through detailed content analysis.
>
> **Design Frameworks for End-of-Life Settings:** Using findings from primary research in light of previous gleanings from secondary literature, pragmatic recommendations were generated and compiled for the future design of palliative facilities. Finally, research was re-contextualised against the changing end-of-life landscape, noting some broadly emerging concerns around patient empowerment, improving integrative care, health system navigation, and public perceptions of dying-in-place.

In the continually evolving end-of-life landscape, patient-centred design has the potential to disrupt the hegemonic care models of mainstream medicine in conceptual as well as pragmatic ways. Anthropologist Jamer Hunt (2015) believes that, "[b]ecause people aren't working in a way that's been consciously and empathically designed, there are many unintentional bad moments that add to the difficulty of the situation." In the same vein, design critic Alice Rawsthorn (2015) notes:

> When well-designed technology can help improve our every living moment, why should it desert us in death? In theory, design could—and should—have a useful part to play in improving the quality of any aspect of daily life that is no longer fit for purpose, and death is no exception...[A]nalysing the strengths and weaknesses of present systems and rituals with an open mind, and applying grace, foresight, rigour, sensitivity and imagination to envisaging better outcomes could help us to die more humanely.

Numerous studies have shown that—despite the limitations of home-based care—patients, families and healthcare providers generally believe medical settings to be under-equipped for meeting the needs and expectations of dying persons (Murray et al, 2009). Stephen Verderber, Professor of Architecture and Public Health at the University of Toronto, writes that human beings are pacified by spatial conditions implying security, privacy, intrinsic meaning and value. He notes that the patient's ability to accept existential situations, find contentment with health services, and experience a sense of control—are all directly manifested in the physical appearance and design of care spaces (Verderber, 2010).

Dying is a sphere where "the interests of [the] government, religion, the law, capitalism and free will all converge, making it an unusually complex field." (Hunt, 2015) Design for end-of-life care, therefore, requires us to venture into the field with sensitivity, humility, and purpose. While design that celebrates, optimizes and sustains living conditions is plentiful, relatively little design concerns itself with death and dying. As a result, even within care spaces, palliative zones are much less visible or consciously designed than curative ones. In conceiving comfortable, empathic, aesthetic, and functional spaces, designers can help relieve patient stress and enhance satisfaction with the quality of care being received. This master's thesis argues that designing for death—one of life's most vulnerable and profound moments—falls directly within design's ambit and registers an urgent call to designers today.

Project 2: INTD 410: Co-Designing Health

Aidan Rowe, Associate Professor, Design Studies, University of Alberta (Canada)
Patrick von Hauff, Academic Technology Specialist, Faculty of Medicine & Dentistry, University of Alberta (Canada)

What role could design play in creating educational environments to address intricate and essential issues in healthcare? How might design tools, methods, and processes be employed by non-designers in medical contexts?

The *INTD 410: Co-Designing Health* workshop was created to interrogate these possibilities.

In 2016, design researchers Rowe and von Hauff created a workshop aimed at introducing university students in healthcare to design processes and methods. The workshop—*INTD 410: Co-Designing Health*—brought together students from across different health practices (e.g. medicine, dentistry, physiotherapy, speech pathology, nursing, etc.) to work together using design methods to address health issues they encounter within their professional environments.

For many participants, this was the first time they were introduced to design through an academic lens, where we discussed—and enacted—how design can be operationalised. The 3 hour workshop was structured as a low fidelity, hands-on, studio-based session and was broken into three sections (each approximately 50 minutes long):

> **Part 1 — Setting the Scene (Meanings and Exemplars):** Beginning with definitions of design, we discussed a variety of design models, design professions and similarities between designers and health professionals. We ended the session with participants sharing examples of design within health that they were familiar with.
>
> **Part 2 — Tackling a Problem (Ideate and Own):** Groups (of 3 or 4 students) were created ensuring diversity of students from different health fields (to promote interprofessional learning opportunities and diversity of experiences). Groups identified existing problems or issues in health and articulated the context (settings, people involved, ramifications, etc.), noting down information on large format forms (provided to them with prompting questions). Groups also proposed potential design interventions (whether product, environment, or system) to address identified issues.
>
> **Part 3 — Exposition (Share and Communicate):** Groups came back together to share the results. Each group presented and contextualised their work to the entire cohort. To conclude, we drew out common themes and overarching narratives emerging across the work completed by all groups.

These workshops were designed to accomplish two main outcomes:

Communicate design tools, methods, and processes to non-designers: In the last decade, design has developed from a fairly specialized discipline to one that is recognised by many other non-design fields—e.g. business, engineering, etc.—as possessing fresh tools and skillsets for addressing a multiplicity of issues and

challenges (Golsby-Smith, 1996, p.5). This shift has been particularly evident in the proposition—often not by designers—that design thinking is a magical panacea that could unravel any problem or boost any industry (Pierri, 2018; Norman, 2014). This workshop was an opportunity for exploring how design's unique characteristics—as a problem-setting, collaborative, outcomes-focused, future-oriented activity—could be applied by non-designers to their own areas of expertise and practice. We believe that design as an academic and pedagogic area offers much to other fields. This workshop provided an ideal opportunity to model and test these offerings.

Embed interprofessional learning opportunities: Central to this workshop was the aim to test venues for interprofessional learning in healthcare education. It has been identified that stratified learning common within traditional health disciplines—nurses learn with nurses, surgeons with surgeons, etc.—is problematic (Shraiky & Lamb, 2013). As Buring et al (2009) note, a fundamental principle of interprofessional learning attempts to address this stratification, asserting "that if health professions students learn together at the beginning of and throughout their training they will be better prepared to deliver an integrated model of collaborative clinical care after entering practice" (p.1).

Since the initial running of two sessions of *INTD 410: Co-Designing Health* in 2016, the workshop—revised in response to researcher reflection and feedback from participants—has been run again in 2017 and 2018. The development team Rowe and von Hauff are also in the process of proposing a credit course for health care students that focuses on design and health.

In the next section, we identify some broader, key gains from integrating design methods, tools and processes within healthcare settings in these two described research projects.

Specific Benefits from Employing Design in Healthcare Settings

Both the research projects presented above—*INTD 410: Co-Designing Health* and *End-of-Life Care through Design: Visualising Places of Death*—integrated design methods within healthcare settings. We have identified specific benefits from this research.

Both of these projects employed **Participatory Approaches** where the researchers worked with participants—whether users, students, clients, or other experts—in rich and meaningful ways. The *End-of-Life Care through Design* project worked with a variety of participants through interviews, walk-throughs and observations. Health experts, academics, administrators, front line staff and patients were interviewed, and days were spent observing environments and how people worked and lived in health settings. The *Co-Designing Health* workshop used participatory methods within the session where students worked together negotiating possible responses to identified issues. The research team, attending faculty, and observers were also active participants throughout the workshop and this work was used to refine future instantiations of the workshop.

Participatory approaches—sometimes termed Co-Creation, Co-Design or Participatory Design— have a long history in situating design as human-centred activity where there is direct involvement of participants throughout the design process (Dimopoulos-Bick, 2018). This direct and continuous involvement of participants works to reveal the actual needs of users rather than those imagined, and allows for stimulating discussion and generates deeper understanding. As health researcher Jiwa (2016) observes, "by collaborating with patients to ensure their needs are met, we can ensure a more satisfactory patient experience" (p.1). Chamberlain and Craig (2017) frame this movement as collective creativity (p.5) and Cottam and Leadbeater (2004) note that the "biggest untapped resources in the health system are not doctors but users" (p.28). Participatory approaches from design are one means of engaging these users to help create healthier futures.

Each of the research projects were also **Future-Oriented**; their goal was to improve upon what was done before and situate these changes in the future. In the *Co-Designing Health* workshop, students identified current real-world healthcare issues and negotiated designed responses to address them. The *End-of-Life Care through Design* study identified specific recommendations for the design of future end-of-life care settings looking to improve current practices. As design researchers Noël and Frascara (2016) note, design "helps to envision new possibilities to enable people to improve health and healthcare" (p.9). Additionally, when design practice is situated in a future-focused frame, a plethora of possible outcomes are made possible. As Ward (2015) observes, "Designers materialise thought in order to push the boundaries of knowledge"—an act he later terms as "a leap into the material abyss" (p.229). This broader exploration of possible futures presents new avenues for innovation and triggers rich responses beyond incremental quality improvement initiatives. This wider scope of responses is urgently needed as the breadth and depth of healthcare challenges expands.

Interdisciplinarity was a key theme throughout both projects. Building further upon the specific histories identified in the *Shared Values: Design's Parallels with Healthcare* section, these projects—as Burns et al (2006) observe—positioned design processes "as a means to enable a wide range of disciplines and stakeholders to collaborate" (p.6). Through interdisciplinary teamwork and by building on its future-oriented focus, design "develops solutions that are practical and desirable" (Burns et al., 2006, p.6). Noël and Frascara (2016) also identify a need for "interdisciplinary collaborations that integrate design and health in a problem-based learning context" to address deepening complexities in modern healthcare (p.5).

Central to both projects—although not necessarily obvious at the onset—is the ability of design research to create **Expanded Scope of Possibility**. In conjunction with—and building upon—each of the three identified benefits of Participatory Approaches, Future-Oriented, and Interdisciplinarity, design research offers opportunities for revealing previously unconceived possibilities and extended realms of action. As Cottam and Leadbeater (2004) argue, when making the case for co-created design led services: "we need a different way forward: not further incremental innovation but rather radical transformation and a new approach" (p.6). Within the *End-of-Life Care through Design* project, researcher Knox noted that working with patient-participants exposed questions outside of the realm of the set research, notably new questions about equitable access to health services, ethical communication between health institutions and the public, and dignity and decision-making power at the end of life. Importantly, the master's research has now led to a doctoral project investigating these raised concerns, specifically, how palliative institutions communicate their positions on assisted dying issues and how patients navigate the healthcare system when and if they choose to receive an assisted death.

In addition to the benefits that design can provide in healthcare settings, there are also a number of challenges. We discuss some of the prominent issues in the following section.

Challenges and Experiences: Design Education, Research, And Practice in Health and Medicine Environments

Within the context of health research, interdisciplinarity is a frequently invoked and aspired-to ideal (Paradis & Reeves, 2012). Studies show that strategies and policies—adopted by health research funding agencies, public healthcare institutions, and academic organizations—to promote interdisciplinary practice and inclusive scholarship within the health sciences do not necessarily translate into practice as we would hope (Jacobs & Frickel, 2009). Designers—like other scholars and practitioners trained in the arts, social sciences, and humanities—continue to report several challenges faced upon moving into spheres of health and medicine (Dimopoulos-Bick, 2018).

The USA-based National Institutes of Health (NIH) calls for the study of complex health problems through a multi-lens approach in order to find innovative solutions to "health challenges that have been resistant to traditional research approaches" (NIH, 2007). Similarly, the Canadian Institutes of Health Research (CIHR) was formed with the aim to promote "the creation of new knowledge and its translation into improved health for Canadians" through "interdisciplinary, integrative health research" including "research respecting health systems, health services, the health of populations, societal and cultural dimensions of health and environmental influences on health, and other research as required" (Government of Canada, 2000, p.3e4). In response, most faculties of medicine in Canada have now declared their intention to support "a rich interdisciplinary environment of learning, practice, research and public service for all our students and faculty." (Faculty of Medicine & Dentistry, University of Alberta).

Despite the widely espoused belief that interdisciplinarity within health and medicine can support a holistic vision for global health futures, numerous reports demonstrate that the landscape of interdisciplinary research is fraught with real world hindrances and impediments.

As a field that has a long worked in partnership with other disciplines and professions, what do calls for interdisciplinary arrangements mean for designers and design researchers?

To begin with, **co-design practices and collaborative research creation are time-intensive, ambitious and complex undertakings.** Literature shows that interdisciplinary work done across and beyond traditional silos does not always result in superior research quality (Barry et al, 2008; Moore, 2011). In Groeneveld et al's study, design students, researchers and practitioners working in active health settings, reported a number of pragmatic challenges when operating across teams, including: health professionals' unfamiliarity with what

design research, user involvement, and design thinking entails; issues around team coordination and managing team relations; barriers in communicating the value of research; building rapport and establishing trust; time and financial considerations; inadequate sensitivity training for designers in relation to vulnerable persons and critical situations, to name a few (Groeneveld et al, 2019).

Additionally, **working across disciplines, professions and academic units** brings out clashes in epistemic values, work methodologies, and criteria for defining professional excellence among researchers and practitioners from different fields (Bauer, 1990; Lélé & Norgaard, 2005). Social science and humanities scholars acquire their training in a research culture where ways of doing, disseminating, and measuring meaningful work are markedly different from—if not dissonant with—practices, methods, metrics for realising outcomes in the health sciences.

When interdisciplinary scholars work with and within scientific communities, they enter a highly structured, institutionalized "market" (Bourdieu, 1971). In a study examining the experiences of social science and humanities academics employed within Faculties of Medicine across Canada, Albert et al (2015) found that the majority had to alter their practice in order to gain legitimacy among their medical colleagues, advance through academic ranks, and meet the evaluation standards of medical faculties. Having to thus adapt to the norms and cultures dominant in health-related environments, resulted in dissatisfaction with their careers and professional identities, alienation from peers in their parent disciplines, and diminished the rigour of work produced. This unfavourable situation "indicates the low value assigned to their research practices" and the expectation for interdisciplinary practitioners to adopt health research conventions "contradicts the principles behind interdisciplinarity: that experts from different disciplines collaborate to create better solutions to enduring problems" (Albert et al, 2015). Finally, it is important to acknowledge that **design cannot solve everything** and there will remain domains of knowledge outside its scope; technological and societal advancements to keep pace with; and practical constraints related to budget, timeline, scale, demand, and resources. Besides pragmatic restrictions, design is abound with ideological, pedagogical, and theoretical quandaries that require thorough critique as the field evolves, and especially, as it straddles new knowledge realms that have been historically dominated by other players and meaning-makers—whether clients, academic experts and or end users. Pierri (2018) cautions against the over-optimistic stance and uncritical framing of design as the new cure-all for complex social and health problems.

As such, designers need to recognise both the possibilities and constraints when exploring the use of design in healthcare settings.

Conclusion

The practice, delivery, and needs of healthcare provision are in a state of continual flux. External factors are drastically re-shaping the medical and health requirements of our population. The idea that design holds promise for resolving complex systemic and social issues is gaining traction worldwide. As Burns et al (2006) note, this new design field enables "a wide range of disciplines and stakeholders to collaborate" and develops a set of practical and desirable responses that "places the individual at the heart of new solutions" (p.6).

In this paper, we argue that design offers a powerful array of theories, practices and ways of thinking to help address key and pressing healthcare issues of today. As design practitioners, educators, and researchers, we need to be at the heart of situating design practices, methods and processes in this expanded field of practice.

The research presented through the two projects documented—*Co-Designing Health* and *End-of-Life Care through Design: Visualising Places of Death project*—are examples of our recent research that interrogate opportunities for change in design to contribute in impactful ways to 21st century healthcare provision.

In addition to design's shared history and similarities with healthcare practice, we identify four opportunities for design in healthcare settings: a focus on rich co-design participatory methods; design as a future-oriented activity; the role of interdisciplinary practice in design, and the expanded scope of possibility provided by and through design.

As noted design researcher J. Christopher Jones (1979) has stated, "It's clear to me that no big change is possible till we change ourselves and our ideas" (p. 33). We propose that design devises new possibilities for change and leverages its methods, theories and practices to address the pressing issues and challenges facing modern healthcare.

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Research Perspectives IN THE ERA OF Transformations

Aesthetic Considerations in the Ortho-Prosthetic Design Process

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Medical products, including prosthetics and orthotics, are designed to partially or completely assist or replace the functionality of specific body parts affected by ailments or medical deformities. People using such devices share similar sensibilities and concerns, such as looking attractive or being able to wear fashionable clothing. However, due to a greater emphasis on function over fashion in designing these medical products, the aesthetic values of the user are not fully considered. This aesthetic paucity may have a strong psychological and cognitive impact, which affects the user experience. Hence, this study aims to explore key parameters affecting the aesthetics of medical products such as prosthetics and orthotics, and identify the challenges involved in their design process. Recommendations have also been suggested for the designers with the help of a design example.

Keywords: Aesthetics, Medical product design, Prosthetics & Orthotics design, User experience, User psychology

Introduction

The design of medical products is a huge industry worldwide, of which, a major interest has always been the design of orthotics and prosthetics. Orthotics are devices, which provide support or stabilize an affected part of the body. They are used in cases of reduced musculoskeletal functionality. In most of these cases, the orthotics are used as the external aid or body support (Sansoni, Wodehouse, & Buis, 2014). However, these supports can be used internally in the form of rods and braces. The most widely used orthotics include splints, braces, slings, compression sleeves, and insoles. There are some simple orthotic products that we use in daily life such as glasses or spectacles, but these have been transformed from simple disability products to a fashion icon (Pullin, 2009).

Prosthetic devices replace or enhance the functionality of a body part (Sansoni et al., 2014). They are used in cases of severe medical deformities or amputations. Other examples of prosthetic use include implants, artificial hearts and limbs. In previous studies, it is quite evident that the use of prosthetics not only aid the user by increasing mobility, but also helps in performing daily activities, thereby enhancing physical, social and emotional well-being (Murray, 2005; Pohjolainen, Alaranta, & Kärkäinen, 1990). The new science of "Prosthology" (Bache, 2008) deals with concept of the prosthetic part of the body being fully integrated as a new part of the body, as described by Gestalt's concept of totality (Giannini, Marzi, & Viggiano, 2011).

Limb amputation has many disturbing and irritating impacts on patient psychology (Horgan & MacLachlan, 2004; Whyte & Niven, 2001) often leading to stress and despair (Breakey, 1997; Williamson, Schulz, Bridges, & Behan, 1994). Product design studies (Bloch, Brunel, & Arnold, 2003; Creusen & Schoormans, 2005; Crilly,

Moultrie, & Clarkson, 2004) have suggested that the visual appearance of a product is one of the key elements affecting user choice and the product-user relationship. Visual aesthetics also have the tendency to make products more acceptable and effectively usable in many cases (Newell & Gregor, 2002) However this may differ across products and contexts. The overall appearance of a prosthetic limb is very important and may alter the level of the patient acceptance for the prosthesis (Biddiss, Beaton, & Chau, 2007; Cairns, Corney, & Murray, 2011; Carroll & Fyfe, 2004; Datta, Selvarajah, & Davey, 2004; Hagberg & Brånemark, 2001; Legro et al., 1999; Murray & Fox, 2002; Pillet & Didierjean-Pillet, 2001; Pons et al., 2005). However, in designing medical products, functionality is the designer's primary concern; with minimal attention given to product aesthetics. This can affect user experience and satisfaction. Most of the available literature is focused on the technical and functional aspects of prosthetics, with only a few studies dedicated on aesthetics, showing a lack of interest of designers and researchers in this area (Cheetham, Suter, & Jäncke, 2011; Klute, Kallfelz, & Czerniecki, 2001). In the case of hand prosthesis, a previous study (Kostuik, 1981) also describes a prioritization of functional usage over aesthetics . While, another study by Biddiss and Chau (2007) suggests prosthetic appearance to be a factor that significantly influences the decision to wear or use a wearable prosthetics. The decision of whether or not to wear a prosthetic may be based on the user's life style and personal needs (Durance & O'Shea, 1988; Hubbard, Kurtz, Heim, & Montgomery, 1997; Scotland & Galway, 1983; Wright, Hagen, & Wood, 1995). However, aesthetics play an important role in altering device adaptability. Additionally, if the prosthesis is purely functional but overly bulky, it can affect user acceptability and satisfaction. This can also have consequences which may affect the user's psychology state and social interactions skills (Bhuvaneswar, Epstein, & Stern, 2007). In order to avoid such situations, it is important to focus on the aesthetics of prosthetics.

Several studies have shown that the acceptability of medical products can be improved significantly by addressing their aesthetics (Goiato, Pesqueira, Ramos da Silva, Filho, & Micheline dos Santos, 2009; Newell & Gregor, 2002; Power, Leaper, & Harris, 2017; Sammartino, Marenzi, Di Lauro, & Paolantoni, 2007). However, a very limited number of studies (Nicola Cairns, Murray, Corney, & McFadyen, 2014; S Sansoni, Wodehouse, & Buis, 2014) have been conducted in the area of medical product design aesthetics. The majority of these studies have mainly focused on improving the aesthetics of upper and lower limb prosthetics (Davies, Rode, & Cywes, 1977). There is still a wide range of possible medical products, whose designs can be optimized by improving their visual appearance and aesthetic properties.

In this paper, the authors explore the field of medical product aesthetics. Some valuable suggestions and recommendations for medical product designers with the aim of improving user experience and satisfaction have also been discussed.

Customary design attitude of Ortho-prosthesis and need of aesthetics

Conventionally, medical personnel such as doctors, physiotherapists and prosthetists are typically involved in the ortho-prosthetics' design process in order to ensure functionality. In the case of prosthetics and orthotics, functionality is important for enhancing mobility and fundamental in performing activities of daily living. However, the aesthetic value of the product is generally neglected or only considered after the users functional requirements have been met (Gotzsch, 2000; Jordan, 2000; Lewalski, 1988; Maslow, 1970; Rutter & Agne, 1998; Viemeister, 2001; Yalch & Brunel, 1996). Functionality is often considered as the cutoff requirement in process of designing medical products unless the product have some clear marketing value based on fashion and styling only. As the industry shifts towards user-centered designs, user experience has gained considerable importance and mainstream designers are increasingly aware of the impact. Hence, medical product designers now need to focus on product aesthetics as well as functionality.

Today, we live in a world where bodily perfection and beauty are given a high priority. People who use medical products such as prosthetics encounter challenges related to aesthetics such as social validation and acceptance (Hughes, 2000). Often unacceptance based on image and aesthetics can cause feelings of social exclusion. Limb amputees face extreme difficulty in accepting new prosthetic modifications to their body (Sjödahl, Gard, & Jarnlo, 2004) which can often lead to depression. Prosthetic users tend to avoid public exposure and are more prone to social isolation due to feelings of awkwardness and being self-conscious. These behaviors can affect psychological wellbeing, self-esteem and the ability to interact in social situations. (Sansoni, Wodehouse, McFadyen, & Buis, 2015).

Design aesthetics play a significant role in changing user behavior and product preference. A designer from Reebok theorized the value of good design by stating that "good design can make you fall in love with the

product" (Dumaine, 1991). By improvising upon aesthetic features, users can have an opportunity to actively or to passively express themselves in their own unique way. Styling can enhance the acceptability of prosthetic usage among amputees by having positive psychological impacts. This can have positive effects on self-esteem and confidence. Hence, it is tremendously important to consider aesthetics when designing medical products.

Parameters of aesthetics affecting user experience

Incorporating natural elements in aesthetic improves the user experience and acceptance. Many designers have used natural and organic elements in the product design process such as those found previously in Art Nouveau (Weisberg & Menon, 1998). Organic elements not only mimic abstract human forms but can also be used as a stylistic element when designing prosthetics. Due to the level of craftsmanship and material handling involved, natural forms were considered to be difficult to manufacture. However, with emerging technology and ease of use of techniques like 3D scanning, modeling and printing, it has become possible to design and customize aesthetically pleasing medical orthotic and prosthetic devices based on personal preference. In the following sections, the authors attempt to explore the current aesthetics issues of existing medical products and provide some possible suggestions and recommendations for improving these aesthetic elements.

Shape and form

The shape and form of a medical device primarily defines its visual appearance. A study (Nicola Cairns, Murray, Corney, & McFadyen, 2014) attempted to investigate the factors affecting user satisfaction. They found that the most important factor suggested by the users was the shape of the device and how it matched the corresponding part of the body. For prosthetics, shape is an important element related to both functionality and aesthetics. Another study (Sansoni et al., 2015) had similar findings. By exploring the relationship of Uncanny Valley and prosthetic devices. Uncanny valley is a hypothesized relationship between a prosthetic's human-likeliness and individual's emotional response to them. In the study, they selected 30 different designs with three different types of forms – artificial looking devices, devices with moderate human-likeness and devices with high human-likeness. Based on their results, the level of user attractiveness increased in proportion to the human-likeness of the device's form. This demonstrates the importance of designing devices with shapes that resemble or mimic real body parts. Conversely, other studies also suggest that this can generate negative moods instead of feelings of attraction (MacDorman, Green, Ho, & Koch, 2009). Therefore, the impact of shape and form in the design process of ortho-prosthetics should be kept in considerate balance in order to promote user acceptability.

One of the key challenges in achieving an ideal product shape is the packaging and placement of functional elements (i.e., electro-mechanical components). For instance, some battery-powered medical devices, battery placement can be problematic if it is not considered during the design process. These elements can affect product aesthetics and lead to user discomfort.

Pye (1978) suggests that workmanship and the development process also play a major roles in the form of the final product. With 3D scanning technology, it has now become possible to acquire accurate anthropometric data, which can be used to develop accurate digital human models (Shah & Luximon, 2018; Zhuang & Bradtmiller, 2005). It can also be used to develop highly customized medical products. With the continued improvement of 3D printing facilities, it become possible to produce such forms with a high level of precision and superior finishing.

Wearable art is one of the potential future trends in medical product manufacturing Wearables can be customized to fit a particular set of functional requirements and customary aesthetic elements for every user. Existing orthotics and prosthetic devices could then be made to look like wearable art forms that blend with the users clothing. Aesthetics and functions can fused together in this way to give psychological pleasure as well as the feeling of fashion and peculiar style sense. The aesthetics of shape and form may differ based on gender. Previous studies (Oumlil & Erdem, 1997; Weitz, 1998) have demonstrated differences in the choice of prosthetics that were based on gender perceptions.

In designing prosthetics for children, designers should make an attempt to stretch the boundaries of their imagination in order to make products interactive or in the form of wearable toys. Some research groups (Knochel, 2016) have also tried to develop Do It Yourself (DIY) types of prosthetics where the user is given the liberty to design their own device. A South African carpenter who lost his hand due to occupational hazards, sought a customized DIY prosthetic hand. He developed it using online resources and the help of a special

effects artist (Owen, 2011). In addition to individual and laboratory-based applications, DIY prosthetics have also been developed as a manufacturing solution for amputees with the ubiquity and greater availability of more economical 3D printing facilities. The process of DIY ortho-prosthetic design and manufacturing can create new opportunities and facilitate in the design process of medical products.

Size and scale

The size of the product has a substantial impact on visual appearance. Size and material affect the weight of the device. If it is too large, it may cause discomfort and may be inconvenient for daily usage. Minimizing the size and visual prominence of prosthetics is important. Although reducing the size of a device may be more costly and technically challenging, it has a positive impact on patient's psychological well-being. Current braces have metallic parts, which are difficult to conceal under regular clothing. Smart textile materials can be used in place of metallic components to maintain product aesthetics. However, if it is not possible to reduce size or to make a device more compact, then efforts should be allocated to make it unnoticeable and discrete in nature.

The size of a prosthetic should also conform to individual differences in body type to ensure that it maintains perfect symmetry with the contralateral part, side or limb. In order to develop products, which are generalizable and can be scaled according to a broader user base, it is important to understand individual variance in shape amongst the target audience. This can be accomplished by developing a database containing large anthropometric data samples based on country, location, ethnicity, age and gender of end users. Customization techniques like casting; last formation, which have been traditionally used, can be replaced by 3D scanning and modelling to achieve better results. In addition, modularity in ortho-prosthesis can be introduced at a grass root level to optimize device size and fitting. The concept of modular design can be implemented to achieve a "one size fits all" design methodology for mass production and may help to stabilize the user market.

Colour

A lot of research has already been conducted on the relation between colour, user perceptions and product selection (Funk & Ndubisi, 2006; Kauppinen-Räisänen & Luomala, 2010; LoBue & DeLoache, 2011). Although the range of colour options for medical products is limited, still the colour of the product contributes heavily in the product appearance.

In the case of orthotics, there is more flexibility to experiment with different colours compared to prosthetics. Depending on the application and user demands, products can be made transparent or incorporate colour to stimulate concealing. The product design value for users changes when the product style or design parameters also change (Holbrook, Morris B., & Moore, 1981). For instance, traditional dental braces use metallic wiring to correct alignment issues. However, they are not aesthetically pleasing and often make eating difficult for the user. Recently, several dental product manufacturers have started producing transparent dental braces without the slightest compromise on functionality. This example illustrates the influence of colour preference in producing a positive user experience without sacrificing functionality.

With prosthetics, many users prefer the product to be similar to the tone of human skin. Due to the limited amount of colour options for prosthetic devices, matching a user's skin colour is challenging and may influence product acceptance. This could lead to a psychological unacceptance of the product as a part of their own body. Some users prefer their prosthetic devices to be more vibrant and colourful. Several new prosthetic limbs with printed artwork have been made available, which have been well received and successful among young users. Similarly researchers (Lenhart & Sumarriva, 2008) have tried introducing printed cartoon characters on orthotics designed for children which have been very effective. Body art's fashion trends such as tattooing are additional design possibilities whereby prosthetics can be perceived as more of a fashion statement rather than a reflection of personal limitation or disability. An intensive care must be taken to make the colour of the device/product as natural and as iconic to meet the user's acceptability and psychological treat. The user should take certain cultural considerations into account when incorporating this type of device customization as it may not be appropriate for mass production. Interchangeable design skins may be a viable option in such circumstances. It is important to understand user needs and preferences when choosing the colour of ortho-prosthetic devices.

Material and texture

Material selection is a key step in orthotic/prosthetic design. From the perspective of product design, material characteristics have a strong impact on the physical product (De Sausmarez, 1964; Hannah, 2002; Scott, 1951). It is important to ensure the material selected has the necessary mechanical and physical properties required for the functional needs of the user. Concomitantly, careful consideration must be given when addressing more intangible characteristics like perceived values, personal associations and emotions. A study by (Karana, Hekkert, & Kandachar, 2008), provides a detailed summary of key parameters to be considered by designers when selecting materials with a greater emphasis placed on the intangible characteristics of materials for improving the product design process. With advancements in material research and technology, it is possible, with new material options, to satisfy these intangible needs.

In addition, care must be taken to make sure materials should be waterproof so that they can be suitable for various outdoor conditions. Water and sweat could be the potential causes for the invalidation of functional aspects and strongly destroy the aesthetical appraisals of amputee. Excessive sweating may lead to itching, irritation and sores, causing unwanted discomfort to the patient, making it less desirable. The material used should be easy to clean and should not allow colours to fade.

Most medical prosthetic devices use metallic components to provide the necessary mechanical strength and polymers or plastics for the external encasing. Newly developed inert materials such as fiberglass, biopolymers and various metal alloys have been used to improve mechanical strength. The synchronization between user perception and product material should also be considered. Material texture preferences may be influenced by gender and various socio-cultural factors. Material, which mimics skin, may or may not be desirable depending upon the circumstances. More research is needed in this area.

Adaptability to fashion and clothing

Just like physically fit human beings, people with special needs also have the desire to be perceived as attractive. An individual's appearance is highly affected by the style of clothing and fashion accessories being worn. However, the ability to use the prosthetic under fashionable clothing is an aspect often overlooked by medical practitioners when designing the device.

Velcro straps can be used to affix bulky orthotic splints and braces which are often prominent, detract from personal aesthetics and make it difficult to wear clothing over top. Due to bulkiness and prominent visibility of prosthetic devices, the range of clothing is limited Current design technologies have the ability to produce customized and sleek products which can be either hidden under clothes or can blend with an ensemble by matching the contour of an individual physique.

The majority of lower limb prosthetics are designed for wearing normal flat-soled footwear. This reduces the number of footwear options and may negatively alter the biomechanics of the prosthetics predisposing the user to postural imbalance and injury. Hence, there is a need for designing adjustable ankle prosthetics, which not only support body weight but can also adapt to different types of footwear.

Following fashion and style trends are often important for the reasons of personal aesthetic preferences. The aforementioned design considerations would help ortho-prosthetic users have greater autonomy and fewer limitations when it comes to choice of clothing. This could have positive effects on social interactions psychological well-being and self-confidence.

Other factors

Factors like age, gender, cultural affiliations and personal attitude affect consumer aesthetic tastes (Bloch, 1995; Ji, Peng, & Nisbett, 2000; Salkind & Salkind, 1997). Previous studies have shown that males prefer more masculine product patterns whereas females are more inclined towards products of beautiful and elegance (Sansoni et al., 2015). Regulatory and legal factors also affect material selection as products often needs to comply with standards approved by the Food and Drug Association (FDA).

Other factors, which also affect the design process, include the cost of manufacturing and affordability of the target users. However, aesthetics should not be compromised based on manufacturing costs or material selection. Although traditional manufacturing processes help in producing more economical medical prosthetics in mass scale, 3D printing has proven to be highly cost effective concerning the customization of products. 3D printing can also avoid f material waste incurred during the casting and manufacturing process. In

addition, 3D printing techniques can be used to facilitate a modular development of ortho-prosthetic devices for individual customization.

"Toe Talk", prosthetic limbs that make a statement: A case study

Wide range of artificial prosthetic limbs are already available which help users (i.e., amputees) perform various daily activities including walking, jumping and even running. However, the majority of prosthetics limbs currently available are designed without considering aesthetic elements, which may make them undesirable for younger amputees. Hence, an alternate means by which the aesthetics of these prosthetic products can be improved upon without compromising function is needed. This will significantly improve the user experience of young amputees.

In this case study of prosthetic limb socket, a design group explored the opportunities of redesigning a prosthetic limb socket into a modular wearable art, which can give users the liberty to express their uniqueness without hampering the functional aspects of the device.

Design approach – Modular design

Modular designs are based on the concept of separating products into multiple parts, segments or modules that can be individually modified and customized (Duray, Ward, Milligan, & Berry, 2000). Recently, a large number of research contributions have been made in this particular area. A study done in 2014 proposed a similar approach (Seok, Woo, & Lim, 2014), which they termed "Non-finito" product design. The products are intentionally unfinished giving users the option to customize and complete them based on their own personal choices and creativity. This kind of approach can help in achieving mass customization and facilitate product design flexibility based on individual preferences. Allowing users to be actively involved during the design process can help to initiate a better product-user relationship, which would better address the user's needs. This can also make the potential problems encountered in the design phase more visible to the designers.

However, this type of design approach is seldom adopted in the field of medical product design. Therefore, the team attempted to incorporate the concept of a modular design approach without compromising the primary function (i.e., locomotion and movement) of the prosthetic limb.

Design Method

A 25-year-old female amputee agreed to participate in the study. In order to understand her needs, a semi-structured interview was conducted in conjunction with an observational study to define her user profile and understand her daily routine. Based on this study, initial insights about fundamental design needs were acquired. Her input from the interview was considered throughout the design process to ensure the final product (i.e., prosthetic limb socket) did not affect the functionality of the prosthetic limb.

Based on the data gathered from the interviews and observational study, an initial brain storming session was performed. Using the principles of modular design, multiple prototypes were developed using 3D modelling software. Then based on the user preferences, a design was selected and further refined.

For developing the prototype, a 3D scan was acquired for the stump of the amputated limb. Based on the acquired 3D model, a customized prosthetic limb socket was developed using a computer aided designing/ manufacturing (CAD/CAM) software. The final design prototype was then printed.

Design requirements

Being a marathon runner and sports enthusiast in the past, the participant did not want her amputation to affect her self-image. Upon interviewing her, it became evident that she was not happy with a conventional prosthetic leg. She felt it looked ugly and did not allow her to wear fashionable clothes or shoes (i.e., high heels). Instead of hiding her imperfections, she wanted the prosthetic to be a more prominent bodily feature in order to serve as a source of inspiration and encouragement for other amputees. In addition to these design expectations, she also expressed the need for a prosthetic that was easy to wear and store when not in use, the possibility of attaching it with existing prosthetic limb, the ability to reduce sweating with greater ventilation capacity and further modifications to improve durability. Additional factors for consideration included the shape, size, colour, material and manufacturing process.

Design process – prosthetic limb socket

To address her needs, multiple design ideas were generated from the brainstorming session as shown in Figure. 1. The brainstorming session focused on three major criteria: (1) wearable art, (2) mix and match and (3) inner maturity. Several rough sketches and iterations were developed (Figure 2).

Figure 1: Brainstorming for the design

Figure 2: Ideation Process

During the ideation process as shown in Figure 2, initial ideas were further reduced to seven designs based on user preference, choice and needs. Various art and cultural elements were considered during the selection of the opted designs leading to the final design shown in Figure 3.

Figure 3: Final design of prosthetic socket

There were three major elements incorporated in the design to make it more appealing and serve as an identity statement for the participant. The first element that was considered was the shape of the socket. It was designed with a mesh form, which made it look more artistic, and at the same time reduced the contact surface thereby allowing it to be more breathable and less prone to accumulate moisture from sweating. Several attachment sites were provided along the device where she could place some text or messages.

The second element of the socket was its use as a wearable form of art. Provisions were made to ensure that certain parts could be removed and replaced. The user can easily slide various images, messages, and photographs in the designated sections of the device based on her mood, clothing combination, life events or the type of event she plans to attend. This provided her with an opportunity to be more creative and allowed her the freedom to use the device as conduit for self-expression.

The third element targeted the issue of using the new design with an existing prosthesis. A two-layered design was created to address this issue. For the existing model, only the outer case design was 3D printed and placed over the existing socket. For developing a new one, the internal frame replaced the socket.

To confirm the shape and size of the newly developed socket matched the contralateral limb, a 3D scan of the existing limb was also acquired to serve as a reference during the entire design process. This was done to ensure limb symmetry and avoid any bulky appearance beneath her clothing thereby allowing her to have a greater range of compatible clothing options.

Based upon her preferences, the prosthetic limb socket was developed in white colour so that it could match any clothing colour. White made it more vibrant, elegant, less likely to absorb heat. In addition, the white background made the other design elements (i.e., attachable text, removable images, and artwork) more prominent.

The final prototype was named "*Toe Talk",* as this gives young, active amputees a chance to express their uniqueness. Unlike traditional prosthetic designs, it is very elegant and artistic.

Figure 4: 3D printed prototype – prosthetic limb socket

The designed prosthetic socket was 3D printed and provided to the participant. However, due to structural issues, the design required further refinement. The 3D printed prototype of “Toe Talk” is shown in Figure 4.

Conclusion

Allowing the end user to be more involved in the design process having user-oriented design (UOD) approach can improve upon conventional approaches to ortho-prosthetic device development. With the advent of modular design techniques, it is now possible to develop products, which are partially or entirely customized based on personal preference. Involving the user in the design process has positive psychological benefits and gives the user a platform for highlighting their creativity.

Maslow’s hierarchy describes three different levels of user needs. These encompass basic, psychological and self-fulfillment needs. Traditional ortho-prosthetic devices address basic functional needs and allow the user to perform daily activities. Psychological well-being and self-fulfillment needs can also be met by addressing device aesthetics

Ortho-prosthetic product design is a vast and constantly evolving field, which has undergone rapid growth. In past few decades, product designs for amputees have transformed from simple mechanical devices to highly sophisticated bionic devices. However, the aesthetic features of these devices have received little consideration. Studies have shown that the absence of aesthetics can have negative psychological and cognitive consequences for users.

This study attempted to identify some of the key aesthetic parameters, which influence the ortho-prosthetic design process. The authors have provided relevant suggestions and recommendations for addressing these issues with a modular design approach. A case study involving the design of a prosthetic limb socket was given to elucidate the benefits and implications of this user-centered approach.

Developing a single product, which satisfies the needs of every individual user, is challenging. There are social, psychological, economic, cultural and personal preference factors, which influence user perception and experience. Modular and DIY design approaches can help to address these issues by allowing the user to be more actively involved in the design process. With a modular design approach, it is possible to customize prosthetics based on the user’s requirements. Users can also employ a DIY design approach by combining different prefabricated parts to manufacture their own product. This could facilitate the customization of such products on a mass scale. Additionally, designing ortho-prosthetic devices in the form of wearable art could revolutionize the field of medical product design and add an element of fashion to the customization process. Not only with this allow the user the option of incorporating their own sense of style or fashion into the development of their device but it can also create awareness for the inclusion of amputees across various social contexts.

For ortho-prosthetic device users, better product aesthetics are more than simply a means of flaunting or showing off, but means by which they can look and feel beautiful or be able to wear fashionable clothing like other people around them. Amputees have the same needs and desires as non-amputees. Meeting their needs is achievable when designers can give the opportunity to reevaluate the ortho-prosthetic’ design process with the objective of enhancing user acceptance in mind.

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Research Perspectives IN THE ERA OF Transformations

Exploring the role of Design in the context of Medical Device Innovation

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Technology is the leading driving force in healthcare and medical device design, however, innovations which emerge from these practices are often driven by clinical requirements. Such innovations are focused on developing products that addresses current health issues, diseases or medical problems – often lacking consideration of the end users' needs. Design innovation advocates that user-centred design happens much earlier in the product development process so that the patient needs are prioritised. However, this emerging field is yet to be defined and explored in a medical context. This paper therefore proposes a framework of Medical Device Design Innovation to explore the role of design in medical device innovation through two medical device case studies. The proposed framework suggests a way to navigate the nuances and complexities of the medical device industry in order to put the patient first while ensuring commercial viability.

Keywords: Medical device design, patient centred design, design innovation, ventricular assist devices, ankle-foot orthoses

Introduction

Medical device manufacturers create life-changing innovations through the collaborative expertise of various disciplines including engineering, manufacturing, clinical, regulatory, marketing, sales and business specialists. The role of the designer is often that of user advocate (Privitera, Southee, & Evans, 2015). However, the design team may also be responsible for aesthetic design, form giving, human factors application and testing, along with implementing contextual inquiry and/or ethnography methods (Petrie & Copeland, 2011; Privitera, 2017). Appropriate use of design tools and methods ensures that the user experience is championed from the early stages of product development and continues throughout the product development process as design trade-offs need to be made (Norman, 1986).

While cutting-edge technology advancement in medical device design is absolutely vital, it is the overall experience (cognitive and emotional) which impacts on the daily life of the patient and caregiver (Bate & Robert, 2006). Exemplary medical device design integrates technology development with user needs (Martin & Barnett, 2012). According to Martin and Barnett (2012), medical device manufacturers are motivated to conduct user research for regulatory compliance during the product development process. Both the European Union and the US Food and Drug Administration (FDA) require that human factors engineering processes be followed and standards be met, demonstrating that ergonomics, human factors, or user-centred design have been considered (International Organization for Standardization, 2015; Martin & Barnett, 2012). Similarly, funding for medical research requires technology developers to prove relevance to 'users' or 'stakeholders' for the healthcare research funding decision process (Martin & Barnett, 2012). Human-centred design should be central to all medical device development to ensure that user needs are met. However, user involvement

often comes later in the product development process, when the form and function has already been determined, and the ability to innovate based on user needs is limited due to a number of fixed parameters (Throckmorton, Patel-Raman, Fox, & Bass, 2016). The technological aspects of product development are often separated from the user aspects or only function to determine product appearance (Jones, 2013; Martin & Barnett, 2012). Schaeffer (2012) describes the role of human factors in this process as "prevention through design", to minimise risk by preventing human error, adverse events, and product recall.

Design innovation advocates that user-centred design happens much earlier in the product development process so that patient needs are prioritised. It is anticipated that the participatory methods used in design could tap into the tacit knowledge of stakeholders (i.e., practitioners, patients and caregivers) and identify their latent needs. This paper therefore explores the role of design in ensuring that patient needs become a point of focus in the development of medical devices, with the aim of improving the patient experience. To understand how the design innovation model could be applied specifically to the challenging field of medical device innovation, the Medical Device Design Innovation framework is presented and explored through two medical device case studies, including: Ankle-Foot Orthoses (Class I); and Ventricular Assist Devices (Class III). The proposed framework suggests a way to navigate the nuances and complexities of the medical device industry in order to put patients first whilst also ensuring commercial viability.

Literature Review

The Complexity of Medical Device Design

Designing a medical device is exponentially more complicated than designing a consumer product (such as a new cutlery set or even an electric toothbrush), and thus traditional definitions of design-driven innovation (Verganti, 2009) may appear naive and oversimplified when overlaid into this field. Many medical devices are not simply distributed or sold direct-to-consumer or the end-user, which is especially true for devices Class II and above. A number of conflicting considerations mean that desirable product aesthetics and meaning-making are much more complex to attempt – often requiring significant compromise. Among others, these considerations include: uncertainty, regulatory environment, complicated diagnostic pathways, complex payment models, biocompatibility of materials and patient compliance (Hanna, Manning, Bouxsein, & Pope, 2001; Hunink et al., 2014; Kucklick, 2013; Lynch et al., 2015; Narayan, 2012; Wimms, Richards, & Benjafield, 2013). Additionally, all medical devices, if sold in the US, must conform to detailed FDA General Regulatory Controls.

Much of the literature on medical device design or innovation stems from the field of engineering, e.g., the work of Ogrodnik (2012). Subsequently, technology is the leading driving force in healthcare and medical device design (Thimbleby, 2013). There is a gap in the research for understanding how innovation driven by design (i.e. design innovation) can be used to address the needs of users holistically in a way that generates value for a diverse range of stakeholders. Such stakeholders are limited not only to patients who receive clinical treatment with medical devices, but also medical device manufacturers, insurance companies, governments, regulatory agencies, healthcare providers, hospitals, clinicians, healthcare practitioners, surgeons, home medical equipment providers and patient caregivers. This gap becomes more pertinent to address due to the notion that medical devices must, in some way, interface, interfere and intervene with the human body (U.S. Food and Drug Administration, 2018). Thus, the risk of mechanical, electrical, system or technical failure is more critical than that of a standard consumer product, justifying the need for a strict regulatory environment which strongly influences when and how innovation is able to occur. However, it cannot be denied that a blurring of the boundary between consumer and medical products has taken place in recent years (Shinbane & Saxon, 2016). In the modern era we live in, patients expect their medical devices to operate and function as well as (if not better than) the consumer products they interact with on a daily basis (Nilsson & Sheppard, 2018). Thus, there is increasing interest in testing consumer innovation models for their applicability to more highly-regulated and high-risk industries such as medical device product development.

Medical Device Classes, Risk, Complexity and Design Innovation

For this paper, we refer to the three classes of medical devices according to the FDA classification system (see *Table 1*), since the US is one of the biggest market influencers in medical device product development. However, the authors recognise the scope of classifications for medical devices across different regions.

Table 1: The three classes of medical devices according to the U.S. Food and Drug Administration (BMP Medical, 2018; Sikorski, 2019; U.S. Food and Drug Administration, 2019a; White, 2018) *and FDA Regulatory Requirements for Medical Devices before release onto the US market* (U.S. Food and Drug Administration, 2018e, 2018d, 2018c, 2018b)

Class	*Risk*	*Description*	*Examples*	*FDA Regulatory Requirements*
Class I	Low to Moderate	Devices are common, everyday medical devices, involving less sustained contact with a patient, and are generally would not in contact with internal organs. Majority of devices are either exempt from the regulatory process or subject to the minor regulatory requirements. Class I devices present a low barrier and are straightforward to bring to market – yet are still subject to FDA General Controls which constitute a series of standards for all medical devices.	Ankle-Foot Orthoses, Tongue Depressors, Enema Kits, Elastic Bandages, Exam Gloves, Surgical Caps, Crutches, Slings, Mechanical Wheelchairs, Toothbrushes, Dental Floss, Stethoscopes, Forceps, Nasal Dilators, Hearing Aids, Bedpans, Device Accessories (e.g. Cleaning Brushes)	General Controls, i.e.: □ Adulteration □ Misbranding □ Device registration and listing □ Banned devices □ Notification and repair, replacement, and refund □ Records and reports □ Restricted devices □ Good Manufacturing Practice And, if new and novel: Premarket Approval (PMA) or if PMA exemption can be proven; 510(k) – Premarket Notification showing substantial equivalence
Class II	Moderate to High	Devices may be diagnostic or come into contact with a patient's internal organs. In addition to General Controls, Class II devices are also subject to Special Controls due to the added complications involved in providing reasonable assurance of the safety and effectiveness of such devices. Class II devices also undergo the FDA's Premarket Notification 510(k) process to justify the device's equivalence to another device that has already been legally marketed, thus demonstrating safety and effectiveness.	Surgical Meshes, Condoms, Hypodermic Needles, Acupuncture Needles, Neonatal Incubators, Catheters, Blood Pressure Cuffs, Powered Wheelchairs, Infusion Pumps, Blood Transfusion Kits, Vacuum Regulators, Wheeled Stretchers, Breast Pumps, Pregnancy Testing Kits, Electrocardiograph (ECG) Machines	General Controls; 510(k) – Premarket Notification showing substantial equivalence plus device-specific Special Controls: □ Performance standards □ Postmarket surveillance □ Patient registries □ Special labelling requirements □ Premarket data requirements □ Guidelines
Class III	High	Devices in this category support or sustain life, are implanted, or exhibit potential significant risk of injury or illness. Novel devices and unproven technologies also fall under this classification. In addition to the other regulatory controls, Class III devices must also undergo the FDA Premarket Approval (PMA) process to prove safety and effectiveness – involving a rigorous scientific study requiring clinical trials, unless an exemption can be proven.	Ventricular Assist Devices, Pacemakers, Defibrillators, High-Frequency Ventilators, Aortic Stents, HIV Tests, HPV Detection Kits, Replacement Heart Valves, Neurosurgical Lasers, Intrauterine Contraceptive Devices (IUDs), Cochlear Implants, Foetal PH Monitors, Implanted Stimulators (for people with Parkinson's disease), Implanted Prosthesis	General Controls; plus Premarket Approval (PMA) including: □ Technical data □ Non-clinical laboratory studies data □ Clinical investigations data Or, if PMA exempt can be proven; 510(k) – Premarket Notification showing substantial equivalence

The major distinguishing factor between medical device classes is risk (BMP Medical, 2018). Increased design complexity correlates with increased risk (*Figure 1*). Class I and Class II devices are characterised by a lower barrier to entry and a reduced risk (University of Limerick School of Design, 2019). Thus, design and design innovation are being explored and showing prevalence in the domains of Class I and II medical devices due this reduced risk and lower barrier to entry (University of Limerick School of Design, 2019). It has been shown that a design innovation approach can lead to highly-successful outcomes for design interventions based upon deep customer insight for lower-risk industries such as consumer electronics, travel, and fashion retail (Wrigley & Straker, 2018), and is also beneficial applied to social innovation projects (Haines-Gadd et al., 2015). Similarly, lower-risk classes of medical devices such as healthcare diagnostics lend themselves well to a design innovation approach (Kyffin & Gardien, 2009). Nevertheless, there is a paucity of data regarding the use of design innovation in field of high-risk Class III medical devices (see *Figure 1*). Due to the higher barrier to entry and increased risk, little is known about the value of design innovation in Class III medical devices. This is unfortunate, as an approach which considers the needs of patients (rather than purely technology) at the onset of design can have significant ramifications for patients' quality of life. It is understandable that this proposition might encounter industry resistance since proper user research and successfully integrated user-centred design may result in challenging the entire fundamental concept behind a medical device (Martin & Barnett, 2012).

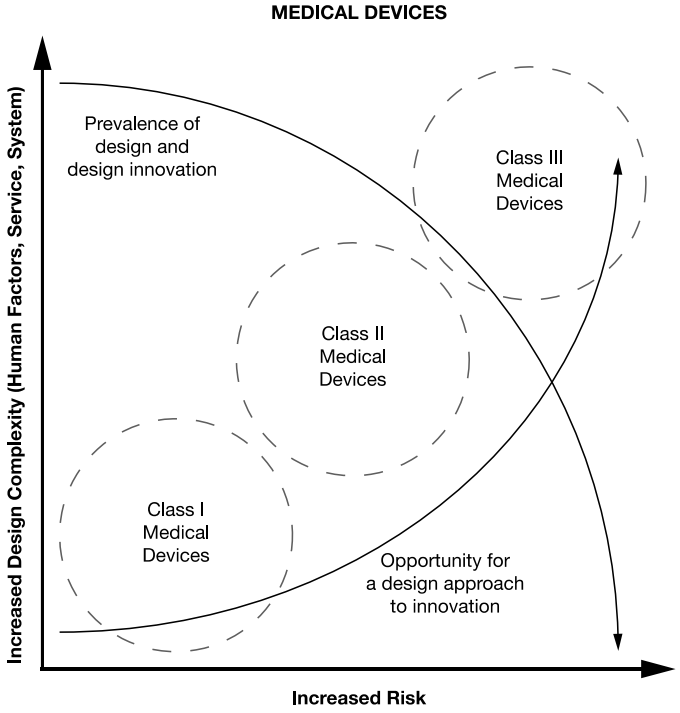

Figure 1: Three classes of Medical Devices correspond to increased risk and increased design complexity (including the human factors, service and system). An opportunity for Design Innovation to move into Class III medical devices exists. Adapted from University of Limerick School of Design (2019)

Introducing the Medical Devices Design Innovation Framework

According to design thinking principles, innovation occurs at the intersection of human desirability, technical feasibility, and business viability (Brown, 2009; IDEO, 2019). When lifted to the strategic level, according to design-led innovation principles, an innovative design outcome results when technology (i.e. the core intellectual property) addresses user needs through human-centred design and also disrupts the existing business model with a strategic value offering (Bucolo, Wrigley, & Matthews, 2012; Wrigley, 2017, p.236). Building on both the design thinking model and the design-led innovation model (see *Figure 2*), here the authors introduce the Medical Device Design Innovation (MDDI) framework (see *Figure 3*).

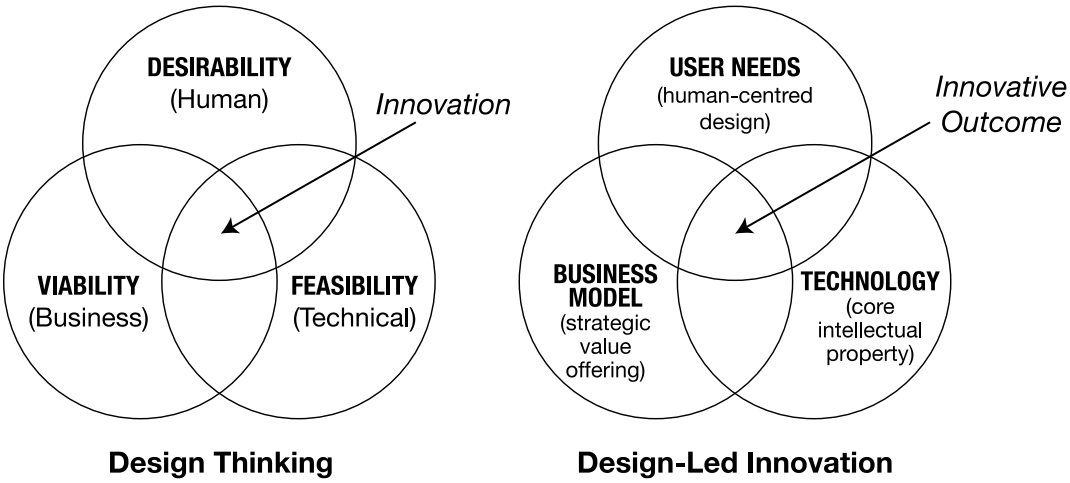

Figure 2: The Design Thinking model on the left (Brown, 2009; IDEO, 2019) *and the Design-Led Innovation model* (Bucolo et al., 2012; Wrigley, 2017) *on the right, adapted from Wrigley (2017, p.236)*

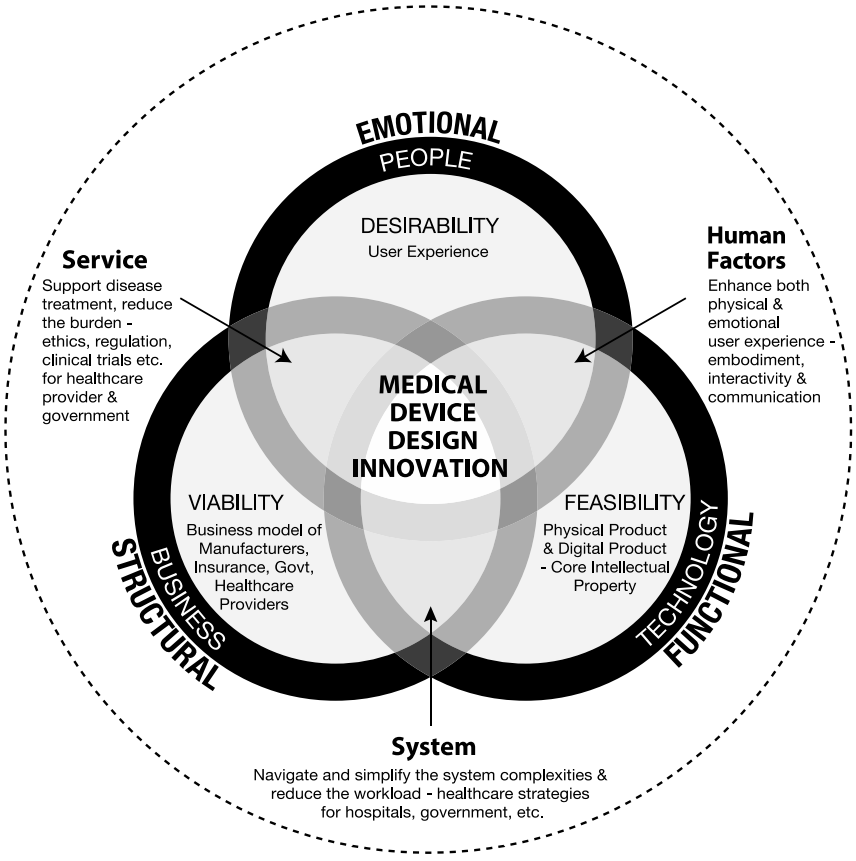

Figure 3: Design Innovation Framework for Medical Devices

The MDDI conceptual model has also been inspired by the authors' understanding of Product Service Systems (PSS) (Manzini & Vezzoli, 2003; Tukker, 2004, 2015; Wallin, Parida, & Isaksson, 2015). Each of the segments in the framework corresponds to a key element of a proposed design innovation approach as it applies specifically to the design and development of medical devices within the context of a highly complex field. The MDDI model provides a conceptual map for each of the key factors that must be considered at the scoping phase and throughout the development process for an innovative design-led intervention within the field of medical devices. Careful consideration of each segment ensures that requirements for design innovation can be met. The order of exploring each segment is not critical, but all must be examined in depth at the early stages of design to inform the design innovation process and to successfully apply the model.

Emotional – Desirability (People)

Understanding and meeting users' emotional needs is the core value of this segment, achieved through eliciting deep customer insights and then designing for them. The holistic user experience of a medical device is integral to the Emotional segment of the framework. Here, latent user needs can be addressed through stakeholder engagement and human-centred design research methods that are directed at discovering tacit knowledge and users' key emotional needs. Here, we ask: who are the key users? Are we solving the right pain points for each of the key users (whether directly or indirectly involved)? Indirectly involved stakeholders' needs might influence the outcome of design. This segment situates design aesthetics, industrial design, user experience design, and interactions, and how user groups experience a medical device through a series of touchpoints throughout their treatment journey. Opportunities are identified here to design emotional user experiences via new products, services and systems that are driven by desirability.

Functional – Feasibility (Technology)

The core intellectual property – i.e., the functional foundation of how a device works to successfully provide disease treatment resides in this segment. Feasibility is borne of appropriate selection and implementation of technology. Technological development represents the ability to manifest a desired user experience through both physical and digital means. Technology development represents the greatest potential for risk due to factors such as manufacturing process constraints, cost drivers, or biocompatibility of materials, but is also currently the most significant industry driver in medical devices. However, in this framework, technology must be reframed as an enabler of user experience rather than a singular driver of innovation potential. Technological advances fall under the Functional segment, where it is essential to determine whether the technology currently exists to accomplish what users genuinely need. If not, whether the technology can be feasibly developed within a reasonable cost and timeframe needs to be determined. Here, we build on the strengths of current and core operational capabilities.

Structural – Viability (Business)

The Structural segment encompasses the wider ecosystem of manufacturers, insurance companies, governments and healthcare providers (such as hospitals). The medical device regulatory environment and FDA requirements (the 'ticket to play' in the Medical Devices industry) are also situated into a stakeholder structure within this segment and herein lies the economic value and value chain delivered by medical devices. Building globally competitive, viable and sustainable business models is imperative, whilst balancing the complex ecosystem of stakeholders (i.e. customers and payors), which collectively form a piece of the structural puzzle. In this segment, it is necessary to consider both the long-term and short-term horizons of growth. This segment is responsible for building the infrastructure to support the holistic user experience of a medical device, and the services and systems that resolve their needs.

Human Factors (Functional + Emotional)

This segment of the MDDI framework encompasses an understanding of human behaviour interactions involved with product experience both directly (tangible) and indirectly (intangible). The goal of this segment is to enhance both physical and emotional user experience through embodiment, interactivity and communication. Through human factors, optimum usability is created when both physical and psychological human capability and limitations are designed into the user experience, hence the importance of achieving an understanding of the holistic user experience when designing any product, but especially medical devices.

Evans and Geiselhart (2012) identified a number of usability factors which may influence an individual's product experience that should be considered when designing medical devices and their associated systems, including: (1) physical abilities, i.e., anthropometry, biomechanics and sensory abilities; (2) cognitive abilities, i.e., how the brain processes information and learn new things, memory, and habits; (3) state of being, i.e., the general health of users, disease states and comorbidities that challenge patients' mental and emotional states, and motivation for learning new things; and (4) experiences, i.e., educational backgrounds, and skills that will guide behavioural interactions. Moreover, environmental factors such as physical environment and life circumstances need to be considered as these encourage or discourage usability and influence overall user experiences.

Service (Emotional + Structural)

The service segment is intended to provide an intangible service in order to fulfil specific customer or user needs through an intertwined web of stakeholder groups and user touch points throughout the treatment journey, ensuring device users are consistently engaged, educated, managed and supported. Patient experience improves more holistically through thoughtfully designed services which include disease treatment support and aims to reduce the burden of treatment as well as enhance the user experience throughout the patient journey. Here, we could explore better ways to recruit for clinical trials, explore ethics, determine candidacy for treatment and regulations that meet the altering requirements for the healthcare provider and government which in turn may add economic value through extended product lifespan and services. In this segment, marketing and sales channels may reside, as well as product lifecycle, replacement schedules and device maintenance, diagnostic pathways, and patient, practitioner and caregiver training and support.

System (Structural + Functional)

Medical device innovation encompasses many different sectors' and stakeholders' involvement. In addition, the 'invisible' underlying system that supports a commercially and clinically successful medical device may not be explicitly recognised for its significant contribution to innovation. The design influence of such invisible systems may not normally be prioritised. However, a well-considered system may support balancing the complexity of many different sectors' and stakeholder's needs and holistically sustain dialogues between these groups. Examples of the system include healthcare structures and strategies which may support building unique relationships with users. This, in turn, may enhance their loyalty and increase efficiency gains throughout the whole medical treatment life cycle by fulfilling stakeholders needs in an integrated and customised way. Consequently, the workload is reduced, and the value of a business is improved. In many cases, the system workflow is rendered invisible in the delivery of digital and physical products and services – the MDDI framework on the other hand, emphasises system workflow and makes it visible.

Case Studies

The Medical Device Design Innovation framework (see *Figure 3*) is explored further through two case studies representing the extremes in medical device classifications currently undertaking a design approach to innovation. These case studies include the Ankle-Foot Orthosis (AFO) and Ventricular Assist Device (VAD), which are Class I and III respectively.

Case Study 1 – Ankle Foot Orthosis (AFO)

Ankle-foot orthoses (AFOs) are thermoplastic braces that support the foot and ankle to compensate for weakness, correct deformities and improve walking ability. These devices are a highly effective non-surgical treatment for patients with walking difficulties, such as cerebral palsy (Wingstrand, Hägglund, & Rodby-Bousquet, 2014), inherited neuropathy (Scheffers, Hiller, Refshauge, & Burns, 2012), and brain and spinal cord injuries (Vogel, Mendoza, Schottler, Chlan, & Anderson, 2007). AFOs improve mobility, maintain surgical correction and prevent recurrence of deformities (Dickinson et al., 2007; Skaaret, Steen, Terjesen, & Holm, 2019). Like other Class I devices, such as bedpans and enema kits, AFOs have undergone minimal change in experiential design, focusing only on function development. The technology surrounding the field has continued evolving, but fabrication of the same designs using traditional, manually laborious, handcrafted methods has continued to proliferate in the field.

The project focuses on patient perspectives of AFOs and design innovation to facilitate the creation of patient-centric designs and improve the qualitative and experiential aspects of paediatric patient wellbeing. The need arises from the lack of AFO development beyond technical adjustments, and dissatisfaction elucidated by preliminary research into patient perspectives – highlighting opportunity for improvement not only in the functional aspects of the device, but also the experience surrounding it. The aim is to explore the process of prescribing, producing, acquiring, and using an AFO to understand how the design and production of AFOs can be innovated to improve patient outcomes.

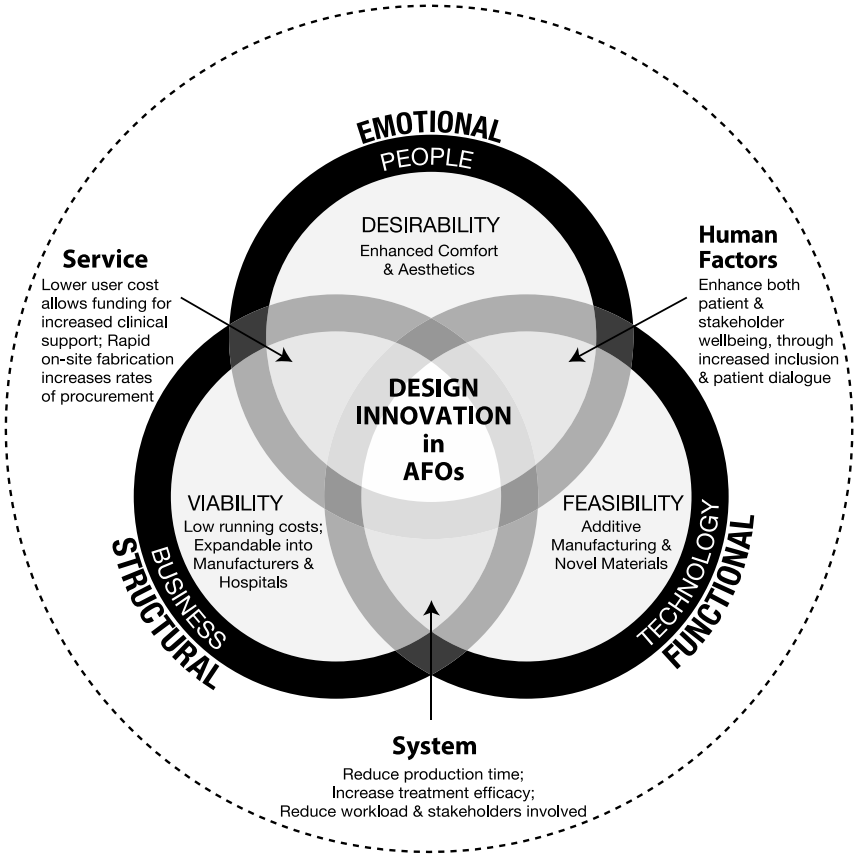

Figure 4: Design Innovation Framework for Ankle-Foot Orthoses

Emotional – Desirability (People)

Recognising the importance of emotional attachment and the capability of design innovation to promote patient-product connection is critical for long term treatment. AFO design considerations cannot be isolated to just those of the patient. Initial research suggests the value of indirect stakeholders (such as parents, carers and orthotic practitioners) in providing compelling insights into AFO design. The Emotional segment encompasses processes that will uncover experiential needs of all stakeholders, both active and latent. Human-centred approaches to design (emotional, aesthetic and functional) will generate novel and custom designs. In the context of a specific group of users - for example paediatric patients - this may foster greater attachment towards their AFO device through personalisation and comfort profiles. The manufacturing of such designs is feasible using additive manufacturing and a streamlined acquisition process.

Functional – Feasibility (Technology)

The primary technological shifts in the industry of AFOs surround the development of biometric analysis tools and similar testing facilities, but very little in the development of the AFO itself (Lai et al., 2010). Prior to the introduction and use of Polypropylene, development of AFO design spans from semi-permanent plaster casts to a metal and leather construction (Wronksi, 2019). Though polypropylene is now the industry standard, that technological shift continues with additive manufacturing. In the past 20 years additive manufacturing technologies (including 3D modelling software, 3D printers, materials and scanners) have emerged from technological infancy and present numerous advantages in manufacturing. Fortunately, the cost of this equipment has made public and private access financially less inhibitive (Wohlers & Gornet, 2014). Costs have reached a tipping point where price no longer inhibits procurement for both the orthotist/practitioners and the recipient patients, allowing for widespread adoption of this new process in lieu of the traditional methods of fabrication. Of the few relevant studies found investigating additive manufacturing in AFO development (Cha et al., 2017; Faustini, Neptune, Crawford, & Stanhope, 2008; Jin, He, & Shih, 2016; Mavroidis et al., 2011) the overall design language and geometry of the AFO is merely replicated, showing little to no sign of innovation. A systematic review was conducted by Wojciechowski et al., (2019) and concluded similarly, that

though additive manufacturing of AFO is being studied, it is an underdeveloped area lacking substantiative research. This is unlike, for example, 3D printed bicycle frames, such as a stainless-steel bike produced by Tu Delft and MX3D, that demonstrate innovation in creating mesh-like designs that do away with a solid homogenous structure. Despite this, additive manufacturing capability and technologies are an apt tool that can be utilised through the design innovation approach, since the technology offers wide variation to accommodate many differing patient preferences identified in the study.

However, technological advances alone do not produce a set of design solutions. Through design innovation, open channels of collaboration, patient contribution and orthotist involvement can develop a new model for the AFO industry, community and businesses that operate within it.

Structural – Viability (Business)

The Structural segment positions the complexities of multiple stakeholders into a framework that balances and supports their competing priorities against the regulatory demands of governing medical authorities such as the FDA. This framework presents AFO practitioners, manufacturers, healthcare providers and insurance companies with Business as a conduit through which meaningful, life-changing and engaging products can be provided. Viable business structures are conceptualised resultant from research into novel payment models, profit structures and cost effectiveness. Innovative cost models generate avenues to innovative processes, for example additive manufacturing. The automated processes associated with additive manufacturing allow for a significant reduction in human labour hours, thus reducing operational costs in the long term, despite initial setup costs being higher i.e.: the purchase of a production grade 3D printer. Lower business costs result in lower costs to users, and decreased waiting time can increase patient satisfaction (corroborated by initial research). Timely AFO replacement increases clinical efficiency. This fosters a patient-centric business model. The adaptive nature of additive manufacturing also lends itself to the regulatory environment, with sudden changes to industry standards or regulations having less of a detrimental impact on manufacturing. Most anticipated changes can be accounted for with a material or geometry change.

Human Factors (Functional + Emotional)

Much of the literature surrounding AFO development, testing and use explores aspects of function, mechanical improvement, and biometric analysis with patients (Faustini et al., 2008; Lai et al., 2010; Lam, Leong, Li, Hu, & Lu, 2005; Ploeger et al., 2007). However, the MDDI model combines both Functional (technology) and Emotional (experience) factors of a product. The model identifies a void of substantial emotional experience qualitative data in the body of AFO research of AFOs. Design innovation highlights this deficiency as an opportunity for improvement of human factors and provides tools to remedy this. Initial research into patient perspectives of published literature and secondary data such online platforms (blogs, message boards, and support forums) form an extensive understanding of the opportunities associated the pragmatic and experiential aspects of using an AFO. Categorisation Matrixes and the use of qualitative data analysis software NVivo will transform the data points into thematic clusters. This is the basis for forming design recommendations and one of the methods utilised by design innovation (Joffe & Yardley, 2003)

Service (Emotional + Structural)

Service encapsulates the intangible experiences and circumstances surrounding a product and system. In the context of AFOs, the Service segment focuses on improving the procurement and acquisition process, appointment scheduling, professional training and communication between face-to-face interactions. This is of particularly importance in paediatric patients (whom initial research indicates may require up to 3 devices of increasing size per year during childhood, depending on growth). By directly addressing patient wellbeing as a priority, new spaces for product services are revealed. Utilising design innovation methods within this space could generate, for example, a patient-facing front end that could be a way that users could engage with and stay connected with their AFO, orthotist and a larger community of users. A combination of design with additive manufacturing technology can fulfil just that.

System (Structural + Functional)

Despite being a Class I medical device, the complexity of stakeholder experiences does not diminish. Preliminary research into qualitative patient feedback establishes a need for clear, ongoing relationships between the patients and all other stakeholders in the system. The desired value of the patient is an AFO that is delivered in a timely and accurate manner; a result that can be propagated by the inclusion of novel

Structural approaches, (such as patient-centric business model) and, Functional approaches (such as additive manufacturing). A combination of these two aspects forms the System segment and can resolve many of the detractions present in the systems surrounding Class 1 devices.

Case Study 2 - Ventricular Assist Device (VAD)

A Ventricular Assist Device (VAD) is a mechanical pump that takes over the pumping function of the heart as an alternative treatment to transplantation for patients diagnosed with end-stage heart failure. VADs support patients while they are waiting for a future donor organ transplant (Bunzel, Laederach-Hofmann, Wieselthaler, Roethy, & Wolner, 2007; Jakovljevic et al., 2014) or when they are ineligible for transplant surgery (Boling, Hart, Okoli, & Halcomb, 2015; Jakovljevic et al., 2017; Kaan, Young, Cockell, & Mackay, 2010; Makdisi, Makdisi, & Bittner, 2017; McLarty, 2015; Prinzing et al., 2016; van Manen, 2017). The user experience of Ventricular Assist Devices is still far less than ideal, which in turn affects the patient's, and their caregiver's, quality of life (Friedman & McMahon, 2014; Kaan et al., 2010; Schlöglhofer & Schima, 2018). VADs place a number of limitations on their users (e.g., ordinary daily activities such as showering, exercising, driving and sleeping are impacted). In addition to the implanted VAD pump, there are a number of additional external wearable components that require constant monitoring and maintenance to ensure proper function, including the controller and external battery pack. These are connected to the pump via a driveline that extends from the internal VAD through an exit site on the patient's abdomen. In addition to their overarching condition of heart failure all VAD patients have a risk of suffering from blood clotting, stroke, bleeding, infection, organ malfunction, device failure, and right heart failure (Schumer, Black, Monreal, & Slaughter, 2016; Starling, 2010) as a result of VAD treatment, which increases emotional impact on both patients and caregivers. While innovation through technology push and incremental market pull has been observed, the translation of deep user needs into innovative new user experiences is an emerging frontier in VADs.

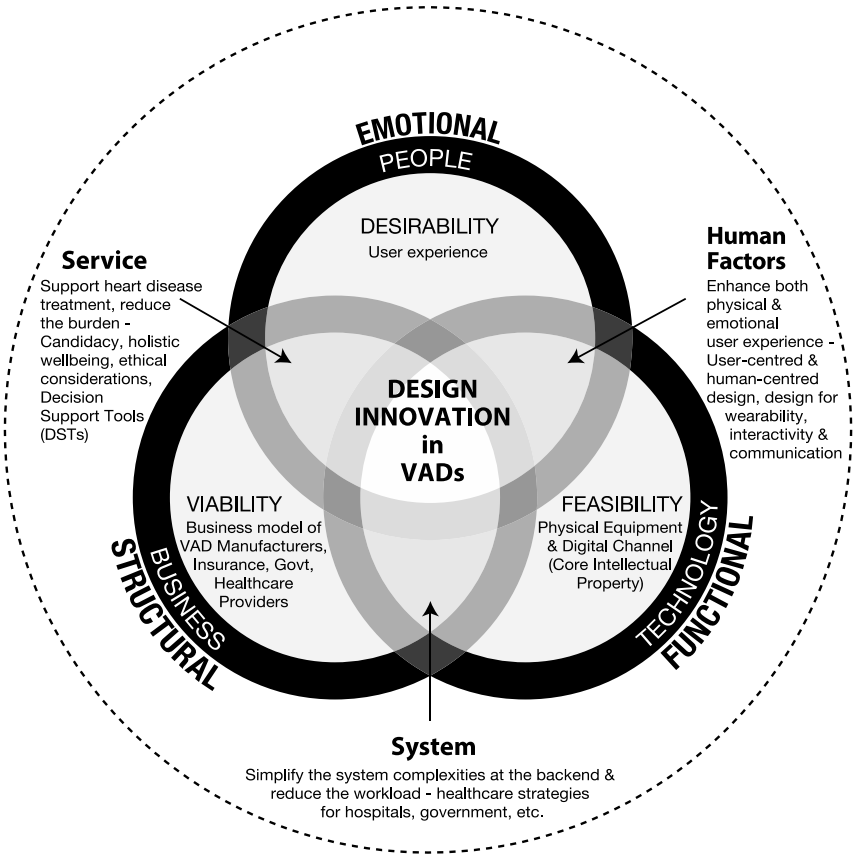

Figure 5: Design Innovation Framework for Ventricular Assist Devices

Emotional – Desirability (People)

There are a several key user groups (i.e. patients, caregivers and practitioners) to consider when designing for VAD treatment. In the Emotional segment, research will use a design innovation approach and practice to elicit authentic user stories of Ventricular Assist Devices in order to define the key needs of the three user groups

above and translate, through design, these user desires into tangible and intangible innovations in the Human Factors, Service and System segments. This segment encompasses user-centred design, human-centred design, product form and function and emotional design, and may explore VAD digital channel interactivity and communication, or develop and use novel tools to determine emotional user experience of VADs.

Functional – Feasibility (Technology)

Currently the VAD industry is technology-development driven and engineering-centric. In the Functional segment, technology must be reframed as an enabler of innovation in VADs, not the driver. Regardless, the underlying technology of any VAD innovation must work with reliability and efficacy but does not necessarily have to be completely reinvented. Feasibility of both the physical equipment and a digital platform that includes any core technological expertise in the form of core intellectual property is situated in this segment. Future technology development for VADs should be prioritised according to deep insights on emotional user needs, instead of user needs being served on the basis of technology capabilities and limitations.

Structural – Viability (Business)

In the Structural segment, a viable business model for VAD manufacturers, insurance companies, government funding, and healthcare providers (including VAD hospitals) is considered imperative. Here, business is championed as an enabler of innovation that brings life-sustaining value to heart failure patients and their caregivers, through cost effectiveness, profit structures, and payment models involving e.g. research funding, government, Medicare, insurance companies, co-pay. This segment recognises and situates the weight of the medical device regulatory environment and FDA requirements into a stakeholder structure involving VAD manufacturers, VAD hospitals, research organizations etc. Alternative business and/or industry structures may be conceptualised in this segment.

Human Factors (Functional + Emotional)

In the existing literature on VADs, human factors and usability is addressed from an engineering perspective looking at componentry and features, how quality of life (QoL) can be impacted and why it is important, but so far there lacks a holistic thread to tie together the integration of technology (functional) with user experience (emotional) into an innovative application of human factors that drives radical innovation of these devices – design is well-placed to do this. Key authorities in usability and the intuitive use of VADs include Geidl et al. (2009, 2011), Granegger et al. (2016), Schima et al. (2014), Schlöglhofer & Schima (2018), and Throckmorton, Patel-Raman, Fox, & Bass (2016), however thus far, human factors is still considered quite late in the product development process. The research team proposes to use human factors principles to drive innovation by incorporating 'Design for Wearability' guidelines for wearable VAD equipment, and by improving communication and interactivity of a digital support channel.

Service (Emotional + Structural)

This segment situates services to support heart disease treatment and reduce treatment burden. It may encompass ways to improve the patient experience such as better clinical trial recruitment, more holistic view of the patient experience from a wellbeing lens, product delivered as a service (e.g. subscription to pump and peripherals, upgradability). This segment provides the space to consider ethical considerations, including device candidacy and Decision Support Tools (DSTs) and develop user-centred services such as dedicated digital channels/platforms and self-care support tools (Ko et al., 2018). Treatment pathways such as destination therapy vs. bridge-to-transplant, alternative business and service models, and propositions of shared value may be explored here.

System (Structural + Functional)

In the System segment there is a may be a need to simplify existing complexities that exist at the backend of VAD product development, regulation, marketing, technological device support systems, and to improve or create networks and interactivity between device (the technology) and the receiver of revenue (the business) in order to deliver the desired value to the customer and patient. This segment situates strategic healthcare systems that may have implications for the broader scope of heart failure treatment pathways via healthcare strategies for hospitals and governments, for example.

Medical Design Innovation Constraints

The MDDI framework illustrates the applicability across the two extremes of Class I and Class III medical devices. The similarities include a need to meet general requirements of all medical devices. However, clear differences between a Class I and a Class III device arise in the increasing difficulty of translating a desirable user experience under immense technical complexity in the context of a more rigid structural environment with stacked constraints that must be navigated in order to achieve an innovative outcome.

Where design does play a role in the development of medical devices, the role is often pragmatic, business centric and/or inward facing – focusing on aspects such as cost-effectiveness (for the business), risk reduction, market placement and regulatory requirements (Medina, Kremer, & Wysk, 2013). An understanding of the role of design and need for design innovation in the field of medical device product development is scant in the wider academic literature, especially in the field of life-saving medical devices. Where design exists, there are many obstacles that distract from a user- or patient-centric innovation model. These obstacles have been attributed to the heavily restrictive influence of FDA requirements, reported as "the first external factor affecting a company's ability to develop new medical technology and influencing a company's product development priorities" (Medina et al., 2013). Such requirements exist for a compelling reason to protect patient safety and reduce the risk of adverse outcomes. Thus, design innovation faces unique requirements, constraints and challenges in the field of medical device design that are unlike any other in consumer product development. Herein lies the opportunity for the framework to yield its contribution (as detailed in *Table 2*).

Table 2: FDA Regulatory Requirements for Medical Devices as they align to the Medical Devices Design Innovation framework – Class III includes requirements listed in Class I and II, Class II also includes all requirements listed in Class I

	Class I	*Class II*	*Class III*
EMOTIONAL – Desirability (People)	--	--	--
Human Factors (Functional + Emotional)	Records and reports	Postmarket surveillance	Clinical investigations data
FUNCTIONAL – Feasibility (Technology)	Good Manufacturing Practices	Performance standards	Technical data Non-clinical laboratory studies data
Service (Emotional + Structural)	Notification and repair, replacement, and refund	Patient registries	--
STRUCTURAL – Viability (Business)	Device registration and listing	Special labelling requirements 510(k) – Premarket Notification showing substantial equivalence	Premarket Approval (PMA); or, if exempt: 510(k) – Premarket Notification showing substantial equivalence
System (Structural + Functional)	Adulteration Misbranding Banned devices Restricted devices	Guidelines Premarket data requirements	--

Conclusion

This study explores the role of design in medical device innovation and introduces the MMDI framework as a way to innovate in medical device product development through using a design innovation approach that has been proven successful in other industries. Two case studies are detailed, with the findings presented suggesting that the MDDI framework is applicable to the wide range of medical devices available from Class I through to Class III. While this study does not offer a conclusive answer to the question of how a design

innovation approach can be best applied to medical device product development to guarantee innovation, it does suggest a new way to navigate the nuances and complexities of the medical device industry from early-end device development through to product launch, in order to better balance user needs with commercial viability.

It is possible, in exploring the Medical Device Design Innovation framework, that learnings could be extrapolated to the wider field of healthcare or health services design that are intrinsically interconnected with medical devices or rely on medical devices to supply care, in order to identify new opportunities for innovation. One example might be for surgical training tools, which exist in the medical education field but may not necessarily be classified as medical devices. The authors acknowledge the shortcomings of this publication in that the Medical Device Design Innovation framework has been exemplified and tested on only two case studies, and this does not yet allow us to validate the model in the vastness and variety of available medical devices.

The Medical Device Design Innovation framework is conceptual in nature and thus requires further exploration in future studies. From the perspective of the VAD and AFO case studies, future research will test the Medical Device Design Innovation framework as a catalyst for driving design innovation in each of these two devices. The framework will be used to assess how novel design proposals for each of these devices fit into a wider innovation context for medical devices in general. Further research is also needed to compare the official FDA Device Development Process (U.S. Food & Drug Administration, 2018a) to actual design-led innovation success stories whereby innovative ideas are nurtured from early-stage research through to product development, manufacture, launch, adoption, and hopefully widespread use and success in the marketplace. There currently exists insufficient research on non-designers who practice design in the field of medical device product development, and there is limited research on the role played by trained designers in medical device design – the work of Mary-Beth Privitera leads the way in this field (Privitera, 2015, 2017; Privitera et al., 2015; Weinger, Gardner-Bonneau, & Wiklund, 2011). Qualitative studies are needed to understand how medical device manufacturers are innovating by borrowing and adapting design methods tools, practices, and processes such as IDEO models (Kelley, 2016), design thinking, design-led innovation, agile, user-centred design, the double-diamond framework, UI/UX design, etc. and how designers are working in multidisciplinary, cross-functional teams. To make a stronger case for design innovation, there needs to be greater understanding from the field regarding how structural constraints (e.g. marketing, FDA requirements, or insurance reimbursement schemes) hinder innovation of medical devices. Research is needed that explores how traditional market research or 'Voice of the Customer' could be stifling innovation in medical device design by simply seeking to prove assumptions and not to deeply understand the relationship between the function of a device and the emotional experience of such a device; that is, asking customers what they want, rather than why they want it (Price, Wrigley, & Straker, 2015). Similarly, further research is needed to determine if and how the FDA 510(k) and similar processes worldwide could be inhibiting medical device innovation processes and endangering patients by making it easier for manufacturers to base a product's design and safety case on a predicate product rather than create a novel invention that would require a PMA, significant investment, clinical trial before launch, and risk mitigation (Fargen et al., 2013). Additionally, research is needed on how the structural conditions of doing business with medical insurers may mean that manufacturers are incentivised to comply to existing insurance reimbursement codes based on older product configurations which also hampers innovation since better products don't get made for patients because then those products wouldn't be reimbursed, thus would not sell. Finally, the Medical Device Design Innovation framework could be tested in-house with a range of medical device manufacturers to further refine and improve upon the conceptual proposal.

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Research Perspectives IN THE ERA OF Transformations

Gaining patient experience insights: an integrated and multi-leveled framework of information

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Taking patient experience as a basis, this paper introduces a theoretical framework, to capture insights leading to new technological healthcare solutions. Targeting a recently diagnosed type 1 diabetes child and her mother (the principal caregiver), the framework showed its potential with effective identification of meaningful insights in a generative session. The framework is based on the patient experience across the continuum of care. It identifies insights from the patient perspective: capturing patients´ emotional and cognitive responses, understanding agents involved in patient experience, uncovering pain moments, identifying their root causes, and/or prioritizing actions for improvement. The framework deepens understanding of the patient experience by providing an integrated and multi-leveled structure to assist designers to (a) empathise with the patient and the caregiver throughout the continuum of care, (b) understand the interdependencies around the patient and different agents and (c) reveal insights at the interaction level.

Keywords: patient experience, experience design, framework, insights, chronic patient

Introduction

With an increasing life expectancy, healthcare systems around the world have had to evolve to meet several challenges. In the previous century, healthcare was mainly oriented towards reacting to acute pathologies where the focus was to address urgent issues. In recent decades, however, the pattern of pathologies has undergone significant change, with an increase of chronic conditions putting unprecedented stress on healthcare systems (Institute of Medicine, 2001; World Health Organization, 2005).

Chronic diseases are also known as noncommunicable diseases, and include cardiovascular diseases, cancers, chronic respiratory diseases, diabetes or dementia. All these diseases have common characteristics, such as their long duration or their usual non-curable condition. The differences between acute pathologies and chronic diseases are changing the way the healthcare system needs to respond, introducing the concept of a continuum of care (World Health Organization, 2018).

The continuum approach has led to an emerging concept in the healthcare sector: the patient experience. Patient experience refers to the range of interactions that patients have with the different agents of care, such as doctors, nurses and hospital staff, medical consultations, health plans and other medical care facilities. Nowadays, patient experience is regarded as a central outcome for many national health systems (Purcărea, 2016).

In this context, technological solutions are contributing to a wide range of opportunities to improve the patient experience (Andreu-Perez, Leff, Ip, & Yang, 2015). Providing a more personalized, safer, timely,

efficient and effective experience is becoming a central challenge for the healthcare system (Berwick, Nolan, & Whittington, 2008; Institute of Medicine, 2001).

This approach locates the patient experience in a central position when designing new medical products and solutions (Wechsler, 2018). Such technological solutions can keep patients on the radar and monitor their adherence to treatment, for example.

Altman, Huang and Breland, (2018) made a systematic review of patient centred solution design concluding that there is an inconsistent use of methodologies. They highlighted the need to develop new methods that effectively integrate the most useful components for the healthcare sector. The use of a structured approach to generate new products and solutions with a patient centred approach may be a key factor in their success. Therefore, there is a need to create specific methods and tools for the healthcare sector that help designers design new solutions that take the patient experience as a reference.

While design is a process with different stages (Roozenburg & Cross, 1991), the entire design process is based on identifying meaningful insights that have the capacity to lead to successful new solutions (Caulliraux & Meiriño, 2015). One of the most effective ways to capture such insights is to focus on the customer experience. This is important because it (1) takes the customer perspective, (2) identifies root causes, (3) uncovers at-risk segments, (4) captures emotional and cognitive responses of customers, (5) spots and prevents decreasing sales, and (6) prioritizes actions to improve (Mccoll-Kennedy et al., 2017; McColl-Kennedy, Zaki, Lemon, Urmetzer, & Neely, 2019). Applying this approach to the healthcare sector, we can focus on capturing insights based on the patient experience with the aim of developing new products and solutions.

This paper presents a framework that enables the identification of meaningful insights based on the patient experience, leading to new products and technological solutions for the healthcare sector.

The framework is based on a literature review of the field of the patient experience. First, we explore the common guiding principles of patient experience, and develop a theoretical framework that integrates different levels of information for capturing meaningful insights. Second, the framework is presented highlighting its potential for empathising, understanding and revealing relevant insights for innovation. Finally, we explore empirically the potential of the framework in a real case study and guide the steps for future research.

Patient experience

Patient experience is a broad and emerging concept. Therefore, its definition is still evolving. The Beryl Institute defines the patient experience as the “sum of all interactions, shaped by an organization’s culture, that influence patient perceptions, across the continuum of care” (J. Wolf, Niederhauser, Marshburn, & LaVela, 2014).

Many authors agree with the “guiding principles” underlined by the Beryl Institute (Purcărea, 2016) such as: engaging all voices in driving comprehensive systemic and lasting solutions; looking beyond clinical experience of care to all interactions and touchpoints; focusing on alignment across all segments of the continuum and the spaces in between; and encompassing both a focus on healing and a commitment to well-being (Silvera, Haun, & Wolf, 2017).

Following this early concept, some authors are rethinking the term patient too. Is it fair to talk about a person with a chronic condition as a patient, knowing that she or he will never be “healthy”? Is it fair to call a patient someone who simply wants to achieve a better state of health? Jones (2013) introduces the term “health seeker”: the health seeker is any person aware of his or her motivation to improve his or her health, whether sick or not. Health seeking is the natural pursuit of one's appropriate balance of well-being.

Therefore, we define patient experience as the sum of numerous multi-agent interactions particularly emotional, as a consequence of the pursuit of health and well-being along the continuum of care, whether sick or not.

Patient experience as a continuum

Patient experience is not just one encounter, but occurs over time and includes many touchpoints; and it is considered as the continuum of care (J. A. Wolf, Niederhauser, Marshburn, & LaVela, 2014). While the patient

experience is built upon diachronic interactions led by different agents and organizations, no agent can oversee the experience like the patient does (Ben-Tovim, Dougherty, O'Connell, & McGrath, 2008).

The patient is the system element that draws a path along the touchpoints; the one who connects all the interactions creating a unique and unbreakable bond, mapping a journey through the continuum of care. These journeys are contingent upon patient needs and the agents involved (Evashwick C., 2005).

The continuum of care has been taken as an axis by different authors in the healthcare discipline, especially when talking about chronic diseases. Batalden et al., (2016) emphasized the idea that the continuum of care for chronic patients goes far beyond mere clinical factors. Patients, seen as co-producers of their own care and attention, live their journey as a continuum, integrating different areas in the healthcare system and other agents present in their life (Figure 1).

The chronic continuum of care leads us to visualize these journeys as more continuous over time and not only based on clinical interactions. Other interactions outside the medical domain are also part of the continuum; for example, tasks related to care or proper adherence to the treatment (Bengoa, 2014) (Figure 1).

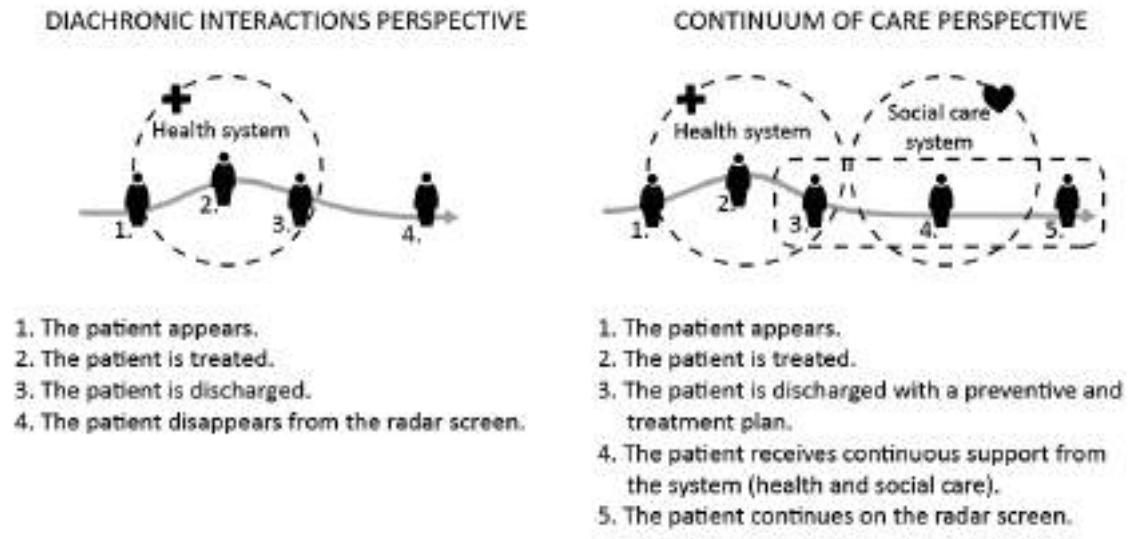

Figure 1: Differences in the patient experience between diachronic interactions and the continuum of care perspective (adapted from Bengoa (2014) and Batalden et al. (2016))

Patient experience as an emotional process

Emotions in patient experience are more relevant than in any other context. Generally speaking, negative emotions are the prevailing trend in the continuum of care (Caulliraux & Meiriño, 2015). These heightened emotions are elicited due to the threat of losing valued resources, such as well-being, money or time that patients experience. Any threat to these resources is, essentially, a trigger event that gives rise to emotion elicitation (Mccoll-Kennedy et al., 2017).

Chronic diseases appear in an unwanted way: they emerge suddenly in people lives as game changers. Valuable resources such as quality of life, mobility, or similar are threatened by a diagnosis. This creates a dichotomy in the experience, defining a before and after the illness. It has been shown that people who suffer a change derived from a disease, such as diabetes (Isla, Vasallo, Guasch, & Rabasa, 2008), undergo a transition process that may correspond to the psychological stages of grief (Afonso & Minayo, 2013; Kübler-Ross, 1969).

When facing the new situation, patients and family members experience intense emotional reactions throughout the continuum. Those encounters that are especially critical for the patient are commonly known as moments of truth or pain moments (Figure 2). These moments have a more significant influence on experience outcomes than any other encounter (Lemon & Verhoef, 2016). (Variables such as frequency, duration or intensity can be used to describe critical pain moments (Bitran, Ferrer, & Rocha-Oliveira, 2008; den Uijl, Jager, de Graaf, Waddell, & Kremer, 2014).

Patient experience as a multi-agent process

A chronic disease guides the patient through a continuum of care. It integrates a high number of agents, operating within healthcare systems increasingly recognised to be complex (Plsek & Greenhalgh, 2001; Sweeney, Danaher, & McColl-Kennedy, 2015). Each agent operates within a variety of systems as members of internally coordinated procedures that seek the well-being of patients (Ham, Kipping, & McLeod, 2003).

The core driver for healthcare systems should clearly be the improvement of health and the personal experience of health. The prevailing trend, however, is to use disease protocols, financial management strategies and centralised control of siloed programs to manage healthcare systems (Sturmberg, O'halloran, & Martin, 2010).

The World Health Organization described the healthcare system as organizations, people and actions whose primary intent is to promote, restore or maintain health (Musgrove et al., 2000)

This includes efforts to influence determinants of well-being as well as more direct health-improving activities. A patient is likely to draw on a network of resources that extend well beyond the focal organization to include interactions with other agents (Arnould, Price, & Malshe, 2006) such as complementary therapies, interactions with private sources such as peers, family, friends, and even other patients (Black & Gallan, 2015).

For the purposes of this research, there are three different types of agents that are regularly connected through the continuum of care, as identified by the Health Innovation Network (2013) (Figure 2):

- Healthcare, developing activities around "cure" (i.e. doctor).
- Social care, developing activities around "care" (i.e. occupational health).
- The patient ecosystem (i.e. a mother caring for a chronic child).

Healthcare providers are typically managed through policies and plans adopted by the government. The healthcare sector employs several staff working in a professional, usually hierarchical structure and orients its work to patient health following rigorous procedures (Ben-Tovim et al., 2008): doctors, nurses, midwives, paramedics, therapists, psychologists, among others.

Social care is not characterized by standardized management (Anttonen & Sipilä, 1996). It is a care-centred concept, that countenances and develops care as an activity and set of relations situated at the intersection of state, market and family and voluntary sector relations (Daly & Lewis, 2000). As a concept and activity, social care covers a number of different relationships and actors, and it is a broad concept full of different organizations: governmental, private or charitable support organisations.

The patient ecosystem (Gallan et al., 2018) refers to close and affectionate agents to the patient: relatives, friends, colleagues or neighbours. Usually the relationship that exists between the ecosystem and the patient is unpaid care, where the caregiver agent appears. Like the patient, these informal caregivers also experience emotional fluctuations that directly influence their everyday life (Carey, Tennant, Rodgers, & Dodd, 2017) (Figure 2).

Patient experience as a sum of interactions

The continuum of care is a journey for the patient. The patient goes through different encounters with different agents (healthcare, social care or the patient ecosystem) and in different contexts. As the patient moves from interaction to interaction, it is important to understand how such interactions affect the overall experience (Lemon & Verhoef, 2016). Therefore, it is important to describe in detail the ingredients of these interactions.

Each interaction can be described in terms of different factors. On the one hand, interactions can be characterized by the agents present in the encounter and on the other hand, interactions happen in specific contexts, locations and under specific circumstances (Lemon K. & Verhoef P. 2016)

According to Klapperich, Laschke, & Hassenzahl (2018), an interaction can be described with: (1) agents profile (description of the agents that take part), (2) practice (i.e. steps and activities, time-based structure that the agents follow), (3) meaning (i.e. why is this interaction meaningful for the agents?), (4) needs (i.e. which psychological needs are affecting agent wellbeing?), (5) skills (i.e. what skills do the agents use to perform the practice? has the illness affected patient abilities?) and (6) materials (which can be divided into the context or environment, and the materials that agents employ to perform the practice).

This approach is based on (Reckwitz, 2002) social practices work where any interaction consists of three highly interrelated elements: meaning (i.e., symbolic meaning, ideas, aspiration and intrinsic goals), competencies (i.e., skills, know-how and technique) and material (i.e., artefacts, tools, physical context and infrastructures). Experiences are the sum of meaningful moments created by interacting with these material arrangements.

As a conclusion, an in depth understanding of an interaction implies analysing factors related to the context and circumstances of the situation. Figure 2 describes the scope of the interaction, such as agents present in the interaction, the patient abilities and skills, psychological needs, material arrangements of objects, different touchpoints and technologies; and tasks and activities which the agents must perform to reach the goal of the interaction.

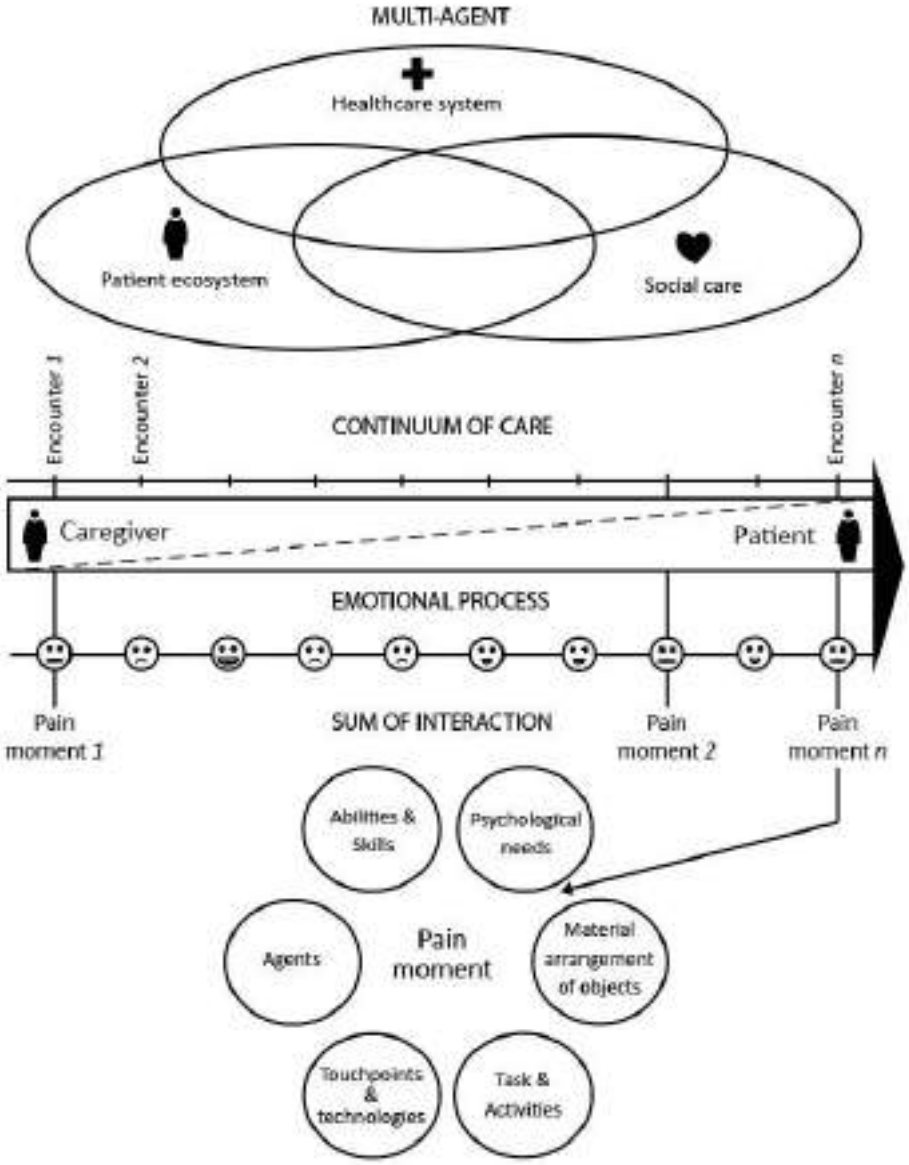

Figure 2: Patient experience features

Methodology

Based on our literature review of the patient experience, we built a theoretical framework to (1) identify significant information regarding the patient experience that enables the capture of design insights and (2) organize information in a multi-level structure to facilitate insight identification.

The framework

We developed a theoretical framework to analyse the patient experience at different levels of information: meso, macro and micro level. The integration of levelled information guided designers to identify relevant and realistic insights (Beirão, Patrício, & Fisk, 2017) revealing technological innovation opportunities that must be used to improve care (Coulter, Locock, Ziebland, & Calabrese, 2014).

Multi-level frameworks encompass different factors that enhance the understanding of an experience (Andreini, Pedeliento, Zarantonello, & Solerio, 2018). By addressing the meso, macro and micro layers of the proposed framework, we visualized the patient experience as a multi-level phenomenon; shaped by emotional, systemic and psychological forces. An integrated view of all relevant factors is needed if designers are to comprehensively understand patient experience.

Linkages between meso, macro and micro levels can guide designers when understanding the full dimension of the patient experience. These connections also provide designers with research guidance when capturing insights that might be relevant for opportunity identification in the healthcare sector (Evans, Higgins, & Hoffer Gittell, 2018; Gallan et al., 2018)

While methods are available for separately addressing each of the levels of the continuum of care (meso, macro and micro) we identified a lack of visualization tools that address the patient experience from a holistic point of view (Curry & Ham, 2010).

To this end, we developed a conceptual framework to visualize information to capture meaningful insights from the patient perspective. The three levels of information visualized in an integrated way are:

1. Meso-level information to empathise: the axis of the analysis is the patient and caregiver journey through the continuum of care. Meso-level analysis involves looking at the patient experience as the key intermediate-sized unit smaller than the healthcare system, but larger than one-to-one interactions. The journey of patients and caregivers is full of information with potential to reveal meaningful insights and opportunities. Many potential new products and solutions will target patients and caregivers themselves, making them the target user. Thus, understanding their routines, emotions and everyday activities is central to identify problems they face and to capture possible insights to solve them.
2. Macro-level information to understand: this level refers to understanding agents present in the patient experience from a system perspective and the interdependencies of how the upper systems function. Studying the largest unit is called macro-level analysis and involves looking at patient experience from a system level. Macro-level analysis is essential for designers to understand how larger system forces affect and shape the patient experience. How agents interplay with each other and how a variety of professionals support patients through the journey is key to identifying specific problems affecting the patient. These professionals may often be target users for specific solutions. An in depth understanding of their working procedures and protocols is a necessary step for revealing meaningful insights in the sector.
3. Micro-level information to reveal: taking patient and caregiver pain moments as a driver, the micro level describes these painful interactions in detail. Micro-level analysis is defined as a focus on individual or small interactions in specific situations. The micro level is important because it focuses on one-to-one interactions occurring through the continuum of the patient journey. The micro level is understood as an in-detail view of the roots of the pain moment and its nuances.

Empathising at a meso level

To empathise with the patient and the caregiver, the meso level has three main factors to be mapped: (1) focusing on the patient and the caregiver, (2) understanding their journey through the continuum of care, and (3) identifying the emotional burden for both of them (Figure 3, meso level).

An important contribution of our framework is to integrate the principal caregiver in the analysis. As the caregiver shares the journey with the patient, the patient's well-being depends largely on his support (Carey et al., 2017). Clinicians frequently overlook the caregiver burden. Identifying pain moments affecting the caregiver, which would otherwise remain hidden, (Adelman et al., 2014) may reveal significant insights that can guide the development of new products and solutions.

To start the analysis, it is important to map chronologically all the interactions that the patient is experiencing through the continuum of care. Moreover, in chronic patients it is crucial to identify those moments that are off the clinical radar. For instance, self-control and self-care moments are important moments to analyse (Telford, Kralik, & Koch, 2006).

This journey is typically characterized by high intensity emotions for both the patient and the caregiver. There are already some design tools like the Customer Journey Map that academic and practitioners use for a better understanding of the entire and chronological experience (Rosenbaum, Otalora, & Contreras Ramírez, 2016). Carey et al. (2017) visualized the patient and caregiver journey through the continuum of care, focusing on their emotions throughout the experience.

Immersive learning increases empathy and understanding of the patient experience (Halton & Cartwright, 2018). Journey mapping allows designers to empathise with the patient and the caregiver experiences to be able to identify critical pain moments throughout the continuum of care (den Uijl et al., 2014). Hendricks, Conrad, Douglas, & Mutsvangwa, (2018) highlighted deep empathy as a key aspect for a better understanding of the problem that contributes to the development of more comprehensive and effective solutions (Yoon, Desmet, & Pohlmeyer, 2013).

Understanding at a macro level

The macro-level information analysis seeks to identify the agents involved in the continuum of care, and how they interact with each other. When designing new products and technological solutions, the perspective of different agents is recognised as a core principle that facilitates the process (Hendricks et al., 2018).

On a first level of closeness to the patient, the patient ecosystem includes agents who have a personal relationship with the patient, such as relatives and friends. Unpaid care is a common feature of relationships with these agents (Gallan et al., 2018).

Typically, healthcare agents include healthcare providers that develop activities around “cure” and social care providers that focus on activities around “care”. These professionals respond to their own system with their own goals and hierarchy. This means that each system has its own logic flow of information, resources and economics.

From a patient experience perspective, inefficiencies and overlapping services between agents may arise. These points can present important insights for designers when visualizing opportunities for new products and solutions.

If designers are to identify insights for new products and solutions, it is important for them to consider how these innovations will fit the current systems (Hendricks et al., 2018). Understanding what a new product or solution represents for different agents and the impact it might have on their own functioning logic is a key issue for further acceptance of the innovation within the system.

Accordingly, our framework at a macro level structures information from the healthcare system, social care and the patient ecosystem (Figure 3, macro level).

Revealing at a micro level

The micro level can easily lead to the identification of especially unpleasant interactions in the patient experience. As an example, Ternik, (2016) highlighted the importance of micro level information for effective product innovation. He explored in detail the many considerations to be factored into the design of oral drug products for elderly patients. His research showed that gaining a comprehensive understanding of patient behaviours and needs, and incorporating that knowledge into product design is crucial.

Mullaney, Pettersson, Nyholm, & Stolterman, (2012) explored how human-centred design can expand the solution space surrounding patient experience in healthcare, specifically studying patient emotions. Their findings focused on anxiety in cancer patients and investigated the situational triggers of patient anxiety within the radiotherapy treatment experience, leading to innovation spaces.

Although it is a complex and difficult endeavor, insights can arise when identifying critical interaction throughout the journey (Lemon & Verhoef, 2016). Encounters that are especially critical for the patient are commonly known as *moments of truth* or *pain moments*. Pain moments are endowed with innovative opportunity potential for designers to improve the patient experience (Figure 3) (Desmet, Fokkinga, Ozkaramanli, & Yoon, 2016).

Emotions, therefore, can be seen as elementary information for new product development (Desmet & Hekkert, 2009). A deeper understanding of patient emotions in the pain moment can help the designer to anticipate and therefore minimize the negative impact of such moments.

Every identified pain moment refers to interactions where patients respond to their psychological needs in a specific context and under specific circumstances. Patient abilities and skills play an important role when the patient goes through a certain sequence of activities or tasks to reach the objective of the interaction. Other important factors that characterize interactions are the specific material contexts, objects, technology and touchpoints and the different agents present at the interaction (Hassenzahl et al., 2012; Klapperich et al., 2018).

In this context, at a micro level, our framework integrates information about activities, context, touchpoints, agents, psychological needs and abilities of the patient following the Klapperich, Laschke, & Hassenzahl (2018) approach (Figure 3, micro-level).

The framework

Figure 3 shows the theoretical framework that integrates multi-level information from the patient experience perspective. The framework pre-structures information so that designers can capture meaningful insights for designing new products and solutions in the healthcare sector.

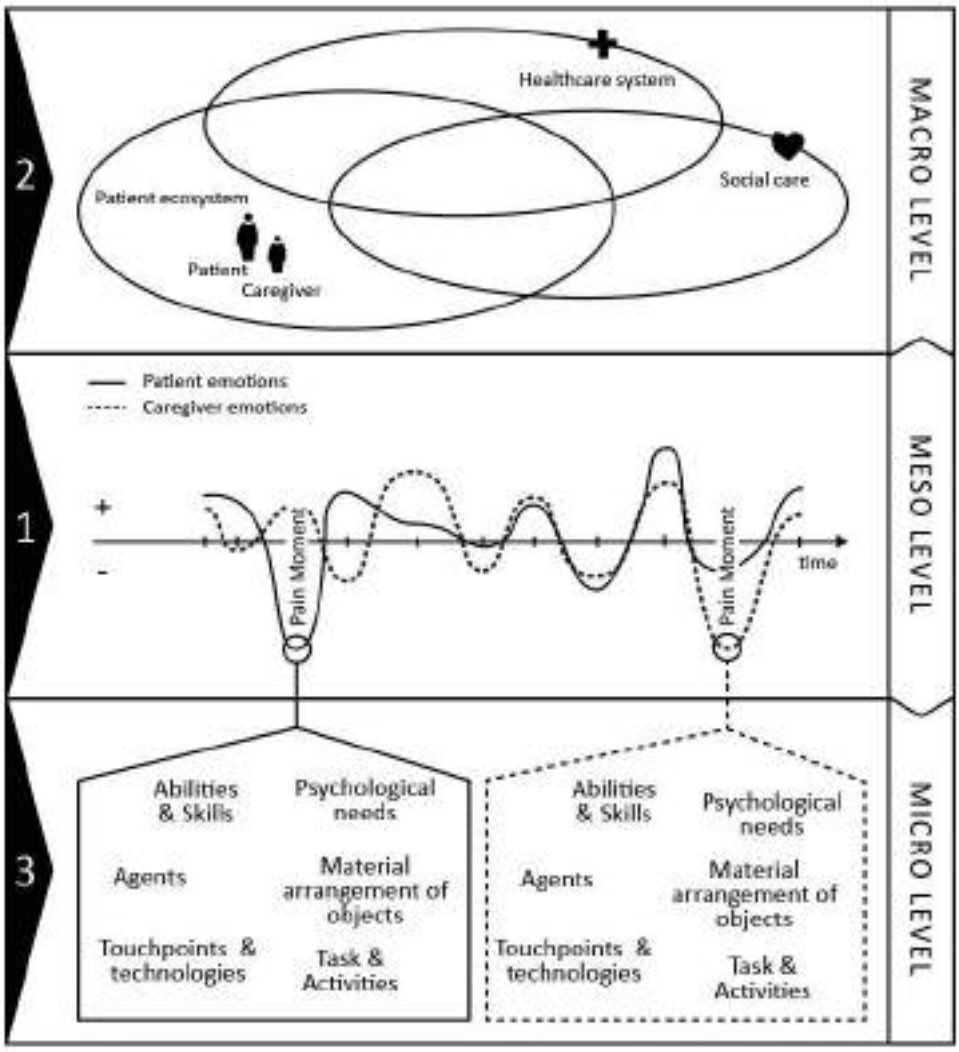

Figure 3: Theoretical integrated and multi-level framework of information

Empirical application of the framework and discussion

The empirical application of the framework targeted the case of a 10-year-old girl with a recently diagnosed Diabetes Mellitus type 1. Diabetes is a chronic disease characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycaemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs (American Diabetes Association, 2014). The correct development of the treatment for diabetes type 1 is based on the balance of insulin injection, physical activity and controlled diet.

The procedure participants used when testing the framework was: (1) interviews with both the child and her mother, (2) identifying, organizing and plotting relevant information in the framework, (3) a generative session to create ideas and (4) evaluation of the results.

We tested the framework targeting a recently diagnosed type 1 diabetes child and her mother (the principal caregiver). Participants for testing the framework were a strategic designer, a service designer, an interaction designer and a product designer. The interview took place in the Diabetes Association. The mother and the child were selected by the association, due to their active participation in different activities. The mother supports many initiatives to fight for the rights and the improvement of the quality of life of people with diabetes. The child takes part in activities, like summer camps, with other children with diabetes. They are aware of their condition and the adherence to the treatment was adequate.

Interviews with the patient and principal caregiver

The framework informed the structure of the interview script, which focused on the meso, macro and micro levels. This helped the designers to (1) extract relevant information about the journey through the disease experienced by the girl and her mother, (2) identify the participating agents on the journey and understand their function and (3) identify the most critical pain moments and elicit the specifics of the context and situation for pain moments.

The semi-structured interview was made to the mother and conducted by the strategic designer and the service designer: It took 1h. The panel interpret that the mother, as the caregiver, should know more about how the institutions operate. So the interview was more focused on a macro and meso level information gathering. The interaction designer and the product designer interviewed the child, obtaining a broader knowledge at the micro level, by taking detailed painful interactions as the focal point. Finally, a brief summary was made all together, the panel and the interviewees.

It is also important to point out the limitations of interviewing. The panel assumed that what the mother or the child said during the interview could not be the same as what they would say or do in other situation. Despite these limitations, the panel tried to create an atmosphere in which they were likely to talk freely. That is why the interviews took place at the *Diabetes Association*, a familiar place for both. In addition, the panel spent time with them in a meal routine, trying to emulate and observe their day-to-day lives to get a deeper understanding out of that encounter.

Identifying, organizing and plotting

With the analysis of the girl's ecosystem, the designers first identified that the adherence to the treatment regimen was supported by the parents, and the mother was mapped as the principal caregiver. The information provided by the girl and the mother is shown in Figure 4, at the meso level. Plotting the emotions of both of them revealed that the experienced pain moments are not the same for the girl and her mother.

For the mother, the most painful moments were those when the girl needed to manage the treatment on her own: at school or in her leisure time, for example. In contrast, the girl reported different pain moments such as routines and activities dissimilar to those of the rest of the children, or a loss of independency, for instance. The entire journey was described as arduous and overwhelming for the family.

One of the most frequent pain moments was having lunch at school (Figure 4 micro level), where the girl needed to manage her treatment. An in-depth analysis identified that the girl felt overwhelmed by the treatment requirements, and unpopular because she was different to her friends. The mother, on the other hand, worried about her daughter´s abilities to manage the treatment on her own. The treatment involved difficult tasks such as glucose control, calculating and injecting the correct insulin dose and estimating the

required number of carbohydrates to eat. Although there were some agents present in this interaction (teachers or canteen monitors), they did not have the knowledge or the responsibility to support the girl.

Designers focusing on the macro level identified different agents that appeared recurrently, for example, the endocrine doctor, the diabetes educator and the diabetes psychologist (healthcare system), the relatives (patient ecosystem) or members of the *Diabetes Association* (social care) (Figure 4, macro level).

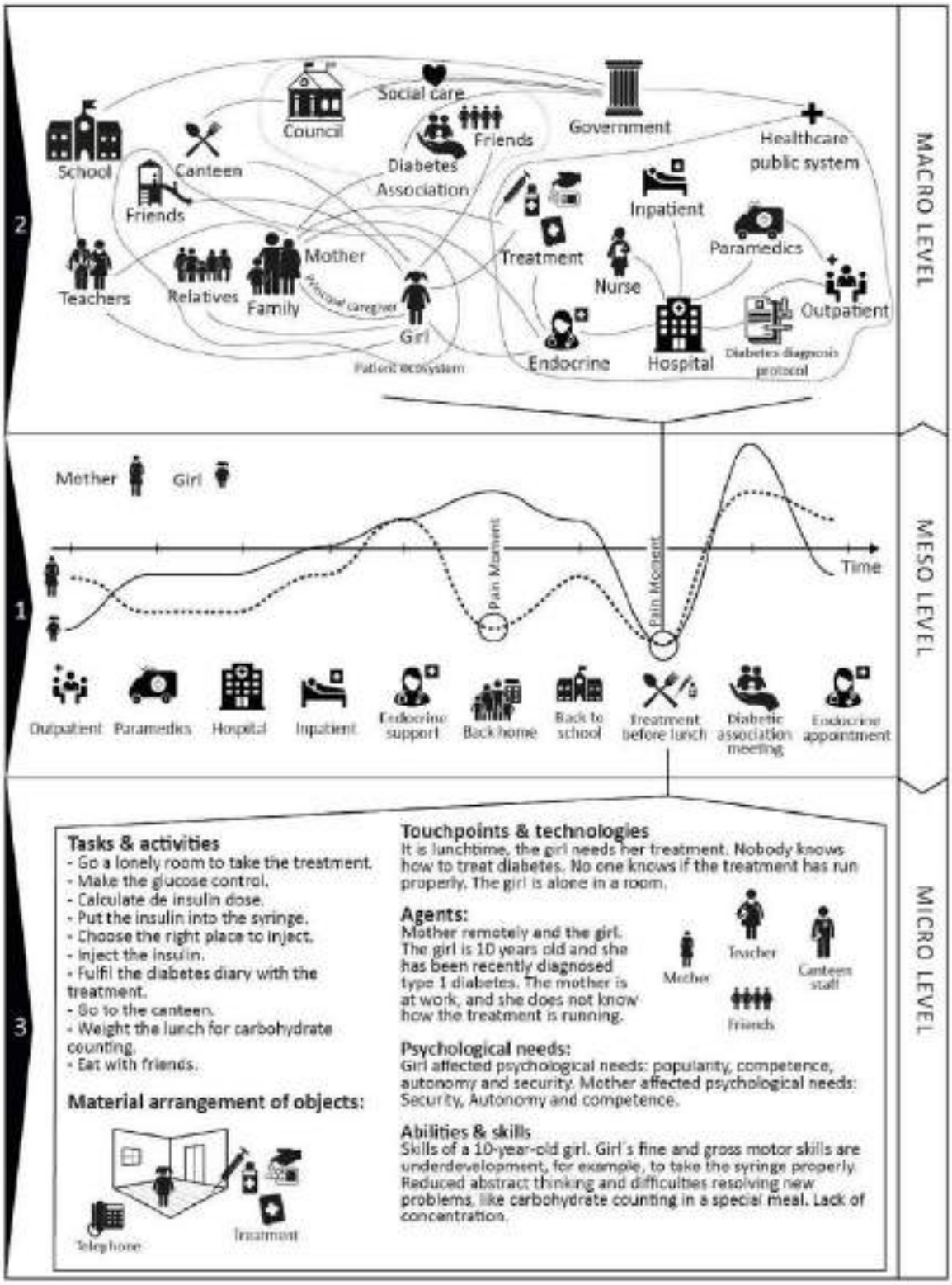

Figure 4: Empirical application of the framework for a recently diagnosed type 1 diabetes child.

Analysing the pain moment “having lunch at school” through the integrated framework, designers were able to understand that the regional education system is not always able to provide healthcare support. On the other hand, the healthcare system does not have the authority to provide healthcare inside the facilities of the school. A further complicating factor was that the canteen service was subcontracted by the council, making inter-agent collaboration even more difficult. Later in the generative session, this revealing insight guided the proposed ideas at the micro level, sharpening feasible proposals.

The integrated framework elicited insights regarding connections and linkages between different information levels in the patient experience, which can be essential for further idea generation in the healthcare sector.

Generative session

After the application of the framework designers proceeded with the identification of insights that led to idea generation. Prioritising pain moments by intensity and frequency, insight identification encompassed the three levels of information and designers were able to create connections among different insights leading to a variety of ideas. This produced a realistic patient analysis base to start creating new solutions that improved the journey.

Five different ideas evolved out of the generative session. These were related to developing skills and/or providing external support to the girl to successfully manage her treatment. Some of the ideas were related to treatment automation, adaption of the treatment devices or the use of information technology.

Evaluation and results

The designers reported that the framework helped to capture patient and caregiver´s meaningful information about their experience at a glance helping to become aware of their condition. The interviews made to fulfil the framework helped to empathise with the child and her mother.

They could easily identify the different pain moments, their intensity and frequency throughout their journey. They highlighted that the structure provided by the framework helped them to gather information during the interviews. Moreover, they emphasized that plotting the information in an integrated way helped them when linking and connecting insights for idea generation.

The panel of designers did agree on most of the positive features of the framework. Nevertheless, one interesting issue arose: It was pointed out that in healthcare-related product design, often solutions find difficult to enter the market, since their existence would mean changing the system.

The strategic designer focused on solving problems in a cross-sectional way, aligning the solutions to an experience-driven approach. This means, instead of focusing on a particular pain moment, she set the focus on the journey´s ups and downs, trying to develop a holistic solution.

The framework facilitated the performance of a detailed analysis of the context, circumstances and agents that intervene in the canteen situation, where the girl needed to manage her treatment. The study of this interaction significantly contributed to the capture of meaningful insights for new products and technological solutions.

The designers, however, found some limitations during the testing. Particularly, they suggested that a more robust framework structure would improve the information gathering process. They proposed supporting the framework with user research tools.

Conclusions

Creating new products and services to improve the patient experience represents a promising field that could greatly benefit from the expertise and contribution of designers and product developers. The complexity of the healthcare sector, however, can pose an important barrier for designers to articulate new feasible solutions (De Sousa Coelho & Branco, 2017), where specific tools and methods for the sector to overcome this barrier are limited. To this end, we presented a framework to support designers in this context.

The framework pre-structures information so that designers conduct qualitative research to gather systematic information aligned with the given theoretical underpinning. It captures meaningful design insights based on the patient experience. After analysis and synthesis, the obtained information is then transformed into insights. These insights are visualised to provide easily accessible representations of the experience (Segelstrom, 2013). Thus, the strength of the proposed framework relies on its integrated approach which

combines, organises and structures different levels of information that are relevant for revealing meaningful insights. When designing for the healthcare sector, designers need to put the patient at the centre of their activities, working towards the best quality of care. Consistent achievement of high-quality care can be guided, therefore, by the patient experience and design (Dixon-Woods et al., 2014; McColl-Kennedy et al., 2019).

The patient experience is at the core of our framework, and this serves as a basis for new products and solutions to be designed. It articulates new solution design pivoting on emotional intensity from the patient perspective throughout the continuum of care (Matheson, Pacione, Shultz, & Klügl, 2015). Another important contribution of the framework is that it integrates the caregiver perspective in the patient experience. Feelings such as anxiety and fear at different levels of intensity are experienced by both patients and caregivers throughout the journey (Carey, Rodgers, Tennant, & Dodd, 2016). Peaks in the intensity level highlight emotional frictions or pain moments, reflecting the disparity between the offered solutions and real patient needs (McColl-Kennedy et al., 2019). Analysing these peaks provides designers with insights to ideate new solutions that can contribute to close this gap.

At a macro level, our framework enables designers to understand the healthcare system and the identification of different agents that influence the patient experience at a certain moment. Different healthcare agents want the same thing: to improve people's health. Unluckily, lack of consensus among agents in a complex system is one of the biggest barriers to innovation (Jones, 2013). Including a macro level perspective is important because potential new solutions may involve changes in healthcare practices, which would have an impact on those agents. Acceptance by professionals, organizations and other agents is a key challenge for the success of new products, which needs to be taken into account when considering different insights.

Finally, designers need to understand the details of interactions within the patient experience so that they can seek innovation. Dealing with information such as the physical context, agents involved or tasks to be performed in an interaction are of significant importance for identifying meaningful insights. Additionally, the micro level of information in our framework refers to information beyond operational and clinical aspects. Factors such as underlying emotions, the psychological needs of different agents in the interaction, or specific patient abilities also need to be taken into account. We believe that these details are of significant value for designers to engage in innovation or new product design (McColl-Kennedy et al., 2019).

It was straightforward to apply the framework to our empirical case. We had the opportunity to evaluate our approach with a real-life chronic patient, and the feedback obtained from the participants was largely positive. The following factors were identified as the main contributions of the framework:

- To capture patient and caregiver´s meaningful information about their experience at a glance helps to be aware of their condition. The interviews helped to empathise.
- To identify and understand different agents and their roles supporting patients and caregivers throughout the journey.
- To understand processes and interdependencies among agents when supporting patients and caregivers.
- To understand how new products and solutions link to the psychological needs and skills of patients and caregivers.
- To gather a collection of especially relevant information which supported designers when capturing insights.
- To structure information collected from different domains in an integrated and organized way.

As our testing was limited to a single case, this study has certain limitations. It is complicated to state substantial findings that can be considered representative of the studied framework, which is still at a theoretical stage and comes out of logical argumentation. However, the first performed empirical test has begun to reveal some leads on aspects to improve the methodology: it must conform a space that allows researchers to collect information from a multidisciplinary viewpoint. This means two things. Firstly, each level of the framework should contemplate the possibility to add information from various agents that may operate at different levels. Secondly, the framework should provide researchers with ad hoc tools, and be a support itself which they could use in situ to gather information. Once those improvements are implemented on the framework, further empirical testing would be performed, that would result in the obtention of more reliable data to establish more significant results.

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Design as an Agent for Public Policy Innovation

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Described as units developing public policies in a design-oriented manner, Policy Labs are tasked to innovate to gain in policy effectiveness and efficiency. However, as public policymaking is a context-dependent activity, the way in which these novel organisations operate significantly differs. This study discusses the emergence of design approaches for policy innovation. The purpose is to map how Policy Labs in Europe introduce design approaches at distinct stages of the policymaking cycle. For this study, 30 organisations in Europe operating at various levels of government were surveyed. Based on the public policymaking process model, it investigates which design methods are Policy Labs deploying to innovate public policies. The study exposed a gap in the awareness of the utilised methods' nature. It also showed that the use of design methods is of less importance than the introduction of design mindsets for public policy innovation, namely 'user-centredness', 'co-creation', and 'exploration'.

Keywords: public, policy, innovation, design, labs

Introduction

In a global context of increasing complexity design has acquired a renewed momentum, for its potential to enhance economies' competitive advantage (Raulik-Murphy, 2010), but also as a strategic tool to foster innovation in the public domain (Junginger, 2014). Since 2008, policymakers worldwide are trying to develop innovative ways for sustainable growth (Bason, 2014). In this context, design has become central to some public organisations, employing designers and introducing notions of design thinking across the stages of the policymaking cycle (Junginger, 2017). Today, several Governments worldwide are gradually incorporating design approaches to develop public policies and services, recognising the value of service providers' and users' insights into the process (Bason, 2014). It is argued that design offers some potential to overcome the limitations of conventional policy methods to fostering public and social innovation by developing creative solutions (Mulgan, 2014).

Moreover, policy-making is conceived as a design activity (Johnson & Cook, 2014), and the implementation of such policies is subject to the design of services and products (Junginger, 2013). Particularly in Europe, central governments and local authorities alike are increasingly working with design managers and incorporating in their organisational structures multidisciplinary innovation units using design approaches (Whicher, 2015). Conceived in a global setting where the limits between public and private sector are becoming blurrier, these organisations look to integrate interests and ideas from various policy communities (Perl, 2013). Although considerably differing from each other, these organisations are frequently labelled as 'Policy Labs' and described as emerging organisations tasked with the devising of public policies in an innovative and 'designerly' manner (Fuller & Lochard, 2016). This study of design in public policy innovation targets these organisations that are comprised of multi-disciplinary teams who explicitly utilise design methods to involve a variety of users in the development of innovative public policies and services.

Similarly, focusing the study to a geographic region responds to this phenomenon (the emergence of Policy Labs) having originated in Europe (Bason, 2014), thus offering the possibility to inquire into the implications of using design for policymaking beyond government pilots. Although organisations incorporating these approaches have reached a supra-national level, systematic understanding of how design is being used to innovate public policymaking remains unclear. Even though there is a growing body of literature on design in policy-making, there is still scarce knowledge of the specific design activities that ultimately produce innovative policies. Understanding how design is currently being deployed in the making of public policies will aid in understanding the potential for developing innovative policy solutions. Furthermore, it will also allow us to understand its potential to modify deeply rooted policy practices and its subsequent impact in the larger socio-political system.

Design for public policy innovation

Interest in design in the public sector has grown over the last decade (Kimbell, 2015; Rosenqvist, 2017). References to design within public policy-making literature are today more frequent; however, it has been largely perceived as only relevant to the implementation stage, paying little attention to the introduction of design into broader aspects of the policy-making process (Junginger, 2013). The adoption of design in policymaking has been largely facilitated by service design's penetration into public organisations (Junginger, 2013). This creative approach to service innovation has been praised for its co-participative nature, stimulating public engagement (Sangiorgi, 2015). It is argued that design growth in the public sector relates to the way in which design-oriented companies (e.g., Airbnb, Apple) have enhanced customers experiences for new services (Kimbell, 2015). This, perhaps neo-liberal, approach to government-provided services has been explained by differences between citizens expectations and the services governments provide (Mintrom & Luetjens, 2016; Rebolledo, 2016). The design promise is to help creating user-centred services, consequently improving the users (the citizens) experience.

Furthermore, Junginger (2013) argues that despite not generally being understood in design terms, policy-making is essentially a design activity. Overarchingly, design and policy-making share the goal of changing existing conditions into preferred ones (Rebolledo, 2016). Yet, it is argued that whereas traditional policy-making pursues this from a normative stance, the design approach is based on a systemic and experimental fashion which offers prospective scenarios through creativity and prototyping (Rebolledo, 2016). Moreover, Junginger (2017) stresses that the benefits of introducing a design approach in policymaking, are deeper than the mere gains in efficiency, by also enabling the creating of more meaningful and faster-implemented policies. By employing design, it is then expected to develop new policies that are based on a human-centred approach to problem-solving (Junginger, 2013).

Of special interest in the development of public policies tackling complex societal issues is the notion that most of the problems addressed by designers are wicked problems (Buchanan, 1992). The result of designers dealing with these types of complex problems over the years has been the advancement of sophisticated professional practices within the designing disciplines able to do this (Dorst, 2011). Moreover, concerning the intractability of wicked problems, is the acknowledgement that more creative individuals engage in problem identification and generally present higher problem construction capability (Reiter-Palmon & Robinson, 2009). Dorst (2011) poses that frame creation is a core design practice by which a problematic situation can be tackled from an original standpoint. This is of high significance because it naturally puts designers and the use of design in a privileged position to target such policy issues.

Additional to that is the idea that "design thinking puts end-users needs –rather than legacy and policy– at the centre of the policy formulation system, shifting paradigms and creating a new decisional process" (Allio, 2014, p. 6). This feature is key since relocating the policy focus could counteract the effects of path-dependency limiting policy innovation. Furthermore, Tunstall (2007) points out the importance of design in making governance tangible to every citizen by giving them a voice in co-participatory policymaking processes.

Therefore, there is a rising consensus that design can play a significant role in restructuring governmental processes and structures (Rosenqvist, 2017). However, political science scholars, are unclear on the methods policy designers employ in identifying problems, defining design criteria or in the overall process (Mintrom & Luetjens, 2016). Consequently, the introduction of design practices in public policymaking has not yet acquired mainstream diffusion.

Public policy(making) innovation

Dissatisfaction on how governments deal with contemporary issues has arisen across the globe (Rosenqvist, 2017). Likewise, the growing number of co-dependent actors in societies makes finding, processing, and implementing solutions even more complex than it ever was (Janssen & Helbig, 2016). Furthermore, "the accelerating flow of ideas, information, goods and money across national borders has affected the nature of policy problems, [and] reshaped the attempts to engage these problems" (Perl, 2013, p. 44). This growing complexity in the issues governments face has also brought an increasing awareness of the inefficacy of the current policy instrument and processes to tackle them (Brookfield Institute, 2018). Moreover, it is currently widely accepted that governmental bodies' structures are not particularly appropriate to address current societal issues (Sangiorgi, 2015). For instance, the British Government already in 2011, recognised that "decades of top-down prescription and centralisation have put bureaucratic imperatives above the needs of [public] service users" (HM Government, 2011, p. 7). Additionally, budget reduction has meant the need for revising public services, often re-assessing user needs to obtain gains in effectiveness and better user experience (Whicher, 2015). Rebolledo (2016), refers to this situation in which there is a disparity between what people need and government do, whilst the latter also requires gaining effectiveness in designing and delivering policies, a two-folded innovation imperative. Junginger adds "we are at a moment in time where many governments are desperately looking for new approaches to policy making and policy implementation" (2017, p. 5).

Although the need for doing things differently regarding how public issues are tackled and how public services are provided has been largely recognised, the process of policymaking remains essentially unchanged. The process model is one of the most widespread means of depicting public policy-making (Howlett, Ramesh, & Perl, 2009), and it does so by disaggregating it into a set of discrete interrelated stages with a logical flow (Hallsworth, Parker, & Rutter, 2011). This process presents an identifiable pattern of activities, although rarely as orderly and systematic as the process model (see Figure 1) portrays it (Howard, 2005; Dye, 2013).

Figure 1: The public policymaking cycle, adapted from Howlett, Ramesh, & Perl (2009) and Dye (2013).

However, when it comes to policy innovation, political scientists have commonly focused on the innovation of the resulting product (the policy itself), ignoring the process by which innovative ideas make their way into government agendas (Mintrom, 1997). Policy innovation is then defined "as a policy that is new to the state adopting it" (Mintrom, 1997, p. 741). Borrowing from the economics of innovation, this definition could be understood as a case of product innovation, since it is based on the introduction of a new product or a qualitative change in an existing product (OECD, 2005). Others exclusively focus on the political aspect of policymaking, recognising policy innovations as those sought by politicians whilst looking for solutions which allow the attainment of conflicting policy objectives (Quiggin, 2006). Newer approaches define policy innovation as the "novel processes, tools, and practices used for policy design and development that result in better problem solving of complex issues" (Brookfield Institute, 2018, p. 6). Thus, emphasises the complex nature of the issues at hand and the need for new ways of policy-making to attain improved results. Similarly, an EY report on public sector innovation, claims "policy innovation is about identifying the needs of constituents and shortening the time required to develop, test, implement and diffuse a policy" (EY, 2017, p. 8). Here, the focus is set on providing the citizens with timely answers to their needs, in what could perhaps be considered a more client-provider relationship. Additionally, the process of policymaking and its distinct stages is made explicit. By stressing the need for reducing production and delivery times, the process efficiency is also highlighted. Again, stretching the definitions from the economics of innovation, we could consider these two definitions as examples of process innovation, in which innovations are oriented to the effectiveness and efficiency in which the organisation (in this case, the state) produces and delivers its products and services (Schilling, 2016). From this, a parallel between how innovation occurs in the private and public spheres can be drawn. As described by Utterback and Abernathy (1975), the outputs of an organisation embody the organisation's innovation at a product level, whereas those innovations in the manner it conducts its 'business' — including how the outputs are produced— represents process innovations (see Figure 2).

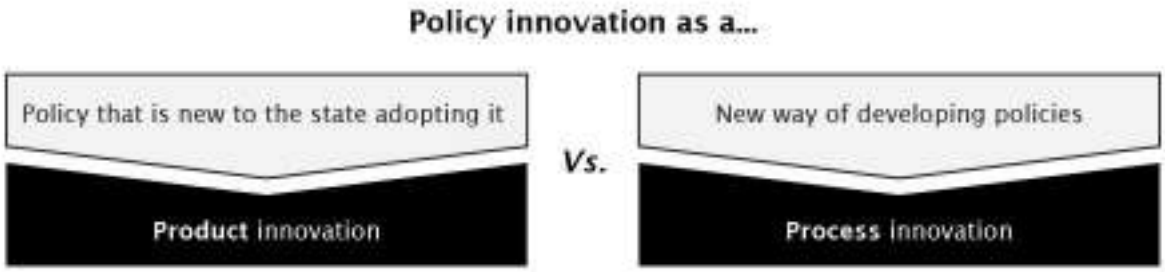

Figure 2: Policy innovation as product Vs. process innovation.

This policy innovation tension could then be described in terms of product-process dimensions. On the one hand, the innovations could be considered as the policies themselves, and the product and services they result in at the implementation stage. On the other, the focus could be set on the innovation of the process of developing new public policies. On this respect, Schilling (2016) stresses that product-process innovation's dynamics frequently take place in 'tandem', this means that innovative products may allow for the development of innovative processes, whereas innovative processes may also enable the development of innovative products.

Following the above, and in the face of new and more complex societal issues, it becomes clear why looking for novel and experimental ways of arriving at innovative solutions has turned into an imperative for many Governments. The rationale seems to be: if current policy instruments are not satisfying societal needs, innovating the process of policymaking may prove crucial to arriving at more adequate solutions.

Policy Labs as a vehicle for design for public policy innovation

In the last decade, public administrations worldwide have built organisations called Policy Labs in the pursuit of increasing the engagement of diverse and pertinent stakeholders, whilst facilitating experimentation in the public sector (van Veenstra & Kotterink, 2017). Albeit being different in form, structure, scope and origin, these organisations are broadly defined as:

> *…emerging structures that construct public policies in an innovative, design-oriented fashion, in particular by engaging citizens and companies working within the public sector (Fuller & Lochard, 2016, p. 2)*

Setting-up new organisations to introduce these concepts into the public sector respond to several reasons. The scale and complexity of the challenges faced by the public sector trigger governments to look at new non-incremental ways of framing issues and developing solutions (OECD, 2017). Furthermore, it is recognised that a more systematic approach that institutionalises a culture of innovation as a core value in the public sector is currently required (Junginger, 2013). Also, that to creatively respond to complex problems, policymakers should develop the ability to envisage new scenarios (Considine, 2012). However, this clashes with the traditional notion of policymaking as a reactive activity, in which policies respond to past and present scenarios, rather than imagining future ones (Junginger, 2014). These novel approaches to creating public value are the means for public sector innovation and imply a shift in how the public sector operates (OECD, 2017).

Although most Policy Labs do not focus on a specific policy area, they share an interest in the participation of multiple stakeholders in the policy-making process (van Veenstra & Kotterink, 2017; Junginger, 2017). A 2016 report by the European Commission's Joint Research Centre recognises that Policy Labs play a vital role at every stage of the policy cycle, though their primary objective is on supporting innovation in the design of public policies (Fuller & Lochard, 2016). This, for instance, has led to the creation of the EU Policy Lab, "a collaborative and experimental space for innovative policy-making… [which utilises] design thinking to explore, connect and find solutions for better policies" (EU Policy Lab, 2016) at a supra-national level. Though not every EU member state features a Policy Lab, governments from those without one have expressed the aim of creating their own, based upon others' experiences in the EU (Fuller & Lochard, 2016). These "special organizational units created at the local, regional or national level have begun to explore how new design methods and new approaches can help them address concrete problems" (Junginger, 2017, p. 6). The need to create special organisations for adopting such methods, could be explained by public sector organisations being described as bureaucratic, hierarchical and risk-adverse structures (Sangiorgi, 2015), which find some design methods to be inappropriate due to their 'playfulness', or tendency for "short-circuiting the traditional decision-making structure by circumventing the political arena" (Bailey & Lloyd, 2016, p. 10). This is interesting since policy scholars claim that "the variety of instruments available to policy-makers is limited only by their imaginations" (Howlett, Ramesh, & Perl, 2009, p. 114). Although only a handful of studies on specific Policy Labs provide with accounts of bespoke design approaches for specific contexts (Bailey & Lloyd, 2016), there is currently no overview on how this "design-oriented fashion" to public policy innovation is being interpreted.

Considering Policy Labs for the study of design in public policy innovation responds to their explicit use of design for such endeavours. Similarly, limiting the study's data collection to European organisations responds to the phenomenon's geographical nature. In this regard, Bason (2014) states that experimenting with design methods in the public sphere has firstly appeared as an Anglo-Saxon and Nordic practice. Consequently, the most longstanding Policy Labs find their roots in Europe, allowing the study of design for policymaking beyond the initial experimental stages, as is the case of more novel initiatives taking inspiration from the European experience.

Research Design

This study mapped the design methods/tools that Policy Labs in Europe utilise when intervening in public policymaking. Adopting a process perspective, these design methods/tools were identified at different stages of the policymaking cycle. Data was collected through online surveys conducted between January and November 2018. The sampling was based on that presented in the European Commission Joint Research Centre–commissioned report Public Policy Labs in European Union Member States (Fuller & Lochard, 2016), and expanded from the original 13 countries as to cover all 46 UN recognised states in Europe. In addition to the four-level classification (City, Metro, Regional, National) used in the above-mentioned report to identify the organisations' reach, the supra-national level category was also considered.

Data collection

A survey was sent to 81 organisations in all 46 UN recognised European states. This inquired about the organisation's understanding of policy innovation in terms of the dichotomy 'product vs process innovation', at

which stage of the policymaking process they intervene (according to the six-stage model presented), and the methods/tools utilised at each stage to innovate public policies. Participants were not given definitions of 'method' and 'tool', nor that of a 'design method/tool'. The sample consists of:

- 46 UN recognised states in Europe;
- 28 EU member states;
- 81 organisations identified as of interest;
- 17 states with at least 1 organisation of interest.

The online survey was divided into two parts. The first part was sent to the 69 organisations in the sample, and the second part was only sent to those organisations which completed the first part. This resulted in:

First survey:

- Opened in January 2018;
- First survey: 69 contacted (85%) out of 81 organisations;
- 30 valid responses (43% of all 69 organisations contacted);
- Responses from 16 countries (89% representation of all 17 countries with at least 1 organisation of interest).

Follow-up survey:

- Opened in February 2018;
- Sent to 30 organisations;
- 17 responses (57% response rate).

The first survey consisting of eight questions was sent to 69 of the 81 organisations initially identified as of potential interest. The filtering responded to a few reasons, namely, some of the organisations listed in the report Public Policy Labs in European Union Member States (Fuller & Lochard, 2016), were no longer operational by the moment the survey was sent, or further desk research showed that these initiatives were small scale projects rather than established governmental units. The follow-up survey was opened a month after and consisted of nine questions with a focus on the respondents understanding of public policy innovation and the methods/tools they utilise to achieve it.

Results

From "a number of Policy Labs […] in a handful of Member States of the European Union" (Fuller & Lochard, 2016, p. 2) reported in 2016, the situation seems to have evolved to a much larger number of organisations in 17 countries across Europe (see Table 1).

Table 1: Surveys respondents' distribution

Country	*# first survey respondents*	*# second survey respondents*
Armenia	1	0
Austria	1	1
Belgium	1	0
Denmark	3	2
France	3	2
Georgia	1	1
Ireland	2	0
Italy	1	1
Macedonia	1	1
Moldova	1	0
The Netherlands	2	1

Poland	2	1
Portugal	1	0
Spain	2	1
Sweden	2	2
Switzerland	1	0
United Kingdom	5	3

First Survey

Regarding the reach of these organisations, the largest proportion (56.7%) of the respondents indicated they operate at a national-level (see Figure 3). On the other end of the spectrum, 16.7% claim to be doing so at a supra-national level. However, when looking at the individual responses, only two of these organisations have decision-power at a supra-national level, whereas the other three are foundations and academic-based organisations whose work is commissioned by foreign governments and organisations.

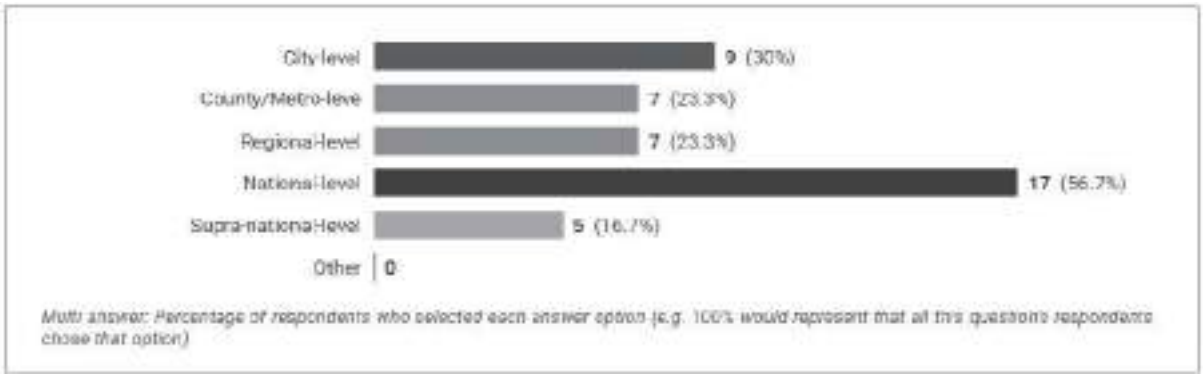

Figure 3: Distribution of the sample's reach. Based on 30 responses.

The initial survey tried to elucidate to what extent using the term 'Policy Lab' as a proxy for 'organisation developing public policies in a design-oriented and innovative fashion' serves as an all-embracing label. The results showed that although 56.6% of the surveyed organisation are either formally or informally known as a 'Policy Lab' (see Figure 4), over 40% of them are not. This negative response includes organisations which had been labelled as such in previous reports (e.g., Sweden's Experio Lab considered a 'County/Metro-level Policy Lab' by Fuller & Lochard (2016)). Moreover, less than a fourth of all respondents are formally known as 'Policy Labs', suggesting that the current label does not effectively encompass all organisations working under the definition.

Figure 4: Sample's identification as Policy Labs. Based on 30 responses.

The main objective of the survey's first part was to map the organisation's activities in terms of the policymaking cycle (see Figure 1). Respondents were asked to indicate at which stage their organisations intervene, allowing for multiple responses. As can be seen in Figure 5, there are consistent responses regarding the agenda-setting, policy formulation, policy implementation, and policy evaluation stages, with over half of the respondents indicating their participation at those stages. Perhaps the most noteworthy stages in the cycle are the problem identification and decision-making stages, with 86.7% and 30% responses,

respectively. Whereas organisations from all the spectrum seem to be engaging in the former, the latter is almost exclusively reserved for organisations embedded in the public sector, with the only exemption being a Policy Lab with origins in a public university. Also, three organisations described their participation in policymaking outside the stages of the cycle, either indicating they "…also participate in policy piloting at smaller scale", or they participate in "policy making process design & innovation" or simply stating that they do policy "experimentation". Moreover, another remark of interest relates to the inability of one organisation in accomplishing its mission due to what seems as meagre political will, stating they "should be part of the agenda-setting stage, but this would require a higher buy-in from our partners in Government".

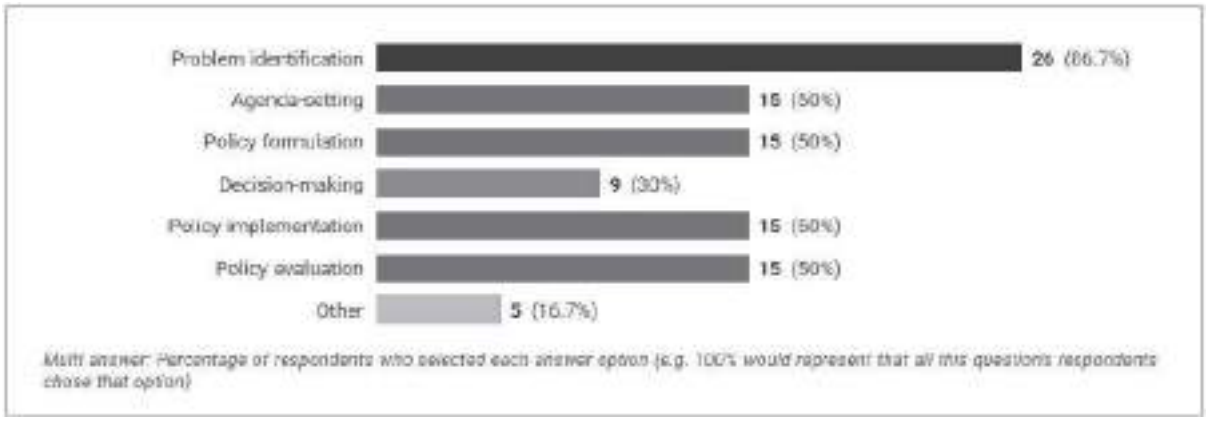

Figure 5: Organisation's intervention at each stage of the policy-making cycle. Based on 30 responses.

Follow-up Survey

The second part of the survey focused on the organisation's understanding of public policy innovation regarding the 'process vs product innovation' dichotomy presented, as well as the methods and tools utilised by them in the pursuit of policy innovation. Unlike the first part of the survey, this second part was only sent to the 30 organisations which completed the first part. Therefore, the results are based on 16 responses.

In regard to their view on public policy innovation, participants were asked to indicate whether the organisation understands it as "a policy that is new to the government adopting it", "a new way of developing public policies", both approaches, or none of them, this last one under the option "other" (see Figure 6). Interestingly, although no organisation understands public policy innovation exclusively in the traditional terms, half of the respondents reported that public policy innovation refers to both approaches, with the remaining seven participants responding it is solely about a new way of developing public policies.

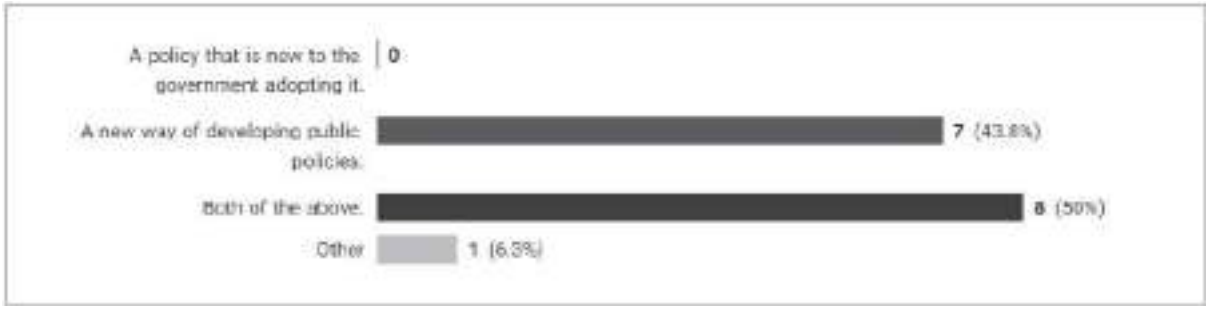

Figure 6: Organisation's understanding of public policy innovation as product vs process innovation. Based on 16 responses.

In a follow-up question (see Figure 7), participants were asked if their organisations aim at innovating how public policies are made, with 62.5% responding affirmatively.

Figure 7: Organisation's aim to produce public policy innovation from a process perspective. Based on 16 responses.

The following question inquired as to why innovation is relevant to public policy-making? Although there was no restriction on who could respond, this open-ended question was responded to by those who had previously asserted that their organisations were looking at innovating how public policies are made. Specifically, some participants argued that innovation is relevant to public policy-making "to create more effect", as well as "to ensure effectiveness of the policies", while others explicitly recognised the complexity and nature of current issues as the most important reason for innovation in public policy-making:

> *"To address complexities of our time and to solve wicked problems new approaches to policy making are needed (stakeholder involvement, evidence-based decision making, ...)"*

or

> *"Because it helps policy makers find more relevant solutions for the challenges of the modern time like climate and economic challenges, improve the governance and respond effectively to the changing context of complexity and uncertainty."*

Another participant pointed out that the current policymaking process does not necessarily consider the user's needs in its development, hence the need for innovation:

> *"Public policies are supposed to work for people, each with specific needs. One can never expect one policy to work for each individual, but one may expect the policy-making processes to start with the needs of people. To incorporate the lived realities of people in policy-making means to continuously involve people in the process – something that rarely happens on a structural basis."*

With the aim of mapping the methods/tools utilised when intervening in the policymaking process, the survey asked participants firstly, if their organisations utilise different methods/ tools at different stages of the policymaking process to innovate public policies, and secondly, if their organisation utilise design methods/tools (i.e., persona creation, user journey mapping) to innovate public policies. The results showed that 14 of the 16 organisations utilise different methods/tools at different stages of the policymaking cycle, and 12 of those organisations utilise design methods. The remaining two organisations which do not use different methods/tools at different stages of the policymaking cycle do claim to use design methods/ tools in their activities.

Regardless of the high rate of positive responses about the use of design methods/tools to innovate public policies, the respondents were not always clear on what those methods are. Similarly, the notion of method/tool was not clear for all participants. For instance, one participant who explicitly responded that "co-design workshops" are used at the policy formulation stage clarified that "probably none of [the] mentioned… are really a tool or a method (in strict sense)". This view was echoed by another respondent who explained that:

> *"The task… [of the] Lab as part of public healthcare is to grow design capabilities and capacity to better integrate the resources of patient/relatives in delivery, development, service innovation and policy making. We are there to create a meeting between Healthcare and Design where both worlds can learn from each other. Design or service design for us is a mindset and the approach we use in all projects and work. Therefore we use and adapt a variety of design methods/tools and adjust to the project at hand. In early stages of course more anthropological tools to investigate user needs/behaviors, etc. Later on journeys/personas, etc to describe insights. Prototyping to explore and implement solutions."*

Table 2 below shows the participants responses when asked to identify the methods/tools their organisations used to innovate public policies at each stage of the policymaking cycle.

Table 2: Mapping of design and non-design methods/tools utilised at each stage of the policymaking cycle. Based on 16 responses.

	Problem Identification	*Agenda-setting*	*Policy Formulation*	*Decision Making*	*Policy Implementation*	*Policy Evaluation*
Design Methods	Ethnographic fieldwork	System Dynamics Modelling	User Centred Design	Agile method	Service design, monitoring systems	Data harvesting (monitoring phases)
	Digital ethnography	Prototyping/testing	Co-design enabling	Prototypes	Spend time with the team who has to use new tools or spaces.	Ad hoc valuation approaches
	Scenarios	Strategic conversation	Co-design workshop (preliminary phase)			
	Data analysis-interpretation	Ws (concept design)				
	User journey mapping	Scenario-based techniques				
	Design Thinking	Agile method				
	Sociology	Foresight	Design thinking			
	Psychology					
	Qualitative interviews					

In Table 2, some of the responses –such as 'Ethnography' or 'Prototyping'— were used as examples for more than one activity, design and non-design methods/tools. Some other responses seem to be representative of specific practices (e.g. "Spend time with the team who has to use new tools or spaces") rather than standardised methods. In this regard, it is important to mention that definitions of 'method' and 'tool' were not provided.

Although most respondents recognised the use of different methods across the policymaking cycle, some were unsure when asked to identify at which each stage they were used. However, respondents were still able to provide examples of these design methods/tools, namely:

- Ethnographic research;
- Co-creation;
- (Rapid) Prototyping;
- Experimentation;
- Co-Creation;
- Personas;
- User Journeys
- Design Thinking;
- Gamification;
- Human-centred design.

One respondent who claimed their organisation does not use different methods/tools at each stage did mention the use of "design thinking [and] design-driven innovation" throughout the cycle. On the other hand,

one respondent said they “use so many [methods and tools] and at different points. It very much depends on the question we are trying to address”.

Discussion

In this section, we analyse and discuss the results of both surveys, considering the design literature presented. Firstly, although the term ‘Policy Lab’ has served as an umbrella designation to encompass all organisations working in the development of public policies innovatively, only a limited proportion (<25%) of the surveyed organisations are formally known as such. This makes explicit the need for coining a broader term to designate organisations working in this area.

The nature of design-specific methods and tools

The study highlighted a lack of coherence on which methods and tools are specifically useful and where the role of the design becomes most useful and fulfilling for policy innovation. One evident aspect of the responses to the survey is the interpretation of what constitutes a design method/tool. The survey did not control for the ‘design literacy’ of the respondents, however, and without delving into what makes a design method, it is difficult to conceive a trained designer claiming ‘sociology’ or ‘psychology’ being one. Likewise, ‘design thinking’ or ‘user-centred design’ are seldom referred to as design methods/tools in the literature. Nevertheless, participants expressed that design is being used in their organisations. This discrepancy could be attributed to the fact that it is not the use of design methods/tools what constitutes these organisations design-led approaches. This could be rather based on the mindsets a design approach entail. Likewise, this could explain the broad definition used thus far, in which public policymaking is addressed by these organisations in a ‘design-oriented fashion’, without necessarily resorting to specific design methods. The notions of ‘user-centredness’, ‘co-creation’, and ‘exploration’ –typically through prototyping— appear as key aspects of this innovative approach associated with a ‘designerly’ manner. Moreover, the recurrent identification of ‘agile methods’ as a design method may support the idea that specific methods are not the most relevant aspect of these organisation’s practices. As the Agile Manifesto (Beck et al., 2001) expresses, the focus should be more on individuals and interactions instead of processes and tools. Further investigating the specific characteristics that shape these design-led approaches will be key to understanding how design can contribute to public policy innovation. Similarly, assessing how expert design knowledge is introduced in these organisations will also help in fully understanding how design is being utilised.

Bringing design approaches to initial stages of the policymaking cycle

The stages of the cycle at which these organisations intervene also highlights an interesting point. A majority (>85%) of the surveyed organisations claim to be intervening at the problem identification stage of the policymaking cycle, and this resonates with the use of a design approach. This is because the ability to create frames which might help in tackling wicked problems is a key skill in addressing complex societal issues. Moreover, this skill has been associated with core professional design practices which allow for the development of original solutions. Furthermore, the need for innovating and bringing new approaches to public policymaking has been explicitly connected to the need to address the complexities of current social policy issues. This links together the notions of contemporary complex societal issues, the need for policy innovation, and the introduction of design to fostering such innovation. Additionally, one implication of these organisations operating at earlier stages of the policymaking cycle (as opposed to solely at the policy implementation stage) is a shift from the origins of the uses of design in public policymaking, where design was employed to operationalise solutions which had not necessarily arisen from a design-led process. However, it is not clear, if these organisations transit a process of problem reformulation once they have been tasked with a defined policy issue, or if the problem identification is conducted from the outset to push the identified problem into the policy agenda later. Should the former be the case, the design process could be entirely occurring at the policy implementation stage. What did become clear is that the decision-making stage of the policymaking process is still reserved to a limited set of policy actors, most of whom do not seem to belong to these organisations.

The need for substantial change to the public policymaking process

With none of the respondents subscribing to the traditional view of policy innovation as exclusively the introduction of a new policy by a government, the idea that the process by which policies are developed is of

utmost importance became evident. However, with half of the respondents indicating that public policy innovation should involve both, a new process and a novel outcome, the parallels between public policy innovation and that described in the economics of innovation is clear. This seems to indicate that innovative public policies can hardly emerge from the way they have been traditionally developed, signalling its exhaustion for providing appropriate solutions. Two main arguments appear crucial in supporting this. Firstly, the need for innovation to address the complexity of current social policy issues, suggesting the traditional processes fail in doing so. The staged-model represented in the policy cycle could be key to understanding how policymaking has been mainly conceived in a reductionist manner, limiting the Government's capacity to integrate a systemic approach to their development. Secondly, including the inputs from a larger set of stakeholders throughout the policymaking process is imperative in developing meaningful and appropriate public policies. The literature is explicit in recognising that during most stages of the cycle, only subsets of the policy universe are involved (Howlett, Ramesh, & Perl, 2009). However, there seems to be an exceptional urge for including the inputs from a very specific group of stakeholders: the users. With the advent of service design at the policy implementation stage, the introduction of the user's perspective in public service development has gained traction, due to its extensive use of co-productive approaches. However, in a more holistic view of the policymaking process, devising a public service may not be possible to disaggregate from the framing of the problem being addressed. Amongst other reasons, this becomes clear when considering the prototyping of solutions, an aspect highlighted by the surveyed organisations. Prototyping will necessarily mean a non-linear process where several iterations of the solution, including the further reframing of the problem, are likely to occur. This consideration, resorts back to the first point, urging for a more systemic approach to the policymaking process.

Conclusion

Incorporating design approaches in the making of public policy seems to hold the potential for fostering innovation, according to this study's participants. However, the introduction of design in the public policymaking process does not appear to be attached to the use of specific design methods, but rather to certain 'designerly' mindsets, namely, 'user-centredness', 'co-creation', and 'exploration'. User-centredness relates to the shifting of the policymaking process' focus towards the 'main' users affected by the policy to be conceived. This implies maintaining a constant feedback loop with these users throughout the process. Concordantly, 'co-creation' refers to the joint development of policies and their actionable outcomes by several stakeholders which might not typically be involved in such activities. This includes, but it is not limited to, those directly affected by the new policy (the 'users') and frontline public servants. The exploratory mindset is embodied by a willingness to experiment with solutions that do not necessarily resemble the existing policies, thus breaking from path-dependency. It also suggests a positive attitude towards failure, in which several iterations of a proposal are tested against assumptions and with several stakeholders, consequently reinforcing the user-centred and co-creative spirit.

New ways of developing public policies as well as new public policies better suited to deal with current societal problems appear to be a requirement for most governments. However, the latter seems to be largely dependent on the former, often demanding significant changes in the public policymaking process. Whereas previously an analogy with the product versus process model for technological innovation was presented, it became apparent that certain features, such as the 'tandem' dynamic where innovative processes may allow for the development of innovative products and vice versa, is not met. Furthermore, as key stages of the process, such as the decision-making stage, remain in control of limited policy subsets a comprehensive co-creative approach to public policymaking will only be partially implemented. Furthermore, retaining the decision-making power in a reduced portion of the stakeholders will continue to hinder exploratory approaches by, for example, interfering in the feedback loops and policy development's timescale. It appears the public policymaking process will require extensive revision to fully incorporate a design approach with the potential of affecting substantial change, as well as to enable a systematic production of innovative solutions.

Lastly, Policy Labs, or more generically, organisations working in innovative public policymaking are promoters of the introduction of design mindsets in this realm. Arguably, the design capacities in these organisations may not be distinctly robust, since, for instance, their understanding of specific design tools and methods is notoriously fuzzy. This does not necessarily imply a detrimental effect on the outcomes they can produce, as the design mindsets employed by these organisations can be learnt and appropriated beyond the use of design methods and tools. However, some of these principles, such as problem re-framing considered crucial in the ability to develop innovative solutions, are sophisticated professional practices which might require in-depth

understanding and long-standing experience to be effectively deployed. Low performance due to limited design expertise may undermine these organisation's legitimacy, thus having a detrimental effect on the expansion of innovative public policymaking processes. Regardless, the shifting of these organisations towards the early stages of the policymaking process may, if the current power structure permits it, precipitate further changes in the way public policies are conceived. Perhaps even making design literacy a key skill of future policymakers.

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Track 2.a Introduction: Decolonising Knowledge to Transform Societies

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The aim of this track was to question the divide between the nature of knowledge understood as experiential in indigenous contexts and science as an objective transferable knowledge. However, these can co-exist and inform design practices within transforming social contexts. The track aimed to challenge the hegemony of dominant knowledge systems, and demonstrate co-existence. The track also hoped to make a case for other systems of knowledges and ways of knowing through examples from native communities.

The track was particularly interested in, first, how innovators use indigenous and cultural systems and frameworks to manage or promote innovation and second, the role of local knowledge and culture in transforming innovation as well as the form of local practices inspired innovation. The contributions also aspired to challenge through examples, case studies, theoretical frameworks and methodologies the hegemony of dominant knowledge systems, the divides of ‘academic’ vs ‘non-academic’ and ‘traditional’ vs ‘non-traditional’.

The 4 paper from 9 authors approach the theme of this track from various perspectives, highlighting different aspects of approaches to other ways of knowing, leading to change and transformation in design. The responding papers came from rich and diverse cultures of India, Namibia, South Korea, United states, United kingdom, Australia, Sweden and showcased examples from many more contexts. The accepted papers covered various forms of decolonisation.

In the first paper, In Colonizing Innovation: The Case of Jugaad, Abhinav Chaturvedi and Alf Rehn question the currently popular concept of frugal innovation that has been appropriated in western management literature as an innovation. This popular phenomena has its roots in the culturally colonial appropriation of indigenous knowledge systems. They sequentially explore various journals for use of postcolonial theory or thinking to inquire into the knowledge systems of innovation studies and innovative thinking, and also break down the concept and phenomenon of Jugaad to understand its linkages. Thereafter, they examine the colonisation of Jugaad through exortisim and narratives of want, and the commodification of the terms as well as the knowledge system; calling for an understanding of the phenomena of non-western paradigms to be reviewed and understood for their own worth and through their own lens.

Boeun Bethany Hong and Sharon Prendeville, in their paper Understanding Development Discourse through Ontological Design: The case of South Korea examine the case study of South Korea's manufacturing industry and its replication as a form of coloniality. While the authors begin their paper with understanding discourse and its relationship to ontological design. Through empirical analysis they demonstrated how the current manufacturing industry in South Korea has been evolved through development assistance strategies from the west. However, in replicating their hegemony of manufacturing know-how in the South-Asian region they are replicating the “West-centred” discourse of developmentalism.

Melanie Sarantou, Caoimhe Isha Beaulé and Satu Miettinen explore Nambian art and design proliferation through the frameworks of decolonising design and participatory service design with scope of improvisation therein, that allows the participants agency to shape the service. They analyse the role of Art South-South Trust (ASST), a start-up Namibian not for profit (NFP) organisation, as service providers, in increasing visibility and enabling global exposure of the artists, designers and artisans. The paper draws on reflective practice to analyse the data of interviews of various Namibian and Australian partner art organisations. It also uses reflective practice to analyse the focus group discussions between Namibian artists, designers, artisans and arts organisations. The authors use critical thinking to evaluate the findings of the focus groups need for awareness and open dialogue and the plural identities and the complex social, economic and cultural environments in which the participants live and function. Expectations of focus groups were to promote Namibian artists and designers globally through sustainable links with art and design organisations, providing feedback to participants and the broadening of knowledge and experiences. The authors suggested sustained engagement with international markets, efficient, yet flexible and agile management protocols. The authors finally build a practical framework for decolonising practices in Namibian art and design through a mindful and enacted shift from stifling institutions to a willingness to erode and fight power structures associated with institutionalisation. The challenged institutional politics and gatekeeping in the arts by suggesting an alternative participatory framework. They elaborate that this could be achieved through adopting bottom-up approaches as well as fostering capacity building in areas of service design, digital business management and marketing and digital storytelling.

The final paper in the track was by Nicholas Baroncelli Torretta and Lizette Reitsma, through enquiring three Design for Sustainability (DfS) projects through design approach strategies, made a case for challenging colonial and modern development structures. The authors problematises the dynamic between situated place, situated community and design work. They also problematise the term sustainability is deeply local and tied to specific nature/culture contexts and as a collective global action for life on planet. They use Paulo Freire's decolonial perspective to analyse the approaches of the case study. They first take on the approach of design activism in an example of Design for Sustainability (DfS), projects on urban farming in Finland. The second approach is of humbling designing shown through a DfS project of energy conservation project in Sweden. Lastly, Radical Listening as design approach in the case of preserving tropical forests through offering healthcare in the context of Borneo. The authors also caution against the use of Design for Sustainability (DfS), projects themselves becoming as a colonial tool. They conclude that steering DfS to become decolonial or colonizing is a relational issue based on the interplay between the designers' position in the modern/colonial structure, the design approach chosen, the place and the people involved in DfS.

All the papers examine the role of local knowledge and culture in transforming innovations. Situatedness, local-global community interplay, indigeneity and identity become a feature in every case study that has been discoursed. All papers locate the innovations inspired by local practices, and diverse design approaches as means of decolonising and challenging the hegemony of western paradigms. They showcase experimentations and scales in this knowledge domain, through their own categories. The diversities of the case-studies and the many locations of the examples show the many ways in which designers, communities, organisations and innovators challenge the expertise position, while acknowledging the models of experiential, subjective and tacit knowledge that making/doing/problem-solving inherently hold. The track also paves way to view these knowledge beyond binaries, create new dialogues and evolve a common language through diverse action examples. The papers examine diverse design approaches and contexts, however the commonality is the caution about any of these case studies or approaches becoming an colonial tool.

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Colonizing Innovation: The Case of Jugaad

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Innovation is one of the most popular concepts and desired phenomena of contemporary Western capitalism. As such, there is a perennial drive to capture said phenomena, and particularly to find new ways to incite and drive the same. In this text, we analyze one specific tactic through which this is done, namely by the culturally colonial appropriation of indigenous knowledge systems. By looking to how jugaad, a system of frugal innovation in India, has been made into fodder for Western management literature, we argue for the need of a more developed innovation critique, e.g., by looking to postcolonial theory.

Keywords: innovation, innovation critique, postcolonialism, indigenous knowledge systems

Introduction

As a concept and the desired end-state, innovation and the innovative organization has for many years been a mainstay in the global debate on management and the drive towards increased efficiency and profit. The modern corporation needs to at least present itself as innovative, or it risks being punished on the stock market (see, e.g., Sood & Tellis, 2009) and in the public debate, and the same goes for business thinking more generally. To be seen as relevant, both CEOs and business pundits need to show continuous innovative activities, pushing both towards a homogenized business discourse (see, e.g., Collins, 2000) and a relentless desire to increase levels of innovation – or at least to make it appear that this has been achieved. At the same time, an increasingly globalized market economy presents companies with additional challenges. Where companies earlier could trust markets to be relatively homogenous, products and services must today often be geared to more and more precisely defined such. Markets that were earlier seen as secondary, such as India and China, are today viewed as central. No wonder, then, that corporations see a great deal of value to be had from gearing innovation efforts towards these spheres (Bruche, 2009; cf. McKenna, 2011). However, in the field of innovation, this cultural 'awakening' also has a flipside, one where non-Western markets are seen not only as a space in which to increase market- share but one from which innovation inputs can be harvested.

This latter move, where previously marginalized markets are seen as a key source for innovation insights, takes some forms. On the most basic level, global companies routinely strive to localize their products and services for new markets and use cultural insights to do this (Petison & Johri, 2008; Swoboda, Pennemann, & Taube, 2012). On another level, markets can be studied for their specific needs, and the existing knowledge and competencies of the corporation can be deployed to serve these (see Anderson & Markides, 2007). Such aspects are well known in the literature on both innovation and, e.g., international business, and we will not here delve deeper into them. Our interest is on the level where the interest of companies isn't to understand the specifics of the market, but rather to utilize 'indigenous knowledge systems,' i.e., culturally specific forms of knowledge and knowing, to enhance their innovation capacities.

The concept of indigenous knowledge (and the systems thereof) comes to us from anthropology (see e.g. Battiste & Henderson, 2000; Semali & Kincheloe, 2002; see also Banerjee & Linstead, 2004), and emphasizes that cultures develop ways of analyzing their world, forming knowledge about the same, and creating novel meanings that stem from their local context rather than from a general mode of 'thinking'. Whereas Western analyses of knowledge emphasize specific modalities of sensemaking (including a strong reliance on 'objectivity' and abstracted empiricism), these shouldn't be seen as general and eternal, but rather as forms of indigenous knowledge unto themselves. Other ways of knowing and thinking, such as it may form in, e.g., a rural Indian, Indonesian or Chinese context, is in such an understanding not erroneous simply because it holds different modalities of knowledge, and can in some contexts even be better suited for the specific locality than the assumedly more objective Western knowledge. This is not, particularly in our use of the term, to be mistaken for absolute cultural relativism or knowledge nihilism. Rather, it emphasizes that local knowledge systems can a) have special insights into specific matters (such as how to utilize resources that are special for an area), and b) provide valuable alternative interpretations and perspectives.

It is particularly this last point that is of interest here. Within the field of innovation, one might say that the art of developing alternative perspectives forms the very core of innovative thinking[1] . In a sense, all innovation hinges on seeing an existing product, service, process or model in a new way, making alternative perspectives valuable in and of themselves. It should come as no surprise, then, that indigenous knowledge is potentially valuable within innovation thinking, particularly if this can be harnessed – either directly or symbolically – to further new avenues in this field. This paper deals with a specific case of this, namely the manner in which jugaad, a form of indigenous knowledge stemming from India, is turned into a resource for Western innovation thinking.

Jugaad, which we will detail as a concept later on in the paper, is in effect a particularly Indian philosophy of innovative problem-solving in situations with very limited means. Its practitioners, jugaadu, are often part of the most socioeconomically challenged group in India and characterized by being poor to the level of destitution, illiterate or functionally illiterate, uneducated and often either living in rural areas or having a rural background. They are, to put it succinctly, among the poorest of the global poor. At the same time, as detailed in a number of contemporary management books (see e.g. Birtchnell, 2013; Leadbeater, 2014; Radjou, Prabhu, & Ahuja, 2012; Radjou & Prabhu, 2015), they have shown a tremendous capacity for developing novel solutions using extremely limited resources, utilizing an improvisational approach to technical development reminiscent of bricolage (see Baker, Miner, & Eesley, 2003; Garud & Karnoe, 2003) and what in entrepreneurship studies has been called effectuation (see Sarasvathy, 2009).

Here, our interest is in the manner in which jugaad has been appropriated in Western management thinking, both as an example of the exotic Other (Jack, Westwood, Srinivas, & Sardar, 2011; cf. McKenna, 2011) and as a potential knowledge-base to be colonized. In the latter case, jugaad is recast to align with the Western preoccupation of continuous progress, and further with the triumphalist notion that innovation can, as long as the mindset is correct, be done with little or no resources. We will return to this latter point.

In the following, we will discuss the possibility of discussing innovation through the lens of postcolonialism, after which we will introduce jugaad in more depth. Following this, we will analyze the manner in which jugaad has been utilized as a resource in Western management thinking, and end by discussing the problems inherent in colonizing indigenous knowledge systems within innovation thinking, and in management studies more generally.

Innovation and Postcolonialism

As a theoretical field, postcolonial theory (see, e.g. Said, 1979; Bhabha, 1994; Spivak,1987), has been widely deployed in the field of organization studies (see Prasad, 2003, 2012; Banerjee & Prasad, 2008, Frenkel & Shenhav, 2006; Jack, Westwood, Srinivas, & Sardar, 2011; Khan, Munir, & Willmott, 2007; Nkomo, 2011). Inspiration from key postcolonial thinkers such as Edward Said, Gayatri Spivak, and Homi Bhabha has enabled scholars of the organization to question Eurocentrism, the primacy of Western knowledge and narratives of organizational identity in ways that have enriched our understanding of organizational life in a

[1] We will in this text use 'innovation studies' when referring to the academic field and the academic literature, and 'innovation thinking' when referring to the more popular field, i.e. the field of business books and similar material for non-scholars.

globalized society. However, the deployment of postcolonial theorizations has been very uneven. It has had its main champions within the field of critical management studies (CMS) and within diversity studies, with decidedly less uptake in "mainstream" fields such as leadership studies (see, however, White, 2010; Nkomo, 2011) and strategy (see, however, Westwood, 2006). Its use has often been a critical one, i.e., using postcolonial theory to highlight epistemological and ontological limitations in how organization studies have attempted to create generalized knowledge without taking into account, e.g., differences in cultural epistemology or power-relations. For instance, Muhr & Salem (2013) use a postcolonial perspective in challenging notions of equality in a Swedish organization. By highlighting the often forgotten colonial history of Sweden, they show how a context often assumed to be one of the most equal and integrated ones in the world still creates images of 'the Other' and silences its own history in a manner that affect the ways in which foreign workers can align themselves to the 'openness' of the studied, Swedish company. In this way, postcolonialism can act as a critical lens into how our understandings and their cultural foundations are created and managed.

That said, it is notable that postcolonial theory or thinking has almost never been used to inquire into the knowledge systems of innovation studies and innovative thinking. In our literature review, we went through the five top journals in innovation, as listed by The Association of Business Schools (ABS), 2015: Journal of Product Innovation Management, Research Policy, R and D Management, Technovation and Creativity and Innovation Management. For each of these, we used the journal's full-text search for the terms "post-colonial," "postcolonial," "post-colonialism" and "postcolonialism" (the hyphen is sometimes used and sometimes not). The results were as follows:

TABLE 1

Journal	*Keyword Search*			
	"Postcolonial"	"Post-colonial"	"Postcolonialism"	"Post-colonialism"
1. Journal of Product Innovation Management	0	1	0	0
2. Research Policy	0	0	0	0
3. R and D Management	0	0	0	0
4. Technovation	0	0	0	0
5. Creativity and Innovation Management	1		0	0

The reader is here asked to note that we in this have had to trust the search engine and that there is always a possibility that insufficient indexing and glitches in the software have returned erroneous data, but some variations on searches, spread out over time, returned the same results. Also, and as a precautionary matter, we searched, in the same manner, for references to the works of three key postcolonial theorists: Homi Bhabha, Gayatri Spivak, and Edward Said. While this is of course not a complete list of possible postcolonial influences, we argue that the lack of references to these thinkers would be notable, as an article that attempts to introduce postcolonial critique would almost certainly have to refer to the seminal works of at least one of these, and most likely all three. The results of this were as follows:

TABLE 2

Journal	Authors		
	Gayatri Spivak	Homi Bhabha	Edward Said
1. Journal of Product Innovation Management	0	0	0
2. Research Policy	0	1	0
3. R and D Management	0	0	0
4. Technovation	0	0	0
5. Creativity and Innovation Management	0	0	0

It should here be noted that references to, e.g., Spivak are quite common in feminist theory, and Edward Said's influence in no way limits it just to postcolonial theory, making the fact that neither has seemingly been referenced or mentioned in Journal of Product Innovation Management even more interesting. As an additional side-note, not even Alexander Styhre, a leading critical innovation scholar who has published on postcolonialism (Styhre, 2005), uses any such references in his book-long attempt to form a social theory of innovation (Styhre, 2013). In this case, the lack of engagement cannot be explained by a lack of insight into the field, as Styhre most certainly has such. So, there is a silence in innovation studies, a silence regarding postcolonial approaches. Arguably, this is due to the more general lack of critical innovation studies (see, however, Sveiby, Gripenberg, & Segercrantz, 2012), as the field is often seen as one representing a general good, one where there is scant need to inquire into the ethical and cultural assumptions it builds on. This, as we will show, is a problematic view, and also one at odds with the professed ethos of the field.

A key, one might even say constitutive element, of innovation, is the capacity to borrow ideas from other fields. Looking to the literature, there is no end to the number of ways in which this can be re-iterated, as innovation scholars have returned again and again to the productive potential of utilizing insights from other fields. The capacity for divergent thinking and for being able to combine ideas from fields previously seen as separate is in the literature on innovation hailed as central to creativity and therefore foundational to innovation. Further, the innovation literature often comments very positively on the possibility of utilizing the insights of one field (e.g., business models developed in the service industry) in another (e.g., deploying the same in retail). In this manner, innovation discourse and innovation thinking quite often glamorize re-utilization of ideas from other fields.

However, the innovation literature, particularly the popular such, is remarkably silent regarding the politics of this. The notion of utilizing ideas from other fields is instead presented as not only a right but imperative for a person or an organization to be innovative. As the latter state is then presented as not only desirable but necessary for survival, the liberal colonization and appropriation of ideas are seen as a non-issue. This, however, is a problematic assumption, which rests on there being an equilibrium of power between fields and that exploitation is a non-issue. In some context, this might be a reasonable argument, such as when rich corporations in one industry learn from similarly rich corporations in another, but this is not always the case.

In contemporary management literature, there has been an awakened interest into viewing markets that were previously seen as marginal or without commercial potential. A lot of this interest can be traced back to a book by Indian-American business professor C. K. Prahalad, namely The Fortune at the Bottom of the Pyramid (Prahalad, 2009). This argued that although the five billion poorest people on the market were often overlooked by major corporations, they represented "vast untapped buying power" and that companies should attempt to create products for this group. The wretched of the Earth would then become

empowered consumers, get access to products designed to their needs, and companies could still profit handsomely. Although one might ask whether becoming a consumer is that great of a deal to the poverty-stricken and whether this truly is the promised "win-win," the book was well received in the business community and became a bestseller.

The interest books such as this garnered, combined with the impossible to ignore the rise of the Chinese and Indian economy, made groups that previously had been overlooked into potential markets. Spaces that had previously been colonized by invading armies and kept under colonial power by way of statecraft were now increasingly colonized by global mega-corporations instead, in what some called "corporate colonialism" (Banerjee, 2006). This covered a multitude of processes through with the corporate world could extract value out of, e.g., Third World countries, but also gave rise to notions of taking in inputs and learnings from fields that would previously have been ignored (see Chipchase & Steinhardt, 2013). In innovation thinking, this process lived up to and boosted the axiom of attempting to bring in ideas from different fields, and was therefore well received.

What has not been addressed, however, is how we are to understand the power issues inherent in major corporations searching for ideas and innovations among the world's poor, and the manner in which indigenous knowledge systems can be turned into corporate intellectual property. It is with this in mind we will look to a specific case of this, namely the phenomenon of jugaad, and the way it has become commoditized.

A Critical Intermission

As our aim in writing this paper isn't to present a specific case study of innovation, but rather to critically inquire into the manner in which indigenous knowledge systems can become commoditized and exploited by Western innovation thinking, it is, of course, important that we are open with our position. One of the authors is a Caucasian from Northern Europe, albeit from a country with its colonial history of oppression. The other is from India, albeit not from the rural poor that we are writing about and for. We can thus not speak directly in the name of those we are here using as an example of corporate and conceptual colonization.

That said, our task here is not to present an ethnography of jugaad, nor to position ourselves as moral arbiters or defenders of the oppressed. Whilst the latter is an admirable position to take, we do not feel that we can justifiably claim to be such. What we're doing in this paper is rather something akin to an intervention, a critical question regarding the manner in which ideas travel (Czarniawska-Joerges & Sevón, 2005) and get commodified, and the power-relations inherent in this. Thus, rather than claiming we are doing a full postcolonial critique of innovation, a task which while interesting and worthwhile would require far more space and depth of inquiry, we're merely showing a specific case in which such a critique is warranted and can serve to open up our debates about contemporary colonialism, the new forms thereof, and the ideology of innovation.

Jugaad as concept and phenomenon

To put it in the simplest way possible, jugaad is an indigenous knowledge system of innovative problem solving, normally utilizing very limited and repurposed means and mostly associated with rural India. As a word jugaad is part of normal discourse across the Indian subcontinent and is essentially a colloquial word of Indian origin derived from the dialectal jugat. One of the meanings of this is "contrivance" which can further be traced back to its Sanskrit form yukti, a term that can mean union, connection, or combination, but which can also mean contrivance, expedient, trick and so on (Monier- Williams, 2005). People who practice jugaad are sometimes referred to as jugaadu, and have in the Western interpretation of their craft been referred to as unlikely innovators, "positive deviants" (Pascale, Sternin, & Sternin, 2010) and, somewhat breathlessly, "modern-day alchemists" (Radjou, Prabhu, & Ahuja, 2012). In less flowery terms, they could be described as craftsmen working with very limited means, problem-solvers who are forced to make constraints work for them and improvise "satisficing" (Simon, 1972) solutions.

In their communities, jugaadu is used as a term for those who focus on solving real-life technical problems and who as a result may be trying out things which at times can seem impossible, naïve or even injudicious. This also highlights that jugaad is highly contextual and mostly non-replicable since the solutions devised to solve a local problem are created in an improvised manner by way of alternative utilization of resources at hand. A key reason for its emergence in India is because it provides for a survival strategy in a situation with widespread scarcity. One example of this, and possibly the origin of the Hindi term, relates to the brain-child of

a farmer in a small village of Gohana, Uttar Pradesh, who put together a "modest contraption" for transportation (Mitra, 1995) with the help of semi-skilled and semi-literate mechanics, mounting an old engine on a wooden body and using old tires. Soon variations of this improvised car became a mode of mass-transportation in the large countryside of north India.

We might also consider the case of Mr. Mansukhbhai Jagani, from Mota Devaliya in Amreli. To overcome the increasing difficulty of ploughing the land by the use of animals after the 1994 drought in Saurashtra, he repurposed a bullet motorcycle as a farming implement. In doing so, he managed to create a cheap, multi-utility farm device which has a leveler, a ploughing machine, a weeding device, and a sowing machine, all in one. The development of this made concentrated use of traditional knowledge regarding how to plough the land, inter-culturing, and the local sowing-challenges, and did so with the simple technology at hand. The indigenous knowledge of Mansukhbhai ensured a machine functional for its local deployment and has gone on to earned him considerable praise.

Other examples of jugaad, collected by one of the authors, include the usage of a washing machine as a mixer to create buttermilk and the repurposing of old cassette tapes, where rural villagers use the zinc tapes to polish metal-wares and shine leather to give it a smooth look. The jugaadu's approach to innovation is, therefore, more a process of re-thinking rather than pure invention. They "recycle, re-use, re-purpose, and remediate" (Leadbeater, 2014), and are continuously trying to find new uses for discarded, overlooked or wasted resource. This has led some to describe them as "inveterate tinkerers" (Leadbeater, 2014), and forms a key part of how indigenous knowledge emerges through the need to overcome a barrier or constraint. One thing which is strikingly evident from these examples is that there are these unlikely indigenous innovators – "positive deviants" (Marsh, Schroeder, Dearden, Sternin, & Sternin, 2004; Pascale, Sternin, & Sternin, 2010) (the Jugaadu in the study), "the outliers who succeed against all odds" (Pascale et al., 2010), who reframe challenges as opportunities, making constraints work for them and constantly adapt to an ever- changing environment by improvising to produce "satisficing" (Simon, 1972) solutions. These are "modern-day alchemists" (Radjou et al., 2012) who imaginatively transform adversity to their advantage by the practice of Jugaad. By reviewing many such examples, we further try to explain the important and necessary conditions/elements that we believe Jugaad is composed.

The Elements of Jugaad

ELEMENT	DESCRIPTION
Need & Creator	In case of Jugaad, the need and the creator for that need are necessarily one. This resonates with Murray (1938) who theorized need as something that impels an individual to act on that need.
Constraints	Two forms of constraints- external and internal. Two forms of constraints- external and internal thought to be possible. When we confront a barrier/constraint in a situation which prevents us from proceeding in our intended direction, but we do not want to be stopped, we deeply wish to act. This is a natural tendency of human beings – where some stop, others act.
"Esemplastic" Power ("Yog")	It is "a magical, synthetic power" (Coleridge,1817), which complements and bring together opposites. It is considered as an extemporaneous act of the mind.
Gestalt Image	The competence to be able to see the overall configuration/structure of the problem. Also, the Jugaadu searches for the clues for the conceptualization of the solution at times by either observing similar or related solutions existing.

Ingenuity ("Yukti")	A Jugaadu's formula of bringing disparate resources in a union that allows him/her to alter, process, and reconfigure the matter that surrounds him/her. Jugaadus generate and use ingenuity to control the implementation of energy to orchestrate the matter in their local environment (including materials and people) in some unique modus operandi with confidence that it will lead to problems resolution.
Resourcefulness	A mindset, defined as an ability and willingness to recognize and apply the available means at hand to alternative usage at times to address the problems that the person considers relevant in an unconventional manner.
Local (Indigenous) Knowledge	the knowledge that he/she has expanded over some time and continue to develop.
Improvised Artefact	A contraption
Time	to be considered as "in short time" rather than "short term."

The interplay of Jugaad Elements

Based on the content analysis of approximately 20 examples (including the ones mentioned), the elements were identified, and it was understood how the interplay of elements lead to a Jugaad solution. In the figure, we see how the elements mentioned above interact with each other.

In the figure, we see that there is a constant tussle between the need and the constraints, i.e., there is constant pressure on the need to escape from the force applied by the constraints. In other words, need is constrained by the lack of resources, lack of available mainstream solution, and other scarcity existing external to the jugaadu. Now, since the jugaadu in his local context within the boundary of the limitations/constraints have a certain freedom to operate and experiment, also along with his local knowledge starts thinking of alternatives. The moment he starts thinking of the alternatives the freedom and local knowledge helps in identifying a path or passage to escape from that pressure situation. It is a pressure situation also because this is a time-dependent need, one which the jugaadu cannot postpone for long. The moment the path is shaped by the local knowledge, jugaadu sees an opportunity to escape and work out an alternative solution. In the process of thinking the alternatives the Jugaadu's Esemplastic power of imagination which complements and bring together opposites in the form of a union leads to the generation of a gestalt image. The gestalt image created relates to "wholeness" – getting a complete big picture (like in the case of the automobile example where the jugaadu looks for something like a tractor) without focusing on the specific components. The jugaadu focuses on understanding the functionality of the different available parts or pieces in relation to the gestalt image of what is desired. Once the union is understood the local knowledge and the Esemplastic power helps in generation of Yukti – the formula which when applied in practice will bring disparate elements together. Now, the jugaadu uses his/her analogical thinking to put available resources and the needed resources to alternative usage by changing their functionality; it is like saying that a chair which was meant for sitting is now being used as a ladder and not for the function of sitting. Along with the Yukti and resource complementarity, an improvised artifact is achieved which is satisficing for the jugaadu. The artefact is the result of the improvisation that takes place when the design and execution of novel activities unite.

The following diagram explains the process of jugaad and its key elements.

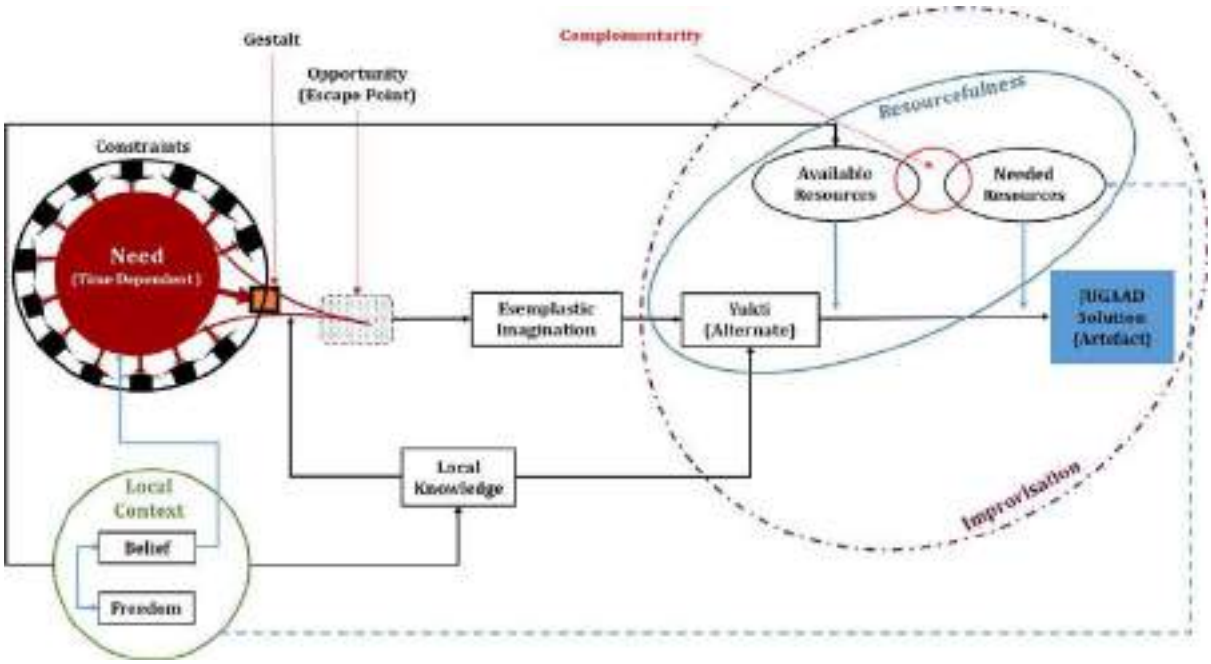

Figure 1, Interplay of Jugaad Elements

Another key element here is frugality – by need, not by choice. A common characteristic of the low income and poor group in developing countries like India is that of irregular income flows, which blocks them from getting involved in regular consumption or investments. This is particularly noticeable in situations where, e.g., a key piece of technology, such as farming or infrastructure equipment, breaks down without there being sufficient capital to replace it. We might note that researchers such as Yongnian (2004) has emphasized the specifics characteristics of Indian culture, including diversity, and this may be of some importance here. Indian culture is an amalgam of both indigenous cultures and several outside ones, cultures brought by traders, invaders, and colonizers. This has led to a contemporary Indian meta-culture which is highly diverse (Yongnian, 2004). Important to note here is that innovation studies, as well as the more popular discourse on the matter, always postulate a positive link between cultural diversity and innovation. Diversity is claimed to increase both the capacity for divergent thinking, a broader input of ideas and insights by way of having multiple perspectives on an issue or problem, and an improved scope for robust critical evaluation, leading to enhanced and more effective decision-making and problem- solving (Hennessey & Amabile, 1998; Bassett-Jones, 2005; Ozbilgin & Tatli, 2008).

Jugaad, this expedient contrivance, has in the literature on it been referred to in numerous ways. It has been called "creative improvisation" (Krishnan, 2010) or "making do" (Tully, 2011), as well as a mostly "makeshift arrangement" (Gupta, 2013). In their popular management book, Radjou, Prabhu, & Ahuja (2012) refer to jugaad as "the gutsy art of overcoming harsh constraints by improvising an effective solution using limited resources." It is also termed as an "improvisational approach of solving problems of self or others' in a creative way, at a low cost, in a short amount of time, and without serious taxonomy or discipline" (Brem & Wolfram, 2014). There is thus a malleability in the term and its usage. As a concept, it can be "reconfiguring materialities to overcome obstacles and find solutions" (Sekhsaria, 2013). Prahalad & Mashelkar (2010) describe this same phenomenon as the one of "developing alternatives, improvisations, and make-dos to overcome a lack of resources and solve seemingly insoluble problems." They, however, completely dismiss the term "jugaad" for what they call "Gandhian innovation" (Prahalad & Mashelkar, 2010) due to an assumed connotation of low quality. However, Vijay Mahajan of Basix, an Indian social entrepreneur refers to jugaad as the ability "to manage somehow, in spite of lack of resources" and argued that "the spirit of Jugaad has enabled the Indian businessman to survive and get by" in an economy primarily beleaguered by numerous controls and thwarted by lack of larger purchasing power (Mello, 2014; Cappelli, Singh, Singh, & Useem, 2010).

Regardless of the exact definition one prefers, jugaad is a term used for a complex group of creative and innovative behaviors in a situation with severely restricted resources, more specifically such rooted in the lived experiences of India, in particular amongst the rural poor. In this sense, jugaad can be understood as an indigenous knowledge system, a way to use innovation for survival in a situation defined by destitution. This

latter aspect is of course not unique to India, which has led to the emergence of a parallel term, namely "frugal innovation" (Brem & Ivens, 2013; Fukuda & Watanabe, 2011; Mukherjee, 2012; Radjou & Prabhu, 2013; Rao, 2013; Tiwari & Herstatt, 2012; Zeschky, Widenmayer, & Gassmann, 2011). Such forms of frugal ingenuity unsurprisingly exist in most if not all societies/communities with a poor populace with highly limited resources. We, however, argue that whilst jugaad can be understood as a form of frugal innovation, it is also a unique form of a local innovation culture, defined by its socio- cultural context and a knowledge system onto itself – which is why it in India has been afforded a special place and vernacular. This can, for instance, be seen in the social network of the jugaadu, who are not merely innovators that work with restricted resources, but a learning community (Wenger, 1998; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). As new forms of jugaad are developed, these are shared and re- deployed, and often adapted to other local conditions. Rather than merely seeing this as a specific form of cheap innovation, it could better be understood as a locally embedded set of practices and practitioners, one that can only be fully understood in the social and cultural context it emerges in.

That, however, is not how it has been received in global management thinking, nor the way it's been presented in business literature. For whilst one could argue against our interpretation of jugaad as separate from other forms of frugal innovation – or at least state that many other local forms of frugal innovation might be described in a similar manner – the fact is that innovation thinking has also presented jugaad as a separate phenomenon, albeit for very different reasons. In popular business books and the likes, jugaad has been used as a specific example, but not necessarily out of care for its cultural embeddedness. Instead, it had been co-opted as a tool for Western management thinking, and it is to this co-optation we shall now turn.

The Colonization of Jugaad

As previously indicated, innovation studies have tended to focus on Western corporations and Western notions of what constitutes innovation. This is now gradually changing to include nations such as India, China, and Brazil, as well as African countries (Petrick & Juntiwasarakij, 2011). This is driven by the growing significance of developing markets and visible in the marked increase in the literature on innovation in and from emerging markets (see Govindarajan, 2011; Hart & Christensen, 2002; Jana, 2009; Saraf, 2009). To some, this is a welcome turn away from Euro- or Americentrism, where the attention paid to innovation from rural areas in India is a way to give voice to the previously voiceless.

However, this is not the only interpretation. As previously indicated, the move to turn systems such as, e.g. jugaad into lessons for Western capitalism contains numerous problems. We will here highlight three such; a) the tendency for exoticization, b) the exploitative logic inherent in commoditizing indigenous knowledge systems, and c) the re-establishment of Western power. All three are central issues highlighted in postcolonial theory, and their inclusion here shows the key logics of colonialism – the marginalization of the non-Western Other, a process of exploitation, and the upkeep of existing and historical power-structures. We shall in the following discuss each in turn and conclude by discussing the implications for innovation studies and innovation thinking.

Exoticism and the Jugaadu

Let us return now to a few of the comments we included when introducing the concept of jugaad. We pointed out that in the existing literature, the jugaadu had been referred to by terms such as an "modern-day alchemists" (Radjou, Prabhu, & Ahuja, 2012). Whilst claims such as these can be read as non-disparaging or even lauding, they still work to present Indian innovation as something Other, something that the Western innovation researcher (or manager) should view as different and exotic. As Edward Said started to point out in his influential Orientalism (1978), there has in Western scholarship been a distinct tendency to present Eastern cultures as mysterious and exotic, different from the assumedly well-ordered West.

In the presentation of jugaad, as well as other forms of frugal innovation (Soni & Krishnan, 2014), this exoticization is in full force. Whereas Western innovators may be described as being brilliant or mavericks, their capacity for innovation is still presented as following logically from their innate genius. When non-Western innovators, particularly such who engage in innovation with scarce resources or come from a deprived background, are presented it is chiefly to marvel at the very fact that they have been able to innovate at all. Consider for instance the many ways in which Indian surgeons have managed to replace costly equipment such as Raney clip with paper clips or polypropylene mesh with mosquito net – both cases that have been highlighted in Western media. Whilst such substitutions are indeed clever; they do not

necessarily differ all that much from, e.g. the practice of wartime surgery. However, specifically, because they are done in India, and can be explained as part of some mysterious Easter knowledge – such as jugaad.

Here the reader might wonder whether we're not doing the same thing, exoticizing jugaad by naming it as a special case of frugal innovation. Such criticisms have value, but as we've previously stated, we have desired to understand jugaad not as an exotic, 'different' practice, but as a culturally embedded form of innovation that needs to be understood in context, not as a chamber of curiosities for Western readers of management literature. This as what the literature achieves by presenting the jugaadu in such a manner is to recast them as a modern version of the myth of the noble savage (Ellingson, 2000), where, e.g. the lack of education or even literacy is then marveled. Through this, the jugaadu are in effect presented to the Western innovation canon not as unique and worthwhile in themselves, but through their difference to an assumed default innovator. They are often poor, often rural, often uneducated, maybe even illiterate. In other words, they are represented as Other, exotic and oriental. Through this, they are presented as being defined specifically by what they are not, by their lack. They are "frugal innovators," and thus in a manner of speaking only innovators in this one, limited degree, while the West can still lay claim to being the default. They are represented as quirky marginalia, rather than a community and a culture.

Still, they at the same time represent strange hybridity, as this has been theorized in postcolonial theory by, e.g. Homi Bhabha (1994), in that this culturally specific learning community, native to India and specifically rural India, is also turned into part of something greater. By being turned into "innovation," and more than this, "innovation" that is relevant to the Western world, jugaad is translated into a hybrid form of knowledge, both local in practice and globally accessible through the wonders of international business literature, both inherently Indian and taught internationally through Harvard Business Review. It is to this translation we will now turn.

The Commodification of Indigenous Knowledge Systems

It is no wonder that jugaad, and similar forms of innovation, has been profiled in both the popular business literature and the international business press. Popular management thinking always borrowed heavily from whatever source it could, providing us with gems such as "Leadership Secrets of Attila the Hun" (Roberts, 1985) and books on learning innovation from gangsters (Clay & Phillips, 2015). That said, jugaad and the way it has been commodified affords us the possibility to interpret this through a postcolonial lens.

The most popular and well-known book on jugaad is Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth., published by Jossey-Bass in 2012 and written by Navi Radjou, Jaideep Prabhu, and Simone Ahuja. The two first authors also wrote a follow-up book, Frugal Innovation: How To Do More With Less, which was published by Economist Books in 2015. Particularly Navi Radjou has, on the back of this, become something of a management guru, and is active on the international speaking circuit. He is however not the only such to have tilled this specific field.

In addition to the already mentioned C. K. Prahalad, who focused on the wretched of the Earth as a potential consumer market, Vijay Govindarajan and Chris Trimble have published on themes remarkably jugaad-like, specifically in their 2012 book Reverse Innovation: Create Far From Home, Win Everywhere, which was published by Harvard Business School Press. To this comes any number of less known management thinkers and consultants who have addressed and/or sold similar ideas and concepts.

All of the aforementioned books on jugaad/frugal/reverse innovation, including C. K. Prahalad's have been very successful in the market. Further, they have afforded their authors lucrative speaking assignments, consulting jobs and similar. They, in effect, represent a process through which management thinkers have been able to translate the often-desperate hacks done by rural Indians trying to stave off starvation or worse into personal, commercial success. They have done this simply by stating that for instance, jugaad can teach valuable innovation lessons to major, often Western corporations, and then charged for these lessons. Judging by the success of only the books themselves (Jugaad Innovation has sold more than 100.000 copies according to its website), they have generated considerable value, one most likely multiplied by a considerable number through things such as speaking and consulting fees. The likelihood that any of this value has benefited the jugaadu is minuscule.

The books, as well as the publications spun off from them, have been published by global publishing houses with intimate connections to the Western corporate world. It is notable but not surprising that most of the authors referred to above are of Indian descent or have at least some Indian heritage. Most but not all work in

academia, mainly at major US or UK business schools, all of them consult. Few if any of them seem to represent the Indian rural poor. None of this would be very surprising from a postcolonial perspective.

Here, global publishing houses represent both a form of conceptual colonialism and a simple corporate such. By stint of their size, they are able to exert a major influence on contemporary business discourse, globally. They depend on authors and academics to act as conduits in this; a position sometimes referred to with the moniker "thought leader." From the perspective of a publisher, rural innovation in India is only valuable if packaged and represented in a way to appeal to the global corporate world. Here, however, the issue of legitimacy comes in. As so often under colonialism, an interlocutor is helpful, and well-to-do Indian thought leaders can be excellent such.

What should be remembered here, however, is the complex politics of the dispossessed. In books such as the ones referred to above, wealthy if at times Indian individuals with deep connections in Western institutions present themselves as speaking for a group that might, using Spivak's (and previously Gramsci's) famous term, be called "subaltern" (Spivak, 1988). Here, however, it is not the jugaadu themselves who are given a voice. Rather, they are turned into "innovators" to fit in with a Western perspective, and their stories then sold and retold to titillate Western business-men. Spivak, among other postcolonial theorists, challenged the right to do so, stating that there is no way in which such ethnocentric appropriation could truly give voice to the heterogenous body politic which is the struggling, rural poor. Here we need to acknowledge that we, the authors, cannot do so either, and only note how what may seem like paying attention to innovation in the developing world may also be a form of exploitation, one ultimately denying the jugaadu their voice.

Re-establishing Western Power

The overarching theme in much of postcolonial studies is the unfolding of how power is continuously re-established in a manner that positions the hegemony of the Western world. One might think that books that set out to glorify and valorize forms of innovation in a markedly different part of the world would not fall into this trap, but alas. Consider the following excerpt from Jugaad Innovation:

> *During the eighteenth century, homes in the United States were primarily heated by inefficient fireplaces that spewed smoke as much of the heat they generated escaped up the chimney. They were also hazardous, as their sparks could trigger fires that quickly devoured wood-built homes. Franklin's jugaad innovation to tackle this problem was a new type of stove with a simple hooded enclosure in the front and an airbox in the rear. The new stove and its reconfiguration of the flues enabled a more efficient fire, one that consumed 75 percent less wood and generated twice as much heat. The Franklin stove delivered ''more with less.''(Radjou, Prabhu, & Ahuja, 2012, pg. 7)*

Yes, no more than seven pages into the book ostensibly about the jugaadu we learn that in fact, long before they got the idea, an American – and not just any American, but one of the most foundational Americans of all – had in fact beaten them to it. Reading somewhat further we learn that:

> *America's founding fathers, as well its creative farmers, industrial pioneers, and scientific explorers in the nineteenth and early twentieth centuries—from Ben Franklin to Cyrus McCormick to the Wright brothers—were historic practitioners of jugaad in the West. (Radjou, Prabhu, & Ahuja, 2012, pg. 7)*

In other words, jugaad is presented not so much as indigenous knowledge or an ingenious innovation culture in India, but rather as a somehow forgotten path of innovation that the West has had access to all along. The jugaadu, then, is presented not so much as originators or creators, but more like bit players reminding America of the innovative powers it has held.

This is a variation of the theme of the noble savage, where the jugaadu is merely a conduit to a history of innovation, harbingers of a simpler time. Through a remarkable feat of rhetoric, the jugaadu get to see their lived experienced colonized not once but twice – first by business authors, then by US history. Something very similar can be found in Govindarajan & Trimble (2012), where the notion of learning from, e.g. rural India is primarily in order to shake major (US) companies out of their creative doldrums and to enable them to "win everywhere," in what might be called a Trumpian innovation policy.

And so, the postcolonial loop gets closed. First by exoticizing, then by exploiting, and lastly by pointing out that the true value still lies with the colonial power.

The Silences of Innovation

Our aim here, as previously stated, has not been to present a full postcolonial critique of a contemporary innovation discourse, as such a critique would easily fill a book. Rather, what we've attempted to analyze is the manner in which one form of culturally embedded innovation, jugaad, has been turned into fodder for Western innovation punditry, and what might lurk behind the superficially fawning presentation thereof.

We have done this in order to note how notions of innovation can become colonized and exploited and to highlight the manner in which popular innovation discourse continuously seeks out new things to commodify. Our aim has not been to claim that jugaad would be a unique case, as it is not. It is merely a practical case through which to highlight a more general problem, one where all forms of knowledge systems or learning communities are in danger of being turned into a bestselling innovation book.

Neither are we claiming that the contemporary innovation discourse solely needs postcolonial critique. Rather, we see that there is a need for multiple critiques regarding the manner in which innovation punditry and the attendant field of innovation studies chooses its questions and its examples. This would require an ideological critique of various strands, including but not limited to feminist and postcolonial theorizations.

In the end, our key point is as follows: The politics of innovation studies and innovation punditry needs to be analyzed, in depth. At the moment, we're seeing increased interest in learning from emerging markets, but this learning isn't necessarily as unproblematic or "win-win" as particularly the popular literature would have it. Rather, it can at worst be a form of colonization, of either the corporate or the conceptual variety. This also, in an odd twist to the tale, limits the innovation potential in the world. By seeing people like the jugaadu as valuable and worthwhile only if their indigenous knowledge systems can be translated to and utilized in a Western corporate logic, we risk missing deeper learnings about things such as intelligent re-use, circular economies, or simply understanding the deeper cultural meaning of innovation in context. As postcolonial theorists have long warned us about, in the hybridization process much can be lost, and in the presence of too many pundits speaking in their name, the subalterns may be quieted for good.

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Research Perspectives IN THE ERA OF Transformations

Decolonising Namibian Arts and Design through Improvisation

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The research investigates the role of service design and improvisation as decolonising practice. It is based on case study research with a focus group consisting of Namibian artists, designers, artisans and arts organisations who participated in artistic and cultural exchange activities of the Art South-South Trust (ASST), a start-up Namibian not for profit (NFP) organisation. The goal of ASST was to increase visibility of the focus group members, enable global exposure and create an arena for multi-vocality. The paper creates a practical framework for decolonising practices in Namibian arts and design by drawing on reflective practice to analyse the activities of ASST alongside interview data collected from Namibian and Australian partner organisations and participants in the program. Critical thinking is used to evaluate the impact of realised activities and processes both in situ in Namibia and in exchange in Australia. This paper explores practices that can enable decolonising processes in Namibian arts and design spheres.

Keywords: Namibia, decolonising design, service design, improvisation

Introduction

The role of service design in the Namibian not for profit arts and design sectors received little attention in scholarly research. Notable studies, nevertheless, include the PhD thesis of Miettinen (2007) that investigated the role of culturally-focused service design in Namibian craft communities and tourism services, and Sarantou's (2014) PhD thesis, which mapped Namibian art and design through a postcolonial lens with a focus on narrative in practice, marketing and sustainability. In post-independent Namibia the art and design "world" (Becker, 1976, p.123) continues to grow and reinvent itself despite the country's three periods of colonisation that caused communities to live in isolation prior to independence in 1990 (Mans, 2003; Melber, 2003).

Namibian arts and design practices are influenced by two systems of knowledge (Palumbo, 2005). One knowledge system derived from the African cultures who are indigenous to Namibia, as well as those who inhabited the area before colonialism. The other system of knowledge is based on Western knowledge systems that infiltrated Namibia through the influence of missionaries and after 1894, colonisation (Walker, 2002). Both systems have contributed to bold innovations and reinventions, evidenced in areas such as architecture and cardboard printing (Palumbo, 2005). Therefore, the blurring of these systems occurred over many decades, but especially after the country's independence, the reinvention of Namibian identities inspired artistic creation, especially in art and design genres such as fashion, jewellery and textile design (Sarantou, 2014).

Namibian artefact making is holistic and makers are not distanced from their making processes and environments, nor from the textilities of their raw materials. Rather, they are deeply involved in their

procedures, materials and social realities during making (Sarantou, 2014). That is why Namibian artists and designer-makers regularly draw on, and learn from improvised processes, because they are regularly confronted with design problems (Sarantou, 2018). In Namibian design communities, making techniques are guided by experimentation on the one hand and traditions on the other. The wide use of improvisatory practices confirm Montuori's (2008) argument that improvisation is a forward going process of making that is underpinned by experience, traditions and risk taking during experimentation. In Namibia, improvisation is often a response to pressing demands and notions of "having to do what needs to be done" (Sarantou, 2014, p. 251; Sarantou, 2018). Recognising the role of improvisation in the sustainable development of Namibian arts and design, and documenting and learning from Namibian arts and design practitioners, would open up opportunities for new service developments that are lacking in this world. Paying attention and value to the improvisatory practice as an important function within design thinking activity, and in a context with limited resources, can redirect discussions of limitations to that of innovation. This would shift the position of local artists and designers from the discussion on "development" into the sphere of innovation and resourcefulness.

Namibian arts and design is generally not well represented in Southern Africa, let alone in the Southern African region or internationally (Sarantou, 2014). Some organisations and a few projects attempted to represent Namibian artists and their works internationally, but their practices were usually short-lived and thus unsustainable (Sarantou, 2014). Additionally, unsustainable practices are followed to support arts and cultural institutions and artists and designers. For example, the total national funding awarded by the National Arts Council of Namibia to local artists and designers for the delivery of new projects and work in the 2017/2018 period equalled 3,172,962.64 Namibian Dollars (around 200,300.00 Euro) (Namibian Arts Council, 2018; New Era Live, 2017).

Due to the lack of strong and well-coordinated research as well as policy development and implementation on a national level, an approach is needed that explores the needs of suitable services for Namibian arts and design worlds. Opportunities offered through online services remain largely untapped, with only a few organisations, businesses and individuals utilising technologically enabled avenues for representing Namibian arts and design. Thus, new service approaches are needed for opportunities that will sustain this world. Instead of tackling the problem top-down, this paper seeks to explore different possibilities for new services based on Namibian local knowledge and culture.

The question this paper addresses is: "How can the sustainable participation of Namibian practitioners in arts and design be enabled?" and "What kind of design practices enable decolonising processes with local Namibian communities?" The paper seeks to explore these questions through a case study of ASST that has the vision to grow Namibian art worlds (Art South-South, 2014). The Trust implemented an arts and design exchange programme between Namibia and Australia (2013 – 2017). The programme included collaborations with several Namibian and Australian arts organisations to facilitate services with Namibian artists and designers, including exhibitions, sales of their work, participation in artist residencies and the facilitation of art workshops in urban and regional South Australia.

Since the establishment of ASST the Trust initiated successful services to Namibian artists and designers, including a cross-collaborative exchange program that focuses on exhibitions, workshops and product sales. Similar to most NFP organisations, ASST faces strong competition in increasingly volatile product and service markets with increasing competition for donors' funds (Austin, Stevenson & Wei-Skillern, 2006). The first section of the paper provides a theoretical framework, a description of the case study and the data collection and analysis, followed by a discussion on the key findings.

Theoretical considerations

Decolonising design

Decolonisation continues to be informed by postcolonial critique (Venn, 2006), which "takes for granted the argument that the forces that established the Western form of colonialism and imperialism continue to operate, often in altered forms, through mutations in local circumstances, and through different apparatuses" (p.3). As an oppositional standpoint theory, postcolonial critique seeks to question dominant narratives and relationships of power that exist in various overlapping social forms that are marked by gender and "communalist ethnic oppressions" (p. 3). Tlostanova (2017) posits that the "Western/Northern" subject "occupies a delocalised and disembodied vantage point that eliminates other possible ways to produce, transmit and represent knowledge" (p. 52). Decolonising practices therefore needs to induce alternative

knowledge systems and ways of knowing. Moreover, research is underpinned by colonial power structures. It is "one of the ways in which the underlying code of imperialism and colonialism is both regulated and realised" (Tuhiwai Smith, 1999, p. 7). Therefore, research itself needs decolonising practices for sustainable futures. Daniels (2011) highlights the challenges involved in research that is executed by the 'North' in research fields in the 'South' due to the dominant structures that underpin academic research. The problem is well-defined as the reliance on "partial and so-called objective knowledge [that frames] the research at the expense of silencing voices and submerging data" (p. 7). Among other methods, the role of research based on storytelling and interviewing have become important in postcolonial contexts as it provides avenues for giving a voice to the participants.

For this particular article, it is essential to mention that design innovation has been argued to inadvertently perpetuate colonial and imperialistic ways (Tunstall, 2013). Tunstall highlights how these issues are reflected within design innovation practices, such as a) the segregation of 'traditional craft' and 'modern design', therefore ignoring other intrinsic forms of design innovation among local communities; b) the perception that design thinking is "a progressive narrative of global salvation" and ignoring "alternative of thinking and knowing" (p.235); c) by venerating European, Euro-American, and Japanese design; and d) the way design innovation project outcomes most often still prototypes, "[limiting] the positive impact on communities" (Tunstall, 2013, p.235). The author advances that "designers in India and Africa have creatively responded to the challenges posed to their communities, often in connection with processes of imperialism, colonialism, and neocolonialism" (Tunstall, 2013, p.236). Thinking about decolonising design practices highlights the importance of the agency question, asks for change, rethinking, reconsiderations of dominant perceptions and narratives, and, ultimately, the rethinking of our existence (Tlostanova, 2017).

Furthermore, decolonising design deeply embeds the values of feminist and postcolonial theories into design practices. However, Raghuram et al. (2009) suggest that designers need the "recognition of postcolonial interaction" by leaving responsibility open to the multiple meanings that it may adopt in various contexts, spaces and places (p.1). This opens up the questions around agency and careful considerations need to be given regarding who takes responsibility, and for what. Responsibility, especially of local actions, should be approached with a focus on "interdependence and coexistence [by making] apparent the potential connections between responsibility, care and power, at a variety of scales" (Raghuram et al. 2009, p. 23). For example, Hamdi (2010) posits that responsibility for the implementation of development actions should remain with the communities.

Service design and improvisation

Service design has developed within the last two decades, so it is still viewed as an emerging area in design. Rytilahti et al. (2015) describes the brief history of service design originating within interaction design and cognitive psychology. The theoretical landscape of service design includes the areas of value co-creation, design research, user experience, learning and citizen engagement as core competence areas of service design (Ryhtilahti et al., 2015). The service design approach has been recognised in the area of interaction design (Holmlid, 2009), design policy preparation and implementation (Jäppinen & Miettinen, 2015), social innovation (Jegou & Manzini, 2008; Meroni & Sangiorgi, 2011) and business service experience design (Kukk, Leppiman & Pohjola, 2015). These developments lead to the versatile theoretical landscape of service design.

Service design is a strategic activity (Sangiorgi, 2012; Wetter-Edman, 2012) that helps develop and manage the service experience. The field has become a conceptual platform for holistic user-centric development work, in which both internal and external stakeholders of organisations are involved in the earliest phases of the design process (Miettinen & Koivisto, 2009; Miettinen, Rontti & Jeminen, 2014). As service design addresses projects in a holistic and user-centered manner, co-creation is also a fundamental aspect of the practice (Stickdorn et al., 2016); this is reflected through a multitude of methods used by professionals. Indeed, as put forward by Corubulo, Selloni and Seravalli (2018), the complex socio-technical contexts of designing services call for engaging and participative approaches that involve multiple stakeholders.

For instance, Participatory Service Design (PSD) can offer new models for improving local development for social innovation. It helps in considering economic development, policy development, strategic management, contextual understanding of the development setting, the sense of ownership and commitment when working with social design and innovation, and design that enables societal change (Miettinen, 2007). PSD manifests itself as a collaborative activity (Sanders & Stappers, 2008), in which power relations are carefully considered (Ehn, 2017) and the designer's role is facilitative (Howard & Melles, 2011). Thus, PSD can be an effective

medium both for marginalised communities to voice their stories and for members of the mainstream society to educate themselves about issues that are important for communities existing on the peripheries.

Furthermore, the role of improvisation in the development and performance of services is acknowledged (John, Grove & Fisk, 2006; Penin & Tonkinwise, 2009; Edvardsson, Haglund & Mattsson, 1995). Improvised outcomes, including services, are determined by a various set of choices made along the journey. Improvisation is 'embedded in the context' of the performative (Lewis & Piekut, 2016). This, it can realise, through action and reinventions, new user journeys. Improvisation offers exciting solutions to design challenges due to the unspecified process paths participants will embark on. Improvisation is 'path dependent', thus it can unfold in a myriad of ways and possibilities (Burrows & Reed 2016, p. 397). This is why improvisation is an increasingly popular action approach in service design user journey workshops and experiments when new services are developed with users and communities.

Again, improvisation is strongly associated with problem solving and acting in the 'now' or in a moment of time (Peters, 2009; Montuori, 2003; Nachmanovitch, 1990). In organisational theory the value of improvisation is recognised as a flexible, more informal approach that includes members of the organization in problem solving through acting in real time to develop strategies or structures (Ingram & Duggan, 2016). Thus, teams can explore real options, in real time. In doing so, participants are more likely to consider alternative and perhaps creative options as they draw on ideas that are usually unfamiliar at the time. Improvisation depends on the affordances in the environment (Richards, 2006, p. 381). This means that problem solvers can only work in the present moment with the options available in their specific environment.

Sennet (2008) briefly discusses improvisation as an avenue for makers to 'mark their presence' in a place or space, whilst it also involves 'skills that can be developed and improved', allowing people to better negotiate borders and edges (p. 237). Richards (2016) links improvisation to experimenting, explaining that improvised experiments afford lessons and stimulates learning. Similar to Sarantou's (2014; 2018) argument, Richards (2016) illustrates the role of improvisation in shifting cultivation in Sierra Leone. He argues that improvisation is contrasted with organisation and planning, but the purpose of improvisation is often overlooked, which is to bring together and solve incompatibilities and unfamiliarities. Consequently it is associated with long term survival strategies (Richards, 2016) and responses to pressing demands (Sarantou, 2014). For these reasons, the paper suggests that improvisation is a promising decolonising method to be explored in design processes, as it can induce alternative knowledge systems, plural ways of knowing and learning, in addition to enabling the negotiation of peripheries.

Case study method, data collection and analysis

The purpose of a case study is to establish rich and in-depth understanding of phenomena that are usually ill-defined in a real-world context (Yin, 1981; Yin, 2017). This method can enable better understanding of the needs of research participants and their organisations (Flyvbjerg, 2006). Case study methodology is based on investigating related situations – the differences between "what was planned and what actually occurred" (Noor, 2008, p. 1602), thus the paper seeks to gain insights into how the activities of ASST were experienced, which may inform decolonising design practices. The case study will consider how the user experiences of the research participants can enable sustainable services that drive participation in arts and design in postcolonial contexts. Primary data was collected from interviews while secondary data was retrieved from desktop search. The use of interviews enabled an analysis of the participants' expectations and enabling the Trust to gain an understanding of their experiences. The primary data was collected in two phases from two different focus groups. The selection of these two groups was motivated by the current collaboration of the Trust with Namibian and Australian arts organisations in facilitating artists from both countries. Data collection tools used were semi-structured interviews focusing on the perceptions, needs, expectations and past experiences. The participants and the researcher were geographically dispersed between Australia, Africa and Europe, resulting in the need to conduct interviews via mobile phone and the internet, lasting 20 to 40 minutes per interview.

The required ethical considerations for seeking appropriate consent and de-identification were followed as the research was conducted in a postcolonial context. Two focus groups were interviewed. The first focus group consisted of five participants at management level of various organisations, such as Trustees, gallery or program managers from different arts organisations that collaborated with the Trust. Thus, one participant from all the Trust's partner organisations between 2013 and 2015 contributed to the research. The second focus group consisted of ten participants, including past and present beneficiaries of the Trust from various demographic groups. The sample size represents more than 70 percent of the Trust's total beneficiaries since

its inception, but this number is not representative of the Namibian arts and design world. Interpretation of the qualitative data from the interviews were used to develop theme-oriented readings of the data. This generated complementary responses from participants, the data, which were treated simultaneously as a resource and a topic for exploration (Hammersley & Atkinson, 2007). Thus, systematic open coding (Burnard, 1991; Berg, 1989) was employed to identify recurring themes and patterns within the data.

Findings focus group 1: Need for awareness and open dialogue

Organisations that supported ASST usually negotiated three complex cultural market segments that includes a) artists, designers and groups; b) donor and partner organisations; and c) the wider audiences. The views of the audiences were excluded from this research as ASST's services are rather targeted towards Namibian and Australian participants and organisations. Participants from focus group one understood the role of ASST to provide opportunities for Namibian participants in facilitating cultural collaboration, artist residencies, exchange and product sales. Two participants in this group believe that the role of ASST depends on its future vision. Collaboration opportunities included the facilitation of art workshops, residencies, exhibitions, skills training workshops and participation in art prizes, markets and fairs. This focus group further understood the role ASST as to assists Australian and Namibian based organisations to facilitate participants' exchanges between both countries while retaining both regional and urban foci. Services that were valued and needs identified by partner organisations were the consultative services received such as the identification of participants for selection in residencies and exchanges. One participant from focus group two said: "I would have no idea that such talented participants existed in Namibia if it wasn't through the Trust and I also would have no idea where to look for these participants" (participant, Port Augusta, 2016).

The motivations for participation were that ASST succeeded in mobilising funding opportunities for activities and programmes, and continued to assist participants with art and design services related to exposure. Additional motivation for collaboration was the research and publication focus of ASST as well as more practical skills development, training and consultation services. A participant from a partner organisation in Australia mentioned that "benefits for regional galleries and participants are huge as they are often inward focussed and lack broader and international exposure and the cultural collaborations offer inspiring experiences that motivate participants to explore new ideas, techniques and experiences to grow professionally" (participant, Port Augusta, 2016). The participant added that "the Trust achieves outcomes despite limited funding which is a creative process in itself as the Trust's management team has attitudes that are conducive to creative problem solving" (participant, Port Augusta, 2016).

Expectations of ASST from focus group one, the arts and design organisations, were to uphold communication, to share costs of activities, provide advice and guidance to both Namibian and Australian partner organisations in areas of nominating suitable participants for collaborations and exchanges. Additional expectations of ASST were to enable the participants to grow through the facilitation of artist exchanges, residencies, artist talks, workshops, skills development, learning and professional development opportunities, including gallery visits and to liaise with the Namibian Ministry of Education, Art and Culture (MOEAC) to design creative strategies and SME development. Another participant from an Australian partner organisation commented that "[their] expectations are to enter into open dialogue so that there are honest selection processes so that [they] can find common goals" (participant, Adelaide, 2016). This participant also commented that the "de-motivators would be a lack of open discussion" (participant, Adelaide, 2016).

Moreover, a participant from a Namibian partner organisations suggested that the "ASST has expertise in and a focus on Namibian Indigenous knowledge in arts and design and this potential should be harnessed to market Indigenous arts, create employment and uplift Indigenous communities" (participant, Windhoek, 2016). Another argued that "benefitting participants should be more proactive in delivering informative talks, sharing information about their residencies and experiences – this should be a requirement of the Trust" (participant, Whyalla, 2016). Two others suggested that the Trust be more involved in consultancy and research activities as it will benefit the larger Namibian art world and attract attention from donor organisations. One added that "collaboration with academic institutions is valuable as it steers away from purely artist-focussed activities, moving the focus to regional and marginal communities instead" (participant, Whyalla, 2016).

A participant from Namibia identified various needs of the Namibian government related to the arts, such as providing expertise to educate, arts curriculum development for Namibian schools and consultancy that would lead to growing Namibian urban and regional arts communities. The participant mentioned that there is a

need for manpower and experts that have program knowledge to provide quality consultancy to individual participants, craftspeople, designers and art, craft and design groups, businesses and organisations in order to sustainably grow Namibian art" (participant, Windhoek, 2016). Additional suggestions were to engage with MEAC to develop materials and publications for schools and the wider public to stimulate audience participation in the arts in Namibia. Although these are valid needs that were identified, some of these expectations were unrealistic considering ASST is a small private Trust with limited resources.

Findings focus group 2: Plural identities and textured worlds

The data collected from this focus group illustrated the complex social, economic and cultural environments in which the participants live and function. The participants from focus group two were from various age groups - later twenties to early sixties. They earned monthly incomes that varied between less than NAD 5,000 and more than NAD 25,000. Six participants generate (mostly their primary) income through art teaching and lecturing, one worked as an arts administrator and another as an arts and design proprietor, while two worked in fields that are not related to the arts. All participants use the internet more than five times per day, while only one use the internet more than five times per week. The participants access the internet through their personal and work computers, mobile phones and tablets, which indicates their active connection to local, regional and global digital and social networks. Most work from personal computers and mobile phones while just over half of the group use work computers. Only two used tablets.

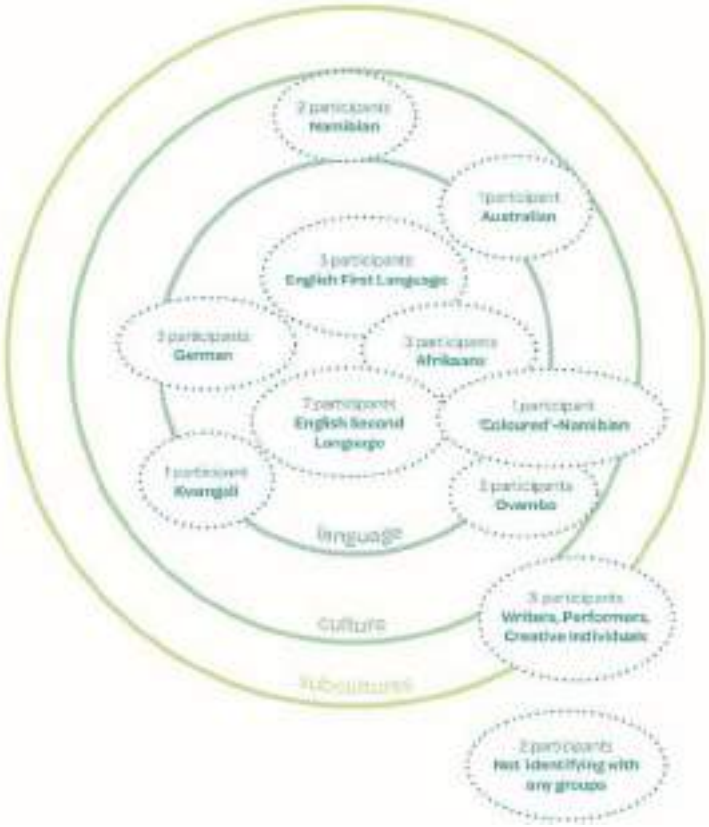

Figure 1: The fluid and plural cultural landscapes of focus group two. source: Beaulé and Sarantou 2019

The participants had multiple fluid and layered creative and cultural identities and roles (Figure 1). Only ten participants were interviewed, but their identities were mixed and overlapping. For example, seven participants identified as artists, while six identified as designers, four as makers, one as an artisan and another as a painter. Participants identify with diverse and hybrid cultural backgrounds. The ones mentioned were Namibian, Ovambo, Kavango, 'Coloured'-Namibian, English-Namibian and German. Two participants preferred not to identify with any cultural group or subgroup. Only three participants use English as their first languages and others used were Oshivambo, Kwangali, Afrikaans and German. Figure 1 illustrates the interconnected, plural and layered identity formations of the participants.

Expectations of focus group two were to promote Namibian artists and designers globally through sustainable links with art and design organisations, providing feedback to participants and the broadening of knowledge and experiences. Sustained engagement with international markets, efficient, yet flexible and agile management protocols were suggested. A Namibian participant suggested that "it will be great if contracts are in place that address the selling, commissioning, shipping, administrative and taxing arrangements of the work" (participant, Windhoek, 2016). An Australian participant expressed expectations: "The opportunity to work alongside international participants, to build an understanding of their cultural backgrounds, including artwork which stems from these cultural backgrounds" (participant, Adelaide, 2016).

The motivations for participation of group two were the promotional opportunities that ASST globally through sustainable networks with arts organisations. ASST provides feedback and new networks to participants, thus broadening their knowledge and experiences, while it also engages with and educates Australian audiences about Namibian arts and design. A Namibian participant identified as demotivating "too demanding programs, and a loss of energy and drive when one person gets too overburdened, and ASST coming up with ideas and projects that do not materialise" (participant, Windhoek, 2016).

Figure 2: Namibian artist Petrus Amuthenu demonstrating his cardboard printing technique to South Australian Aboriginal Artist Sherrie Jones during a cultural exchange workshop at Arts Ceduna in South Australia. The initiative was supported by ASST, Country Arts SA, Streaky Bay Regional Council and Streaky Bay Tourism. source: Sarantou 2016

Needs, wishes and ambitions of the Namibian artists and designers were identified, especially those related to the recognition and exploration of plural and changing identities of the artists and designers. More fundamental needs included the fostering of an understanding for the work and artists and designers, having respect and stay true to the vision of the artists and designers and not trying to change their identities or those of their works. Participants indicated obvious needs that relate to good working relationships, getting the art and design "out there" through good management and marketing practices. Important needs also included the artists and designers in the processes, providing feedback, be reliable and flexible and assist with digital-based exposure that compliments the work. The participants pronounced resistance against the usual service systems that only focus on profits.

The needed services identified by the participants were the marketing and selling of work, the availability of platforms to showcase work, and assistance with the development of promotional tools. The participants acknowledged that arts and design services require expert knowledge as they are not regularly consumed products. The participants also noted that the services should be as creative as the products. All participants think that cultural exchange is a potential service that enables exposure, the sharing of new ideas, knowledge, techniques and approaches, next to fringe benefits that may include travelling, product sales, opportunities to teach and conduct training workshops (Figure 2). Knowledge is shared back in the home country with other artists and designers, which prevents isolation and encourages cross pollination of best practices.

Benefits of working via a service agents included the reaching and connection with wider audiences and networks, thus growing marketing platforms. The challenges of employing a service agent would be that participants are more removed from selling process and this may impact negatively on the product, whilst service approaches that are limited to a profit focus were thought to be unsuitable. The negative perceptions of arts and design services (e.g. marketing) were that they are a nuisance, taking up too much mental space and energy that should be invested in making/producing arts and design, while they are time consuming and expensive to develop. Participants lacked the expertise to promote themselves successfully, because art and design is often personal. Moreover, Namibian markets are limited due the country's relative small population, thus participants are frustrated by the lack of arts and design services in the country. It was widely acknowledged that Namibian markets are often informal, as wide cohort of Namibian artists and designers do not take business very seriously.

Discussion

The partner organisation that collaborated with the Trust, highlighted the need for awareness of Namibian arts and design that can be supported by timely, continuing and open discussion. Two of the authors, who are experienced in working with this world, can report that this is often not the case. Communication and open discussions within the Namibian arts and design world falls short between institutions and individuals due to the power structures. One of the primary shortcomings of this world are the limited funding and representational opportunities for artists and designers. With the National Arts Council of Namibia (NACN) currently being the primary funding body of all art forms, and considering the limitations to national funding, many individuals are demotivated to engage in open discourse or participation in the arts. For example, artists report that they are not participating in the annual NACN funding round as they lack information about the funding and find the application process overwhelming and tedious (Shapwanale, 2014). Again, the authors, who are experienced and have been successful in seeking arts funding, can report that, compared to funding application procedures in Europe and Australia, those of the NACN match in timeliness and have similar requirements.

Many additional power structures play a role in this world, and apart from the more obvious struggles with Namibia's social, political and economic realities, other challenges relate to institutional politics and gatekeeping in the arts that cannot be denied. At government level the drive for policy implementation and deep insights into the realities of the Namibian arts and design world lacks. For example, research has illustrated the weakness of the Namibian arts and design market due to a small population and an overflow of foreign artefacts (Sarantou, 2014). However, in performance agreement between the Namibian government and the MOEAC, arts and culture is only promoted nationally and regionally, but not internationally (Ministry of Education, Arts and Culture, 2017). Such inward-looking approaches stifle new and sustainable development opportunities for this world and that of Namibian artists and designers who mostly are marginalised economically and socially. The ongoing lack of knowledge about the talent that Namibian artists and designers have, as the data of this paper illustrates, further undermines the sustainability of this world and its

practitioners. It is thus clear that the Namibian arts and design world, especially at institutional level, is in need of structural change in order to meet the needs of its local users. The data collected in the case study demonstrates an opportunity to use service design as a catalyst for sustainable development of creative industries through improved services that enable viable economic and social models through decolonising methodologies.

The Namibian artists and designers had to manage their multiple identities as they are relatively transcendent, fluid, overlapping and context sensitive (Lawler, 2008; Appiah, 2007). They negotiate and make sense of their identities through complex processes, such as combining and changing identities, which are not necessarily clear-cut and smooth. Many have to navigate their life realities that are continuously influenced by postcolonial histories (Sarantou, 2014). Many individuals negotiate contradicting identities and roles, since they are formed between, rather than within persons (Lawler, 2008). The Namibian artists and designers are immersed in specific social, economic and environmental contexts that are influenced by institutional power structures and the sad reality of social stratification, alas the result of class rather than race-based segregation after the abandoning of the Apartheid regime in Namibia (Winterfeldt, 2010). The participants live their lives as they unfold into the myriad pathways of their textured worlds and art and design practices.

Unsurprisingly, Namibian artists and designers are well-connected to the internet with mobile phones being the most popular tool for having access. Due to the usual lack of fast and efficient shifts in institutional and organisational life, the internet and digital participation offers new opportunities to this world. The threats posed by the internet to privacy and copyright issues are widely acknowledged, yet in the stifling institutional environment of this world, Namibian artists need to rely more on their own resourcefulness and development. It is here that improvisation, co-creation and service design offer new opportunities to this world. New digitally-enabled services can be developed reasonably inexpensively with the help of the internet through avenues such as social media, blogs, websites and sales platforms. Moreover, improvisation opens the door for processes to include different ways of knowing and being, through the involvement of multiple stakeholders and users. This will enable the shift from colonised minds and bodies (Nandy, 1989) into decolonising practices into the sphere of innovation and resourcefulness. Important to mention, however, is that Namibian digital sales platforms that currently exist are undermined by the power structures associated with the Namibian shipping industries that are working predominantly in sync with the South African transport ecosystem. Thus, the costs for international consumers of Namibian art and design is phenomenal. For example, a printed work with a price tag of NAD 1500.00 will have a shipping cost of NAD 2800.00 (START Art Gallery, 2019). These cost structures can be verified by the authors who dealt extensively with the shipping of Namibian artefacts. Here is one example of a challenge that may shift from having a negative impact to a new opportunity for participatory service design and improvisation to solve incompatibilities and enable long term survival strategies (Richards, 2016).

The paper presents a practical framework that seeks to enable sustainable practices, resourcefulness and long term survival strategies. Hence, a practical framework for decolonising practices in Namibian art and design is to:

- Decolonise art and design worlds through a mindful and enacted shift from stifling institutions to a willingness to erode and fight power structures associated with institutionalisation. This includes working against rigid gender, traditionalist and inward-focused ideologies sedimented in Namibian government and institutions and which restrain open discourse and co-creation. Additionally, the minds and bodies of Namibian arts and design practitioners needs to be ongoingly decolonised from the oppressive social and economic shortcomings that are presented by everyday life, towards proactively engaging in initiatives that focus on local knowledge and culture.
- Embrace service design as a solution to and implement new service strategies that are based on plural avenues, digital participation and technology-driven solutions. The participatory potential of service design should be used to explore different avenues and drive the inclusion of Namibian arts and design into an international arena. Decolonising design innovation methods should also be used in order to acknowledge and include local and already existing innovation processes. Because these as still emerging practices, this case study could help develop decolonising design methodologies.
- Acknowledge the importance of narratives and digital storytelling in rendering audible and visible Namibian artists and designers by the sharing of Namibian local knowledge and culture according to the terms of the artists and designers, such as “our cultural significances that is told by us and explained by ourselves”. Digital storytelling and connectedness to new (virtual) networks will get

Namibian artists and designers 'out there' so that their talents can be harnessed for new economic opportunities.

- Adopt bottom-up approaches and the role of improvisation and knowledge stemming from local contexts and from there on, develop and publish best practices charters as some artists have unrealistic expectations from support organisations (Shapwanale, 2014). The new initiatives (mentioned above) should be improvised as the approach incorporates, by definition, ongoing learning, experimenting and fine-tuning of results, which fosters approaches that are based on local knowledge and culture.
- Engage in the fight against exclusion through open and ongoing discussion in addition to embracing co-creation amongst artist and designers. An equally local and international focus will build new networks and markets as the focus will be on mutual enactment of goals and strategies. The impact of digital participation in addressing the needs for connectedness amongst marginalised communities is illustrated in the literature (Davis, Waycott & Schleser, 2019; Sarantou; Akimenko & Escudeiro, 2018).
- Foster capacity building in areas of service design, digital participation (including digital business management and marketing) and digital storytelling. This may enable the control over processes that many of the participants mentioned as a pitfall for having marketing agents and other 'outsider' service providers involved.
- Engage in ongoing research that embrace arts-based approaches and narratives. These approaches will be suited to the cultural complexities and mixed identities that many Namibian artists and designers deal with ongoingly. The research should impact policy development in a variety of sectors in Namibia, but it will also address the lack of deep insights and understanding within this world.

Conclusion

Sustainable participation of Namibian practitioners in arts and design can be enabled through improvised processes, participatory service design that harnesses the potential of technological and digital tools and processes. Opportunities for service design, based on co-creative approaches, may offer new opportunities if the narratives and stories of Namibian artists and designers are diffused and dispersed, impacting on and stimulating new initiatives for products and services. Service design based on digital participation will also harness new economic opportunities whilst the cultural meanings of the Namibian arts and design world will be explained through vocalised and visible initiatives. Current on-line marketing and sales initiatives are limited by weak shipment infrastructures compared to global networks, which needs remedy.

The kind of design practices that enable decolonising processes with local Namibian communities include improvised processes that focus on local knowledge and culture and acknowledging their existing innovation processes. Additional practices are those focusing on services that address colonial organisational structures upholding traditionalism that do not sufficiently stimulate improvisation and experimentation practices that usually derive from the bottom up. Weak funding structures for arts and culture results from weak policy implementation. Decolonising design is an avenue for new service solutions, self-determination and acting through self-selected avenues. Suitable multi-channel strategies need to be developed by the artists and designers themselves. The strategies could be based on plural avenues, including those of self-services and network building, to sustain this world. Art and design managers should adopt decolonising practices in arts and design representation. Their focus on contributing to the capacity building of practitioners, encouraging bottom-up approaches that answer to local solutions, and the facilitation of sustainable services for sustaining this world, are pressing needs.

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Research Perspectives IN THE ERA OF Transformations

Understanding Development Discourse through Ontological Design: The case of South Korea

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Discourse is a powerful way of understanding/forming the world. It consolidates/disassembles society by conforming/disarticulating. However, the work of discourses has not been explained sufficiently in terms of design theory. In this respect, this paper aims to explore how the work of discourses can be understood in relation to the concept of ontological design, especially from the perspective of coloniality. The case of South Korea's development experience around different types of development assistance strategies was used to interrogate this question. A hermeneutic approach and discourse analysis were adopted for the empirical analysis. The research found the designed development assistance strategies of the "West" design back the development thinking and new development assistance strategies in South Korea. In doing so, the country replicates the "West-centred" discourse of developmentalism. From this, we conclude that discourses are shared through the ontological practices of designing. This informs design studies of how discourse relates to design.

Keywords: Ontological design, Discourse, Developmentalism, Coloniality, Hermeneutics

Introduction

> *A certain order of discourse produces permissible modes of being and thinking while disqualifying and even making others impossible (Escobar, 1995, p. 5).*

Discourse is a selective way of understanding/knowing the world (Escobar, 1995; Krippendorff, 2005). As Krippendorff (2005) identified discourse *(re)draws boundaries* "between what belongs and what does not" (p. 23) and *creates conceptual frameworks of society* by (re)justifying its identity. Because of this selective nature, tending to exclude others, discourse always contains the concept of 'power' (Escobar, 1995; Kim, 2015). However, the boundaries of discourses do not stay in fixed forms. They are rather permeable in ways of being consolidated or rearranged, or even replaced by those of stronger discourses, as they interact with different issues in society (Krippendorff, 2005). Therefore, studying discourse with respect to social issues is significant to understand how our material/immaterial world is (re)formulated: discourses consolidate society by conforming the existing framework of the issue or disassemble a social order by disarticulating/reconstructing. As Mignolo (2011) stated, discourses (re)construct power relations in society by pursuing certain "set of rules" (p. 50) (boundaries).

'Development discourse' or 'developmentalism' is one of the powerful hegemonic discourses forming the contemporary world. Developmentalism is a political consequence of 'development assistance strategies' designed by American or European power in the mid twentieth century (Dirlik, 2012; Du Pisani, 2006; Kim, 2015; Sachs, 2017). The discourse was based on a missionary task of the "West" (countries in Europe or

Northern America) to enlighten the non-West who are “less-developed” (Ndlovu-Gatsheni, 2013). From this conceptual framework, depending on how much money a nation earns and how industrialised it is, the global societies coined new names such as “developed”, “developing”, and “underdeveloped” (Escobar, 1992; Esteva, 1992). Developmentalism does not remain in the state of being designed. Instead, it shapes the people’s understanding of development and the world they live in and even leads society to design another form of development centred outputs. Kim (2015) found that developmentalism generalises the history of “West” as an ideal or a normal state of the world that defines “developed-ness” and gives power to those “developed countries”.

In this respect, developmentalism was widely accepted by international society especially by the countries in the non-West, who have faced economic crises, after they achieved political independence after the Second World War (Kim, 2015). South Korea is one country that was influenced by the national and international increase of development regimes and the global discourse of developmentalism (Kim, 2013).

This research proceeds from the position that the relational work of discourses are related to design. We often consider that designed things remain in the state of ‘being designed’ solely directed by human intentions and disregard the consequences they can bring, so the performances of discourse have rarely been connected to the theories of design. However, discourse insidiously relates to and pervades every being including design. Despite the conventional understanding of design, which emphasised its functional aspects (Simon, 1996), the new era of design studies has begun to acknowledge that the essence of designing is on the *philosophies (discourses)* that underlie its performances (Buchanan, 1992). Building on this perspective, design scholars have conceptualised design in the context of ontology: design *formulates the ‘world’* that we are living in and what we have designed is *designing ‘us’ back*. Discourse resembles the ontological practices of design as it influences things around it and (re)produces artefacts through the relations with other discourses. For this, Krippendorff (2005) remarked discourse as a “design problem” (p. 22) who works in active and recurrent practices. First, discourse constructs all kinds of artefacts from literacy to abstract theories, cultures and even to material products and places within the people who produce/consume it. Second, discourse repeats its practices by shaping individual experience, generating conceptual direction of society, and producing artefacts that exemplify the formers. Likewise, this study understand design is enmeshed with the work of discourses in a “redirective” (Fry, 2017, p. 30) way to shape human beings and their world, encompassing the relations between designed thing, its users, and a society. Since the subject was hardly studies hitherto by design scholars, an empirical investigation of understanding the work of discourses through the language of ontological design, especially from a political perspective, might be useful.

This research aims to explore how the colonial discourse of developmentalism might be understood in relation to ontological design. To achieve this, the study asks, ‘**how can ontological design theory relate to discourses of developmentalism?**’.

We have two expectations from this research. First, this research will contribute to understanding of *ontological design and its practices* by investigating an empirical case of South Korea. We expect this research will provide a more practical explanation of how design takes part in implementing and creating discourses. Second, by navigating the unequal global order through the discourses of developmentalism this research will provide insights on *the politics of design*, especially in terms of *decolonisation of design*. Since the subject is rarely investigated by design scholars, this study will respond to a need for critical scholarship into power imbalances and their relation to design.

In the following parts, we will introduce the key literature related to our research topics of design and developmentalism, explain our research design based on hermeneutics and case research, show the case results based on South Korea’s development story and provide discussions and conclusions with respect to design theory.

Literature review

Theory of design

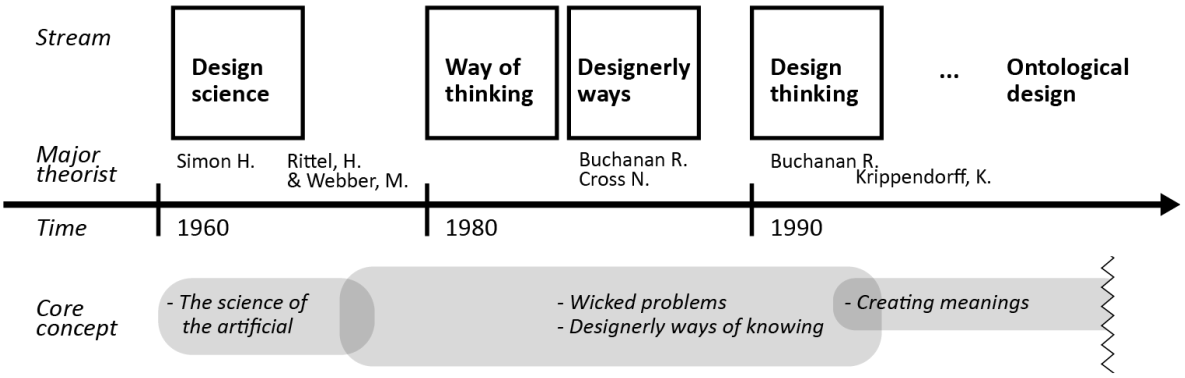

Figure 1: An overview of the history of design thinking

Design in the past emphasised the functional aspects of design to solve immediate problems and developed the idea of "science of design" to apply the quantitative methods of natural science to design practices (Cross, 2001; Cross, 1993; Cross, Naughton & Walker, 1981; Huppatz, 2015; Johansson-Sköldberg, Woodilla & Çetinkaya, 2013; Simon, 1996). However, as the inherent differences between science and design have been demonstrated by design researchers, design started to be understood as an independent area of study differing from science. Unlike science, design aims to achieve practical goals through action or solutions; uses various types of knowledge such as craft, design, organisation, and management; and takes place in commercial or organisational contexts (Archer, 1979; Cross, 2001; Cross, 1993; Cross, 1982; Naughton & Walker, 1981; Krippendorff, 2005; Rittel & Webber, 1973). In this sense, "designerly ways of knowing and thinking" (the term is Cross') became significant ways to deal with intricate and "ill-structuring" (Cross, 1982, p. 224) problems known as wicked problems by developing multifold ideas to produce the most appropriate solution (Cross, 1982; Johansson-Sköldberg, Woodilla & Çetinkaya, 2013). Since, the object of design has evolved to include services, systems, business models, policy innovation, organisational structures, as well as traditional work of producing tangible artefacts (Archer, 1979; Buchanan, 1992; Cross, 1982; Cross, Naughton & Walker, 1981; Johansson-Sköldberg, Woodilla & Çetinkaya, 2013; Rittel & Webber, 1973).

Richard Buchanan (1992), in his paper "Wicked Problems in Design Thinking", has addressed that this expansion of design in its meanings and connections is an inevitable phenomenon because of the intrinsic nature of design as "an art of experimental thinking" (p. 8). In other words, despite the conventional understanding, the essence of designing is not the production of pragmatic results, but the **philosophies** that underlie its performances (Buchanan, 1992). Therefore, design and "designerly" ways of thinking can be implicated in flexible (various) forms with philosophies that *shape human experiences and the world that we are living in* (Buchanan, 1992; Krippendorff, 2005; Willis, 2006). Building on this perspective, design scholars such as Terry Winograd, Fernando Flores, Charles Spinosa, Hubert Dreyfus, Anne-Marie Willis and Tony Fry have also conceptualised design in the context of ontology. Ontology, following Heidegger, is one's various ways of understanding about self (being) and its relations with the world around it (Fry, 2017; Willis, 2006). Therefore, **ontological design** is referring to "a way of understanding the dynamic **designing relations** between the world, things and human beings" (Fry, 2017, p. 26). The designing relation, according to Tony Fry (2017), is illustrated as follows:

> *Design almost totally directs the form and content of the environment in which we live. It pervades our lives, constitutes a world within the world, and impacts how we view, understand, use and extend this world (p. 26).*

For ontological design, design formulates the 'world' that we are living in and what we have designed is designing 'us' back (Escobar, 2018). These relations of designing exist and work without any direction (Fry, 2017). Rather, they are chaotically repeated within "*a hermeneutic circle"* (Willis, 2006, p. 70), which is to say

what is designed is designing the world and the "being-in-the-world" (Fry, 2017, p. 10) in a "redirective" (Fry, 2017, p. 30) way. This essential, but recently constructed conceptualisation of design is still developing in this sense.

An ontological understanding of design surfaces the political in design. Design materialises social relations and politics that have long-term structuring effects on society. Tony Fry (2017) has stated that "design always has profound political consequence" (p. 29), as it shapes the environments that people "depend" (p. 29) on and accordingly *shapes the lifestyles and minds of people* who live within those environments. Politics in ontological design is revealed through the fundamental notion that **design has "futural" consequences** (Fry, 2017; Willis, 2006). For this, Willis (2006) has defined that ontological design entails "an argument for particular ways of going about design activity" (p. 70), which acknowledges the responsibility of designing for its *discursive impact* on people and world both in the present and the future. In this way, design and the act of designing become politics.

Among various ontological consequences of designing, coloniality is one which limits sustainable futures. Tony Fry (2017) has commented on this as follows:

> *The world of the South (or "underdeveloped countries") has in large part been an ontological designing consequence of the Eurocentric world of the North (or "developed countries"). Thus, design was deeply embedded in the structures of colonial imposition. For example, (…) the colonial city was not merely an expressive form of colonial power, but equally an ontologically designing operational system of order (p. 26).*

After the territorial conquest of the European empire that colonised the subjugated distance by force, the history of coloniality have been constantly reproduced through the various forms of "military intervention, aid, humanitarian causes, technical assistance, goodwill or education" (Fry, 2017, p. 11). This phenomenon is called 'neocolonialism' by scholars in social science (Clarke & Haraway, 2018; Fry, 2017; Sachs, 2010). According to Fry (2017), the colonial discourses in contemporary society have been imposed through the activities, narrative and the spirit of "development".

Developmentalism and coloniality

Development has been used as an important term in global politics from the twentieth century (Cowen & Shenton, 1996; Dirlik, 2012; Du Pisani, 2006; Sachs, 2010; Sachs, 2017). The literal meanings of development are manifold, however, the "ideology of development" (Dirlik, 2012, p. 4) or development thinking which has acted as a powerful mentality to guide global thought and behaviour (Sachs, 2010) was designed within a specific context to indicate a specific circumstance (Du Pisani, 2006; Esteva, 1992; Ndlovu-Gatsheni, 2013; Sachs, 2010). The most consensual explanation of the invention of development thinking comes from an international assistance programme of the United States whose aim was to benefit the world through economic growth. In this sense, development began to stand for an economic richness of a nation, especially driven from the "Western style" of industrialisation. This understanding of development is called **development discourse**, or **developmentalism**. By the force of American hegemony, developmentalism has been shared worldwide and has urged the world to achieve the state of being "developed" (Sachs, 2010). The inverted paradigm of development was presented by the United States to monopolise its political leverage to the world after the Second World War and the model of development has been mostly borrowed from the industrial experiences of the United States and its neighbouring capitalist countries in the "West" (Clarke & Haraway, 2018; Du Pisani, 2006). Therefore, the 'West centred development' or 'Western style of development' became a dominant discourse in the sense of development thinking. Today, the practices of developmentalism survive through the work of international institutions such as the United Nations (UN), missionary ministries, and non-governmental organisations (NGOs) (Sachs, 2017).

However, developmentalism is often criticised as "a commitment to progress without people" (Dirlik, 2012, p. 4). A cast for development and for an achievement of a global position of superiority are accompanied by exacerbating anxiety to escape from the indignity of "underdeveloped-ness", which threatens society with uncertainties for the future (Dirlik, 2012). Many critics have condemned developmentalism for its madness of "using borrowed and foreign views" (Sachs, 2010, p. 3) rather than looking within one's own culture; a poor design of top-down strategies that fails to sustain the goodness for all; and a marginalisation of more than a half of the world (Sachs, 2010). As a consequence, the term 'development' became completely opposite from what it should have meant: people use the term in dreaming of a comprehensive future, but the real

consequence of “development” is exclusive and uncaring (Cowen & Shenton, 1996; Fry, 2017; Sachs, 2010). The development discourse and its consequences are inherently engendering **neocolonialism**. According to Sachs (2010), as developmentalism has become widespread throughout the world, with the emergence of globalisation, it has constructed a transnational economic class instead of national economic structure and this has produced an international economic hierarchy. Under this phenomenon, brutal competition between nations to obtain the winning title of “developed” has proliferated (Sachs, 2010; Sachs, 2017) and nations have come “under the custody of the economy” (Sachs, 2017, p. 2574; Clarke & Haraway, 2018).

In response to such criticisms, ‘sustainable development’ has been discussed as a new mainstream alternative for an inclusive future (Dirlik, 2012; Du Pisani, 2006; Sachs, 2010; Sachs, 2017). The concept of sustainable development has increasingly emerged since the 1970s with an acknowledgement of the ecological crisis and socio-political inequality caused by the extreme optimism of unlimited economic development (Du Pisani, 2006). In this sense, the concept has been promoted as a redevelopment for ecology and democracy (Sachs, 2010) and immersed into development discourse (Du Pisani, 2006; Sachs, 2017). However, sustainable development has faced criticism that it might be just another ideology of “Western” capitalist countries rooted from a shallow foundation imposed on the rest of the world that prolongs the disparity between “developed” and “underdeveloped” countries (Du Pisani, 2006). Indeed, Dirlik (2012) stated that

> *Sustainable development has done little to change the existing paradigm of development, relying above all on technological solutions which may be part of the problem (p. 11).*

Despite these concerns, in September 2015, the 2030 agenda for Sustainable Development (Sustainable Development Goals; SDGs) was adopted by the United Nations (UN) as a guide to world politics.

Methodology

Hermeneutic approach

This study is positioned within a standpoint of constructivism which is an ontology focusing on the meanings and the interpretations of an object produced by individuals (Creswell & Poth, 2017; Crotty, 1998). As this interpretivist approach “looks for culturally derived and historically situated interpretations of the social life-world” (Crotty, 1998, p. 67), the approach tries to explain the relative concept of understandings within the real-life context. From this ontological perspective, the research aimed to interrogate the discourses and meanings ascribed in the research object(s) from semiotic perspective and how design deploys them within the context of international power relations. Since the purpose of this research is to identify the hidden meanings beneath the narratives, the nature of the study is qualitative. To interpret the collected data, this study adopted a philosophical stance of **hermeneutics** and used **discourse analysis** for an in-depth analysis. Hermeneutics in social research is one of the streams of interpretivism whose premises is to understand social phenomenon through semiotic analysis of meanings, intentions and contextual relations (Johansson-Sköldberg, Woodilla & Çetinkaya, 2013). The analysis can be achieved by examining the language, literature, behaviour, art, religion, law, symbols, histories, and cultures surrounding the object(s) (Creswell & Poth, 2017; Crotty, 1998). As hermeneutics pursues the interpretation of meanings, this research approach is commensurate with the nature of discourse and ontological design.

Case study research

A case study research method of South Korea’s development experience around the different types of development assistance strategies is used to investigate an in-depth understanding of the phenomenon within the real-life context (Yin, 2012). South Korea is a unique example of a country who once was a recipient of the “Western” development assistance became a producer of its own development assistance strategies to other “underdeveloped” countries. The research presents an empirical case of how a country who has been formerly influenced by West-centred developmentalism, transforming its political, economic and social foundations, replicates the performance of delivering development discourses elsewhere. This indicates how the ontological practices of designed development assistance strategies of the “West” shape South Korea’s understanding (discourses) around development and how the global power relations influence new designs of the “underdeveloped” nation’s (South Korea’s) own development assistance strategies.

Table 1 List of documentary evidence used for analysis: Introductory resources

No.	*Title*	*Publisher*	*Year published*	*Format*	*Page(s)*	*Abbreviation in this paper*
1	Korea Saemaul Undong Center	Korea Saemaul Undong Center	2018	Website	14	I1
2	SMART Saemaul Undong story: comprehensive rural development	Korea International Cooperation Agency	2015	Electronic brochure	12	I2
3	Knowledge Sharing Program	Ministry of Strategy and Finance	2018	Electronic brochure	12	I3
4	Korea's leading think tank: KDI	Korea Development Institute	2018	Electronic brochure	36	I4
5	Happiness for All, with Global KOICA	Korea International Cooperation Agency	2016	Electronic brochure	16	I5

Table 2 List of documentary evidence used for analysis: Review documents

No.	*Title*	*Publisher*	*Year published*	*Format*	*Page(s)*	*Abbreviation in this paper*
6	Year One of Implementing the SDGs in the Republic of Korea: From a Model of Development Success to a Vision for Sustainable Development	The Government of Republic of Korea	2016	Report	34	R1
7	2017 Korea's ODA white paper: Beautiful sharing, wonderful growing	ODA Korea	2017	Report	185	R2

The data collected by documentary evidence and qualitative interview. Documentary evidence represents two types of materials including introductory resources and review documents of South Korea's Official Development Assistance (ODA). Introductory resource (I) indicates a self-introduction of an ODA agency in South Korea in the form of web pages, explanatory documents of organisation initiatives and brochures. This contains the history, purposes and visions of an organisation. This allows the researcher to determine the official explanations of the intention of the South Korea's development assistance and how South Korea identifies itself in this context. Based on the structure of South Korea's ODA, five introductory resources of the most active agencies of South Korea's development assistance were selected for analysis including the web pages (14-pages) as well as brochures (76-pages). Review document (R) is a summary and evaluation of the nation's aid plan. The summarised texts of the review provide a synthesis of all the plans and activities initiated by the South Korean government with specific examples and contain the evaluation of the nation's aid plan in the contexts of politics, economy, cultures and history. From this, this study aimed to gain a contextual understanding of the history of South Korea's ODA and the domestic and international influencers of the project. Two review documents published in 2016 and 2017 by the South Korean government were selected for an analysis. These documents are total 219 pages but selectively examined by the researchers based on the research objectives. The evidence was found in K-Developedia (www.kdevelopedia.org), a platform produced by the South Korean government to organise all information related to its development experience. Since the resources in K-Developedia are officially approved and presented by the South Korean government, this gives an authority and adequacy of the resources in this research to examine how the nation intends to design and deliver its own story. The list of the documentary evidences used for this research is indicated in Table 1 and Table 2.

In addition, qualitative data collected in this project was gathered through interviews. Two actors participated in the interviews, who were from the research department of the one of the key organisations communicating South Korea's development experience. The interviews lasted approximately thirty minutes with each participant and were conducted by video chat due to the far distance between the researchers and the participants. The interviews were semi-structured with some tentative questions. However, the questions were developed in indirect and value-neutral expressions to encourage the natural and spontaneous answers of the participants and minimise the unintended influence of the interviewer (Hammersley & Atkinson, 2010).

Discourse analysis

Since the case study object analysed in this research was a 'nation' which does not own a single unit as a whole nor has a projection to represent itself, it is impossible to meet the nation face-to-face and interview it. Therefore, to examine how a 'nation' identifies self and other, creates discourses, and promotes itself, this is achieved through analysing the narratives it produces. Therefore, the research used **discourse analysis** as a practical method to analyse the empirical case of South Korea, aims to investigate/define "colonial semiosis" (Mignolo, 2011, p. xx) ascribed in those narratives. With a critical approach that proposes a need for change and seeking alternatives, especially in the sense of power, justice and ethics, the research design of this study is aligned to Tony Fry's concept of ontological design to investigate how designed narratives can formulate the world and how possibilities for change might appear.

Table 3 Process of discourse analysis (Clarke, 1999, p. 364)

Action	*Stages*	*Stages in this research*
Story presentation	A. Hearing and Writing the Story	Reading documentary evidences
Identify significant statements	B. Hermeneutic interpretation	Identify initial insights
First level of themes	C. Learning through dialogue	Learning through interviews
Second level of themes	D. Construction	Construction
Individual categories		
Major group categories		
Group conceptual model	E. Conceptual model of phenomenon	Conceptual understanding

The analytic structure was informed by Clarke (1999)'s research design as shown in Table 3. First, the research data was collected by reading and re-reading the documentary evidences (stage A). Second, the research gained initial insights by identifying the significant statement from the data observed in stage A (stage B). The initial insights of stage B was conceptualised in depth through qualitative interviews (stage C). The findings of stage B and C were synthesised and discussed by constructing the meaning of the results (stage D). In the final stage, the holistic understanding of the research object was concluded (stage E). As discourse analysis derives interpretations and insights from observing and re-observing the materials, the analysis process of stage B, C, and D in this research were overlapped and replicated with several iterations at the necessity of the research.

Results and findings

Case study

We have developed the framework of the case based on the information we have found around developmentalism and the history of South Korea.

Background of the case: Colonial history of development

After the second World War, the territorial coloniality of the European empires that conquered the distant dominions finally came to an end. However, the traces of imperialism are transmitted to current people's lives formatted through laws, literacy, language, customs, and so forth (Said, 1994). This history is repeated with an imperial thinking, which is 'discourse'.

In the early twentieth century, the discourse of civilisation acted as a hegemonic discourse in the world (Kim, 2015). It distinguishes the world into "civil" and "barbarian" and gives the superiority to the European countries (so called the "West") by positing the cultures of the "West" as predominant (Kim, 2015). However, since the world had gone through a tragedy of the First World War, the fame and the power of "civilised West" had become quickly weakened (Brohman, 1995). The war seemed to reveal a violence of materiality and science driven by the "West" and suddenly the "West" had become a danger that threatened peace and humanity (Kim, 2015). Since the world had lost faith in the "civilised countries" in Europe, the power of civilisation discourse began to decline. In addition, as the United States raised its global supremacy, a need for a new hegemonic discourse headed by the United States grew (Kim, 2013).

To fulfil the need, developmentalism came out in the mid twentieth century alongside the emergence of American power (Kim, 2015; Sachs, 2010). The discourse was propagated during the presidential speech on 20 January 1949 of Harry S. Truman, the 33rd President of the United States (Ndlovu-Gatsheni, 2013; Sachs, 2010). In the speech, Truman declared the "Truman version of development" whose goal was to change the world by transforming each society with industrialisation and economic growth. Ndlovu-Gatsheni (2013) explained that this proposal was based on a "missionary task" of the West to enlighten the non-West who are "less-developed". From this conceptual framework, the world was divided into "developed" and "underdeveloped" depending on how much money a nation earns and how industrialised it is (Escobar, 1992; Esteva, 1992, Sachs, 2010). Because developmentalism understands the world through the standards of the "West", it prevents a comprehensive understanding of the global economy and society and oppresses sufficient discussions of different nations (Escobar, 2018; Kim, 2015; Sachs, 2010)

Developmentalism in South Korea

Developmentalism was widely accepted by the international society to overcome the economic crises that followed the Second World War. Especially the countries who had just achieved the political independence wanted to escape their poverty by following the principles of developmentalism (Kim, 2015). South Korea also adopted development discourse in this manner. As the Korean War broke out in 1950 right after the liberation from the imperial Japanese in 1945, the two Koreas had faced extreme poverty. Under the political influence of the United States, South Korea tried to overcome its economic crisis by following the American model of industrialisation and modernisation (Kim, 2015). In the 1960's, a former president Park Chung-hee (the fifth to the ninth president of the Republic of Korea from 1963 to 1979), stated that his regime's very first goal is to achieve economic development by industrialisation and to get a higher position in the global community (Kim, 2015). By adopting the concept of developmentalism, South Korea conceded to identifying itself as an "underdeveloped" country which is less progressed and less organised (Kim, 2013). Moreover, to stimulate the citizens' attention and increase the country's profitability, Park's government emphasised Korea's "undeveloped-ness" during his presidency (Kim, 2015). Regarding rural villages as a symbol of 'poverty' (Korea Saemaul Undong Center, 2018) and orthodox Confucianism as an old-fashioned tradition which is conservative and refutative for change, South Korea focused its national endeavours to transform from villages to government departments to become one of the "developed" countries while 'catching up with the West' (Sonn & Gimm, 2013; Kim, 2013). According to Kim (2013), the government's 'self-degradation' strategy has brought a hierarchical understanding of the (economically) developed "West" to others and a loss of independent originality of Korean tradition. In this respect, the modernisation of 'catching-up with the West' was legitimised in Korean society, as stated by Kim (2013).

Through its national endeavours to become one of the "developed" countries, South Korea has experienced *rapid change* in terms of economy, politics, and culture (Doucette & Müller, 2016). In 1996, South Korea joined as a member of the Development Assistance of the Organisation for Economic Co-operation and Development (OECD) and has reached over USD 30,000 for Gross Domestic Product (GDP) index in 2018. The country transformed its role in the international society from an aid-recipient to a donor (Doucette & Müller, 2016). South Korea calls this rapid transformation "development" and tries to *share its development strategies* as a part of the nation's foreign assistance plan to the other countries who want to become "developed" as South Korea has. "With the hope that South Korea's past can offer lessons for developing countries in search of sustainable and broad-based development" (KDI President Oh-Seok Hyun, in Han, 2012, p. 4), South Korea's project of sharing its development experience aims to contribute to poverty reduction in "underdeveloped" countries, to provide a new alternative option for policymakers, to increase the global marketisation of the nation, and to enhance the meta-narratives to facilitate the former (Doucette & Müller, 2016). By doing so, the nation strives to promote a positive image of its national identity while introducing its "development

experience" as "great advances in prosperity, stability, transparency, productivity, education, and in many other important areas" (Anholt, 2011, p. 294).

Development experience of South Korea and its relation to developmentalism

Here we introduce significant narratives related to developmentalism encompassed within South Korea's experiences of "development" as identified through the documentary data sources (as indicated in Table 1 and Table 2).

Table 4 Narratives related to South Korea's development experience

No.	*Narratives related to the development experiences in 20th Century's South Korea (1950~2000)*	*Narratives related to the development experiences in 21th Century's South Korea (2000~)*
1	The nation posited economic growth as the nation's top priority	The nation shows positive sense to developmentalist thinking
2	The nation carried out the Western model of modernisation and industrialisation to achieve economic growth	The nation emphasises its rapid transformation

First, *economic growth* was a top priority of the South Korean government before 2000s:

> *As its iconic motto of "Let's Live Well" illustrates, it (Saemaul Undong, a government-led movement in 1960s-1970s' South Korea toward national development) was a movement aiming at better lives. It brought people around* ***the same dream of getting themselves out of poverty*** *and propelled* ***government's pursuit toward development****. (I2, P. 4)*

Second, to achieve development, South Korea carried out *modernisation* and *industrialisation* agendas of the nation such as renovating traditional houses, paving roads and enlightening people:

> ***The development of rural areas*** *is key to eradicating poverty. (I1)*
>
> *In 1970s, SMU (Saemaul Undong) served as a driving force behind* ***Korea's economic development by modernizing rural communities and reforming people's mentality****. (I2, p. 4)*
>
> *Priority projects (of SMU) at Foundation & Groundwork stage (year 1970~73):* ***Improve Living Environments*** *–expand roads inside villages, construct laundry facilities, improve roofs (eliminating the rural thatched houses). (I1)*
>
> ***Rural Enlightenment****: As part of SMU, rural enlightenment aiming at* ***changing people's mentality*** *was launched. To this end,* ***people were encouraged to abide by order and manner and keep their surroundings clean****. Along with it, SMU encouraged people to be frugal, receive education, read books and put their money in banks. (I2, p. 4)*
>
> *As a result, Korea not only successfully achieved economic growth in quantitative terms but also ultimately brought about* ***qualitative changes to its economy by receiving technology transfers and improving its systems of production and employment****. (R2, p. 30)*

Some expressions indicate developmentalism was adopted in South Korean society.

By positing '*becoming an advanced country*' as an important goal, South Korea shows its positive sense of the developmentalist definition of "*advance*". In addition, the country distinguishes itself from others by identifying itself as *an "advanced country*" and its ODA partners as "*underdeveloped countries*":

> *(After addressing that foreign aid had helped 'Korea's remarkable, seemingly almost miraculous development') As a country that has gone from being a receiver of ODA to being a giver of ODA, and* ***from being a least developed country to being an advanced country****, Korea's ODA history provides a unique example (R2, p. 24)*

'*Recipient-turned-donor country*' is one of the most frequent and representative expressions to describe the rapid and unique transformation of South Korea. By using this expression, South Korea emphasises the uniqueness of its development experience and its status as an "*advanced*" country:

> *The ROK (South Korea) has also transformed itself* ***from a recipient country of Official Development Assistance (ODA) into the 23rd largest Development Assistance Committee (DAC) donor*** *in terms of its ODA as a percentage of GNI, and the 16th largest donor by volume for many years. (R1, p. 2)*

> *On the strength of its remarkable economic development, Korea has* successfully escaped poverty and hunger*, and has been returning what it once received from the international community. As* ***the only recipient-turned-donor country in the world****, Korea has become a formal member state of the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD), joining the ranks of advanced donor countries in the field of development cooperation. (R2, foreword)*

Designing new development assistance strategies

The sharing of South Korea's development experience is one of the major development assistance strategies in South Korea's Official Development Assistance (ODA). To inform its development assistance strategy, the South Korean government formulates the nation's development story (development experience) in various ways.

Table 5 Narratives designing South Korea's development experience

No.	*Narratives designing South Korea's development experience*
1	The nation uses self-identification expressions (e.g., 'model', 'example', 'success', 'once a recipient and now a donor')
2	The nation uses expressions of praise (e.g., 'remarkable', 'miraculous')
3	The nation ratifies its development movements

The South Korean government designs its development story by using self-identification expressions and remarking on the experience.

'*Model*', '*example*' and '*success*' are frequently used to describe South Korea's development experience:

> *Global Saemaul Undong:* ***Universal model for development cooperation****, which contributes to eradication of global poverty and sustainable development. (I1)*

> *As a country (South Korea) transformed from one of the poorest to* ***one of the most successful development examples in the world****, and as a donor country (…) (R1, p. 32)*

As described in the previous findings, *'once a recipient and now a donor*' is the most common expression to emphasise South Korea's rapid and clear transformation.

Some *expressions of praise* were used by the ODA agencies of South Korea to describe its development experience:

> *Behind this dramatic transformation (South Korea's economic growth) lay a long period of foreign aid receipt that made* ***Korea's remarkable, seemingly almost miraculous development*** *possible (R2, p. 24)*

South Korea *gives authority* to its experiences of development by ratifying them. For instance, the nation designated Saemaul Undong (SMU) in UNESCO Memory of the World Register and established Saemaul Museum (development Museum)

Analysis and Discussion

Hermeneutic circle of designing development strategies in South Korea

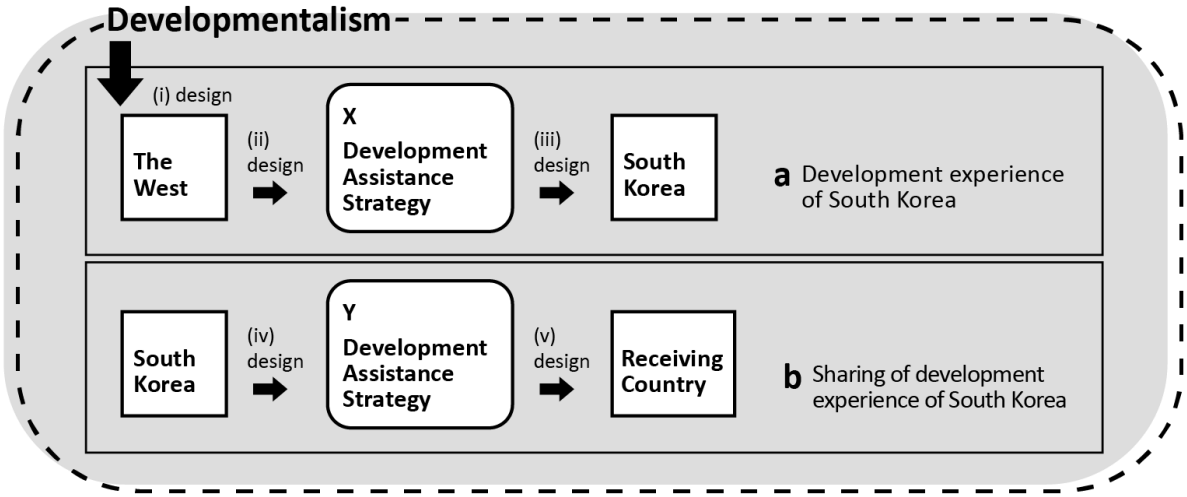

Figure 2: Ontological design model of South Korea's development strategy

In this part, we will discuss what we can understand from the case about ontological design and its political consequence encompassing coloniality of developmentalism. South Korea had experienced a rapid transformation in terms of economy and politics and tries to produce development assistance strategies based on this experience. However, we argue that South Korea's development experience contains colonial concept of West-centred developmentalism and this discourse shape the foundation of the nation's overall understanding of development and international power relations. Therefore, when South Korea designs development assistance strategy based on this understanding, the possible consequence of the project might be a reproduction of coloniality. Such phenomena have implications for design practitioners, as such governmental policies and programmes are implemented through products, services, projects and activities that design practitioners are increasingly involved in. Figure 2 represents the ontological relation of South Korea and its development strategies.

Development experience of South Korea

The research findings show how South Korea's development experience was influenced by West-centred developmentalism and how this in return designs the nation's understanding of development and global hierarchy. This is described in Figure 3.

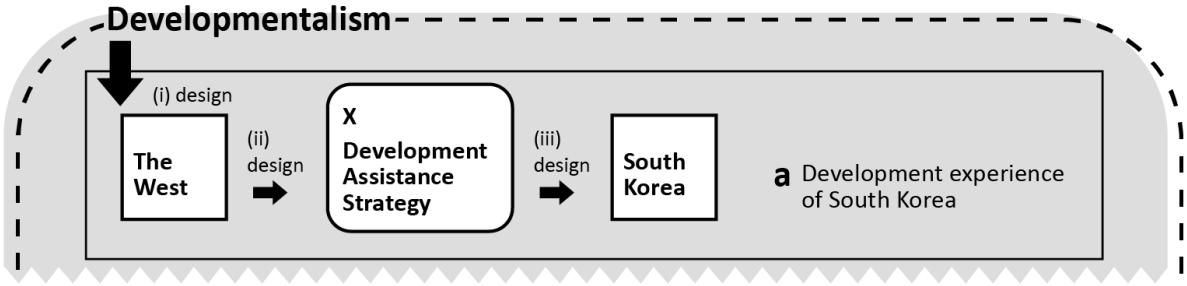

Figure 3: Ontological design model of development experience of South Korea

When developmentalism posits economic wealth as a substantial indicator to defining "develop-ness" (Esteva, 1992) this had appointed South Korea, who did not have an economic foundation after Korean War, as "underdeveloped". To escape from such stigma the South Korean government had economic growth as its top

priority and led national development strategies including 1970s' Saemaul Undong (SMU). The nation's development strategies were mostly designed by imitating the "Western" model of modernisation and industrialisation. For instance, as seen in the results and findings part, by regarding rural houses as a symbol of poverty the country transformed traditional rural houses with slate roof and paved the roads. Also, the government had tried to follow the "advanced" industries of the "West" to provoke its economic growth. However, as mentioned in literature review, such notion that West-centred modernisation and industrialisation are an ideal mode of development is grounded by the discourses of development (Du Pisani, 2006; Escobar, 1992). Moreover, since the discourse of development was generated by American hegemony which divides the world into "developed" and "underdeveloped" by the standard of the "Western" model of economy (Kim, 2015; Ndlovu-Gatsheni, 2013; Sachs, 2010), the attempts of South Korea to become 'developed as the West' is a result of the acceptance of developmentalism.

Designing new development assistance strategy

The research findings also show how South Korea's developmentalist understanding is integrated in the nation's development assistance strategy and how this reproduces colonial concepts. This is described in Figure 4.

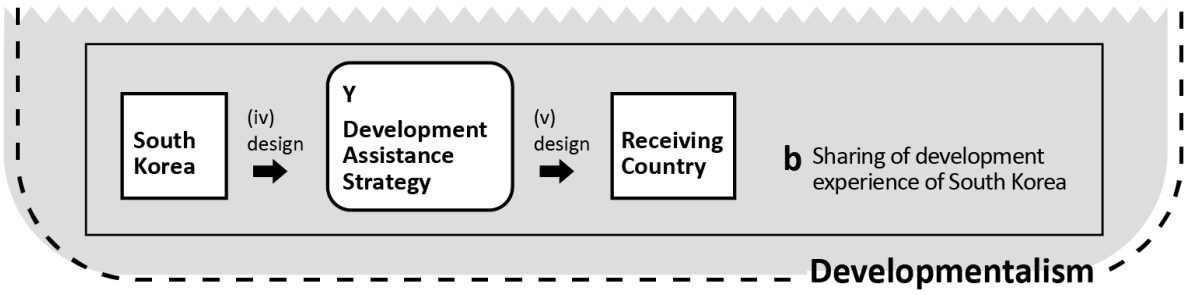

Figure 4: Ontological design model of sharing of development experience of South Korea

As shown in the results, the sharing of South Korea's development experience is one of the major development assistance strategies in South Korea. Thus, by analysing the narratives used in the South Korea's development story, we have found that the nation's development assistance strategies embody the West-centred developmentalism. South Korea has a positive sense on the word 'advance' and identifies itself as an 'advanced country' in designing its development story. The nation also employs the phrase, 'once a recipient and now a donor', to demonstrate its status as "advanced" and "developed" with an idea that being a donor indicates the nation's economic richness. However, as explained in the literature review, the phrases 'advanced country' and 'developed country' are the economy-centred definitions conceived of by the "Western" powers (Du Pisani, 2006; Escobar, 1992; Kim, 2013; Kim, 2015). That is to say that when South Korea deploys those phrases to emphasise its newly got position in the global economy, this indicates that the South Korean society has assented the spirit of developmentalism and so have its development assistance strategies. Developmentalism has reinforced the dominant power of the "West" to the non-West *by injecting dignity and superiority to the rich countries* in Northern America and Europe (Clarke & Haraway, 2018; Escobar, 1992; Kim, 2015). This reinforcement becomes even stronger when the rich "Western" countries have appointed the 'non-West' as an object of their "missionary task" (Kim, 2015, p. 102) for global development (Escobar, 1992; Kim, 2015). Likewise, when South Korea identifies itself as a "developed/advanced" country and its partners "underdeveloped" or an object of the country's assistance project ('mission'), South Korea's sharing of its development experience may replicate the same traces of the West-centred developmentalism that the country has been formerly influenced by: the economic stigmatisation on "underdeveloped-ness" reproduces the global power imbalances.

The results also show that South Korea's development story gives distinction and superiority to the 'able Korea'. Specifically, the country's self-identifying expressions describing its development experience such as 'model', 'example', 'success', and 'the only aid recipient-turned-donor country' reveal the nation's positive attention to its development experience. Since the words 'model' and 'example' themselves signify the meaning that the following object(s) is something to be learned from, those words imply a relational concept between the object and the others. Also, by using some praising words including 'remarkable' and 'miraculous'

to describe the nation's economic growth this positive attention is expanded. As those praising words emphasise the uniqueness and distinction of the following object, they make a classification and give specialty to the object. The development experience museum and UNESCO register of SMU also work in the same way. Likewise, since South Korea designs its development story in a positive image and separates its distinctiveness from other countries who are "underdeveloped", we argue that this can orchestrate hierarchies. From a broader perspective, within the context and the history of foreign aid being used as a strategic tool to consolidate the existing unequal global relationships (ODA Korea, 2017), the sharing of South Korea's development experience can also work as a means to provoke global power imbalances. Indeed, Escobar (1992) and Mudimbe (1988) emphasise that representation is the primary method to constitute the concept of dominance-subordination relation described in developmentalism.

Relation to ontological design

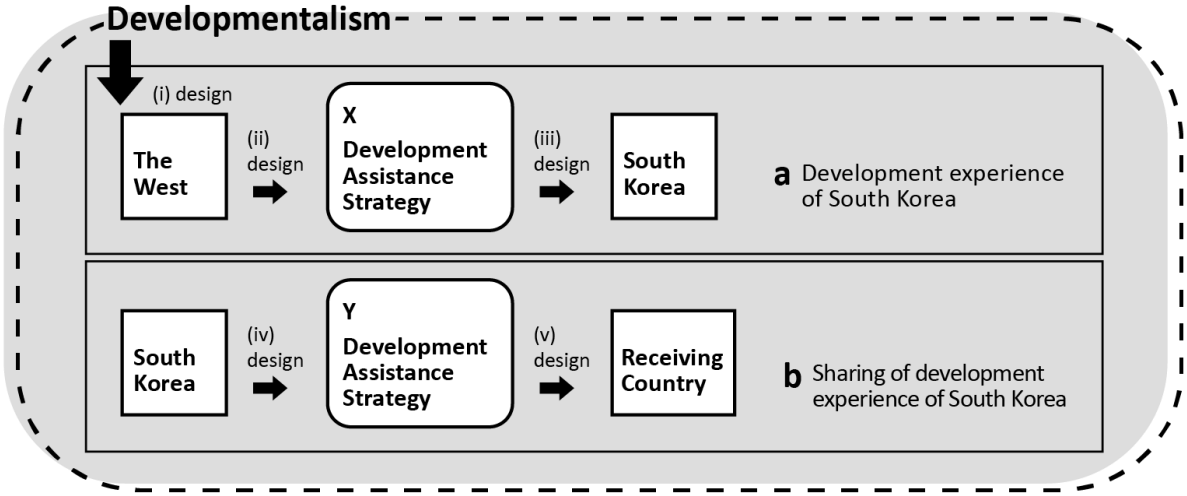

Figure 2: Ontological design model of South Korea's development strategy (revisited)

We have analysed how South Korea's development experience has been generated around different types of development assistance strategies. First, as explained in the literature review, the development assistance strategies designed by the "West", 'X' in Figure 2 (the figure is revisited from the previous discussion), was formed by the discourses of development (i&ii in Figure 2) (Du Pisani, 2006; Esteva, 1992; Ndlovu-Gatsheni, 2013; Sachs, 2010). The results of this research show that the designed development assistance strategies of the "West" (X) impacted the existing environments of the South Korean society. The strategies transformed the economic, political and social environment of the nation and reconstructed its social discourses by designing the nation's understanding around development and the global power relations (iii). Again, the results also show that these realigned discourses have brought a new designing (iv) of South Korea's own development assistance strategies for other "underdeveloped" countries (Y). This ontological circle of dynamic designing relations around development assistance strategies has worked in a "redirective way" (Fry, 2017, p. 30) over many years (Escobar, 2018; Fry, 2017; Wills, 2006). We haven't verified in this research, but the new development assistance strategies of South Korea might bring a similar consequences (v) of those of the West (iii).

In this study, we have inductively presented the significance of discourses for design theory and practice in the context of governmental policies and programmes related to developmentalism. Through this exploration of discourses of developmentalism based on the specific case of South Korea we illustrate the importance of studying the relational work of discourses with respect to design. Since, the object of design has evolved to include services, systems, business models, policy innovation, such phenomena have implications for design practitioners, as such governmental policies and programmes are implemented through products, services, projects and activities that design practitioners are increasingly involved in.

Conclusion

This research started from a question that 'how can ontological design theory relate to discourses of developmentalism?'. From an empirical case of South Korea's development experience, the research found that South Korea's experience of "development" encompasses West-centred developmentalism: the country posited economic growth for its top priority and imitated the "Western" model of modernisation and industrialisation to achieve this goal. We also found that South Korea's development assistance strategy targeting underdeveloped countries engenders developmentalism as well: when South Korea shares its "development" experience the country gives itself superiority to other countries by using self-phrasing and hierarchical expressions. Our findings reveal the ontological practices of design and their relation to discourse: the designed development assistance strategies of the "West" impacted experiences and thoughts of South Korean society and have brought a new designing of South Korea's own development assistance strategies. Development discourse has been transmitted throughout this process. From this, we conclude South Korea's development experience is "redirectively" (Fry, 2017, p. 30) interacting with the development thinking inside and outside the nation by implementing development assistance strategies of the "West" and designing the new strategies of the nation. This shows the ontological nature of design that interacts within the relations between designer, designed things, and the world around them and how these ontological relations of designing are closely woven through the work of discourses.

In this study, we have argued from the position that the relational work of discourses is important to consider for design theory and practice. In this sense, we suggest design practitioners need to ask ways to produce more comprehensive designs considering possible futures, such as decolonisation, and have responsibilities to introduce this approach to design practices including policy making and discussions of global development agendas. This work forms the basis of a PhD exploration into ontological design and discourses. Further work will elaborate on those early insights presented here.

Appendix: List of documentary evidence used for analysis

Introductory resource (I)

I1: Korea Saemaul Undong Center. (2018). Retrieved from http://www.saemaul.or.kr/eng/

I2: Korea International Cooperation Agency (2015). *SMART Saemaul Undong story: comprehensive rural development* [Brochure]. Retrieved from http://koica.go.kr/download/2015/brochure_Saemaul_Undong.pdf

I3: Ministry of Strategy and Finance (2018). *Knowledge Sharing Program* [brochure]. Retrieved from http://ksp.kdi.re.kr/skin/files/ksp/KSPBrochure_en_2017.pdf

I4: Korea Development Institute (2018). *Korea's leading think tank: KDI* [brochure]. Retrieved from http://www.kdi.re.kr/kdi_eng/about/data/kdi_brochure_2018_eng.pdf

I5: Korea International Cooperation Agency (2016). *Happiness for All, with Global KOICA* [brochure]. Retrieved from http://www.koica.go.kr/download/2016/KOICA_Brochure_2016.pdf

Review document (R)

R1: The Government of Republic of Korea. (2016). *Year One of Implementing the SDGs in the Republic of Korea: From a Model of Development Success to a Vision for Sustainable Development*. New York: Sustainable Development Knowledge Platform.

R2: ODA Korea (2017). *2017 Korea's ODA white paper: Beautiful sharing, wonderful growing*. Sejong: Committee for International Development Cooperation.

The evidence was found in K-Developedia (www.kdevelopedia.org) which is a platform produced by the South Korean government with a purpose to organise all information related to their development experience. The most important standard to define the appropriateness of the resource was whether the data contain the ideas of promoting a nation or the national narratives such as self-identification, storytelling of a nation or of organisational activities, especially encompassing the topic of *South Korea's development experience and its communication of the former*. The resource should be documented in forms of texts and pictures which the researchers can easily go back and analyse their meanings repeatedly.

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Design, power and colonisation: decolonial and anti-oppressive explorations on three approaches for Design for Sustainability

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Our contemporary world is organized in a modern/colonial structure. As people, professions and practices engage in cross-country Design for Sustainability (DfS), projects have the potential of sustaining or changing modern/colonial power structures. In such project relations, good intentions in working for sustainability do not directly result in liberation from modern/colonial power structures. In this paper we introduce three approaches in DfS that deal with power relations. Using a Freirean (1970) decolonial perspective, we analyse these approaches to see how they can inform DfS towards being decolonial and anti-oppressive. We conclude that steering DfS to become decolonial or colonizing is a relational issue based on the interplay between the designers' position in the modern/colonial structure, the design approach chosen, the place and the people involved in DfS. Hence, a continuous critical reflexive practice is needed in order to prevent DfS from becoming yet another colonial tool.

Keywords: Design for Sustainability, coloniality, decolonial, power structures, reflexivity

Introduction

Our contemporary world is organized in a colonial structure (Mignolo 2012). As Dei and Lordan (2016) point out, colonialism, more than just an historical moment, is a global structure in place since the historical moment. This structure has benefited European regions and worldviews and oppressed non-western societies and worldviews for the benefit of Europe (Mignolo 2012). Similarly, Walter Mignolo (2012), defining the current society as "modern/colonial", demonstrates how modern society emerged from and is sustained by European colonization and dominance. Even though many former colonies are now independent countries, the systems of dependence still exists, especially through coloniality (Grosfoguel, 2002). Coloniality is the imposition of global desires, of Euro-USA Eurocentric (Quinteros, 2015) worldviews and value system in a way that benefits Europe and the USA while at the same time affecting these regions (Quinteros, 2015; Grosfoguel 2002).

The professional and academic field Design, as well as the fields from which we borrow - and steal - information and methods in Design for Sustainability (DfS), such as Sustainability Science and Anthropology emerged from the modern/colonial world. As Haraway (2016) points out "nothing comes without its worlds". That is, design and sustainability are situated in Western modern/colonial paradigm and thus inherit the modern/colonial structure and behaviours. Even though there are growing efforts to "open up" various field for diverse worldviews, we have to be aware of their roots in the colonial power structure and how such

situatedness and inheritance play a role in sustaining or changing the modern/colonial structure when we, as designers and design researchers act in and through various locations. As many authors have argued (Ostrom 2009; Schumacher 1973; Lovelock, 1995; Grinspoon 2016), sustainability can only be achieved if we shift from oppressive hierarchical organizations to horizontal collaboration. Therefore, one of the needs for sustainability is the dismantling of oppressive hierarchical power relations such as the modern/colonial power structure.

In this paper we describe and analyse three approaches in Design for Sustainability: design activism, humble designing and radical listening. Using Paulo Freire's decolonial work on the ontologies of the oppressed as a lens (1970), we look at how each approach deals with power structures and what they mean in relation to colonization. It is important to notice, that, for this positionality that we do not claim to provide a global "solution" for decolonial and anti-oppressive DfS. The power relations and inheritances of colonized and colonizer people and places are as diverse as the cultures oppressed by colonization. Therefore, there is no single solution that can fit every place and situation. What we argue for is a constant critical reflection on positionality. The study we present here and the conclusions draw for decolonial and anti-oppressive DfS is thus situated in our experiences of being born in and working in Brazil, The Netherlands, Mozambique, Finland, Sápmi, Sweden, Borneo, Mexico, Namibia, The United Kingdom and South Africa. Hence, in this paper we look at how the positionality of people involved in the design process influences each approach towards being colonial or decolonial. Our aim is to elucidate how positionality of a designer or researcher is not fixed, but rather changes dialectically with the place and time and the design approach chosen. Our goal is to highlight the importance and encourage a constant critical reflective practice by designers in order to understand the possible colonizing results of each situation we find ourselves in.

Contextual Framework

Parts of the world have continuously benefited from the modern/colonial power structure in place at the cost of others (Mignolo, 2012). Colonizing countries have benefited not only from the extraction of values - natural resources, cheap labour and cheap land - from the (former)colonies (former in parenthesis as bondage still remains in both economic but also ontological sense as shown by Mignolo, 2012) but also from using colonial power structures to become the "good doers". That is, from a higher position in power structures, western (mostly EU-USA) people have had the opportunity to access oppressed/(former)colonial countries and carry projects to - among a plethora of colonizing words - "save", "improve", "empower" and "dignify" the "underdeveloped world". Such efforts pose western perspectives as both oppressors in colonial histories but also as contemporary "saviours". This relation, far from being liberating, sustains the structure of dependence and bondage between colonizers and (former)colonial areas (Freire, 1970). It is important to notice, however, that many projects have actually engaged critically with colonial and local power relations in the search for emancipation and liberation, but they are a small amount in comparison to the plethora of cross-country collaborations that end up sustaining rather breaking modern/colonial structures. For DfS projects to be decolonial it is not only a matter of good intention, but rather a matter of the contextual interplay of *what*, *how* and *where* a project is done as well as *who* is doing it and *with/for whom* the project is being done.

In a globalized - colonized - world, it is inevitable that people, ideas, methods and practices travel around. This is the case with Industrial Design, Sustainability Science and all other academic fields. Born in Europe from the Industrial Revolution, Industrial Design schools are now widespread around the globe, echoing and sustaining the canons of German, English, Italian and Scandinavian design traditions. Not dismissing the achievements and relevance of European design movements, it is important to notice that, as Barad (1996) argues, knowledges are not innocent. Industrial Design emerged from a specific nature/culture and political situation; it is therefore a situated field that echoes the worldview of where it was created. The movement of ideas and practices to areas other than were it emerged is not harmful *per se*; however, it is important to be aware of how such displacements - of people, fields, methods and ideas - work through and affect colonial power structures of dependency. As design starts to engage more and more across political borders, it is important to see how design approaches can be colonizing by imposing worldviews and prescribing solutions and methods.

Design (research) work becoming neo-colonialism is not only a matter of the non-innocence and situatedness of the field of Design and its approaches. It is an interplay between the situated field, the situated design team (individual or group with their cultures and inheritances) and the situated place and community that design work will affect and their positions in the modern/colonial structure. This dynamic becomes even more problematic when we deal with Design for Sustainability.

As Manzini and Vezzoli (2002) argue, sustainability is deeply local and tied to specific nature/culture contexts. Nevertheless, as Grinspoon (2016) reveals, sustainability is broadly defined as collective action for sustaining life on (of and as) the planet. Sustainability therefore has two sides in dialectic relation: being simultaneously local and global. The relation between this two-sided perspective can be seen clearly in the concept of Gaia (Lovelock, 1995; Latour, 2017). Gaia presents the world as one living organism made by various interrelated systems. Gaia shows how we, Homo Sapiens are, while living in diverse cultures, also interconnected to and part of bigger ecological systems. However, as Bruno Latour (2017) points out in his book "Facing Gaia", Gaia is an interconnection of communities in conflict rather than of peacefully connected entities. In light of a world formed by conflicting communities with different positions of power and privilege, Sustainability cannot be taken as an innocent agenda. Sustainability, with its specific type of knowledge (such as the emerging field of Sustainability Science) is also a situated field. Emerging from a Western academic environment, just as Design, it carries western worldviews and value systems. Imposing sustainability as a neutral global agenda thus renders as a form of coloniality.

In Design for Sustainability we adopt many concepts from Sustainability Science and its way of seeing the world to guide design work. One example, amongst various, is the adoption of the term "Anthropocene". This controversial, yet vastly adopted term, was chosen to define our current geological epoch. The Anthropocene, the epoch of the human, refers to the impact of humans on the planet being greater than the impact of all natural factors combined (Grinspoon, 2016). Through its terminology the Anthropocene suggests that to be human is to be in unbalance with Earth's natural systems - it is to make harmful impact on the planet. Framing our epoch in this way assumes that unsustainability is a natural and inevitable consequence of *a "normal" way* of being homo sapiens. That is, the Anthropocene generalizes and flattens humanity by implying that there is a normal way of being human. As any generalized view of the world inevitably assumes the image of the powerful, and as sustainability is a western concept, the Anthropocene homogenizes humanity through a Euro-USA-centric white hetero-patriarchal image.

Arguing against the homogenizing nature of the term Anthropocene, authors such as Donna Haraway (2016) have suggested other terms to name our epoch. For instance, Haraway (2016) has suggested terms such as Capitalocene or Chutchlucene. Haraway proposes such nomenclature as to highlight that unsustainability is not a natural consequence of the Homo sapiens' specie, but rather a consequence of a specific way of organizing society, a consequence of a capitalist modern/colonial socio-political structure.

If Design is a Western- situated field, Design for Sustainability has both feet in the Western world. Here the potential for Design to become colonialist is even stronger. In working in Design for Sustainability, we have the afore mentioned interplay of situated perspectives (profession, people and communities), plus the situated field of sustainability, the imposition sustainability as a global agenda through global political movements and the two-sided perspective of local and global implications of sustainability.

Methodology

In order to analyse how Design for Sustainability can be colonizing or liberating through this interplay, we use here the work of Brazilian educator and philosopher Paulo Freire as lens. Freire's work is intrinsically decolonial (Chabalgoity, 2017) as it fights for the liberation (a word he uses to imply action for freedom) of the colonized self from the oppressive structures of the modern/colonial world (Chabalgoity, 2017). We use Freire's work for two main reasons: First, because his philosophical and theoretical articulations are deeply connected with action. As Freire points out, theory and practice are not dichotomies, but are in a dialectical relation to each other. As he argues, knowledge is not transferred but rather created by acting to change the world one lives in. This link towards action, we believe, is very fitting with design. Secondly, we use his work because his relevance as an author and teacher has served as inspiration for much of the latter work on decolonization, anti-oppressive work and on non-western (in this case Latin-American) ontologies.

As Chabalgoity (2017) shows, the Freirean oppressed is different to the European "subaltern". The European subaltern is the one from whom ownership was denied, while Freire's oppressed is the one that, through colonization, has been denied the possibility of being "fully human". The oppressed in Freire's notion, is the one into whom was internalized a feeling and behaviour of being "naturally less and worse" than the (colonizer) oppressor (Freire, 1970; Chanalgoity, 2017). It is important to notice, however, that the oppressor and the oppressed in Freire's work are not separate people, but rather behaviours. In his book "Pedagogy of the oppressed" (1970) Freire defines oppression as a behaviour of prescription. According to Freire, the relationship of oppression is the prescription of the oppressor's worldview and values onto the oppressed,

forcing the latter to not have the right to its own worldview and values (Freire, 1970). One central concept in Freire's work is that liberation from oppression starts from "concientização". Concientização (becoming conscious, from Portuguese) stands for a becoming aware that is inseparable from action - a getting to know about one's position and action in the world by acting (Freire 1970). Freire (1996) argues "it would be incomprehensible if the understanding of my presence in the world didn't already mean the impossibility of my absence in the construction the presence itself. As a conscious presence in the world, I cannot escape the ethical responsibility of the moving myself in the world" (1996, p 19 – authors' translation). For Freire, concientização – the active becoming aware - and consequently liberation – becoming free from oppressive structures - can only happen through praxis of interconnected critical reflection and action (Freire, 1970).

In order to analyse Design for Sustainability from a Freirean perspective, we will focus on analysing three aspects of each DfS approach that we introduce below: (1) the relationship between people and the possible behaviours of prescription, (2) the position of people in the power structure of the modern/colonial world and (3) the possibilities for liberation or bondage in each based on whether spaces for concientização (becoming aware about and through action) are opened or not.

In the next session we describe three different approaches to Design for Sustainability that focus on power relations. These approaches are not exemplary, but rather examples - three items in a broad and diverse spectrum. We chose these three snapshots of design action for two main reasons: First, because we believe they reveal three very different ways of dealing with power in design. Having these three diverse and rather opposing ways of doing design for sustainability can serve as points of navigation for a broader conversation about power issues in design. Secondly, we chose the approaches for our intimacy and experience in using and researching them in different nature/culture and political situations around the globe.

Study: Three approaches for Design for Sustainability

In this section, we describe three different approaches for dealing with power issues in Design for Sustainability: Design activism, humble designing and radical listening. We first introduce each approach and give brief examples of each. We then look at the similarities between each and lastly, we analyse them from a decolonial and anti-oppressive perspective using the lens described above. The goal of this analysis is to elucidate the possibilities and dangers that each approach provides in informing non-oppressive and decolonial ways of doing Design for Sustainability.

As mentioned before, these are not isolated approaches, but rather images of the field of Design for Sustainability in a motion of understanding and tackling power issues in design for sustainability. As parts of a similar spectrum, these three approaches share various characteristics, such as: they are all centred in collaboration; they are aware of power relations between designer, community and political governance; they are sensitive to the imposition of worldviews and values; and are all based on mutual learning. However, it is the degree to which each approach takes these characteristics that sets them apart and makes them fitting to specific natural/cultural and political situation. We hope that revealing how each approach articulates these characteristics can contribute to nuancing power issues in design and help designers and design researchers to critically reflect on the situations we find ourselves in in order find non-oppressive ways of doing Design for Sustainability. Through this, we hope to help steering Design for Sustainability away from becoming a neo-colonial tool for the continuous domination of the world by a Western-modern/colonial capitalist agenda of sustainable development.

Design activism

Design activism, as defined by Fuad Luke (2009, p.27) is "design thinking, imagination and practice applied knowingly or unknowingly to create a counter-narrative aimed at generating and balancing positive social, institutional, environmental and/or economic change". Design activism comes into being when a group of people (of which designers may or not be part of), discontent with the actions of mainstream political governance, take the initiative (co-articulated counter-narrative) to act on the issue themselves. (Fuad-Luke, 2009; Julier, 2013)

Design activism is when people who are not on the top of a power structure, empower themselves by coming together, forming a collective, co-articulating an issue to be addressed, and tackle the issue as an independent collective that takes front and defies governing powers (Julier, 2013). Design activism is an action of taking over power through action. Design activism is thus community driven and community led, it is an insider action

within a community that identifies itself through a common issue. It is a motion from and by insiders to take over power and collectively act for creating change.

Kääntöpöytä Urban Farming - Helsinki, Finland.

One example of Design activism is the growing urban farming movement, in which the first author has been involved. While not all urban farming is necessarily design activism (as they may rely on governmental support in order to start) many of the urban farming, specially the guerrilla farming movements (see for example Reynolds, 2008) are examples of people taking over power to farm in urban areas. One example in this movement that started as a design activism action was the Kääntöpöytä (turntable in Finnish) area in Helsinki, Finland. Kääntöpöytä started with a group of people taking over an abandoned dumpster in an unused train maintenance area. The group started by turning the dumpster into an urban farming space. Nowadays, Kääntöpöytä has a bigger area comprising a greenhouse, a kitchen and an event space in the same area (Torretta, 2014). Kääntöpöytä, at present, defines itself as “a sustainable food production and urban planning laboratory located in Pasila's yard, and a centre for peer learning and urban culture”(Kääntopöytä, n.d.).

However, while design activism, for its interventionist approach, challenges mainstream politics (Julier, 2013) takes over and defies power structures, it does not necessarily survive as activist. For example, the Kääntöpöytä group, having started with a design activist approach, developed towards having governmental, industrial and non-governmental organizations support in upscaling urban farming practices throughout the city of Helsinki, becoming more of an urban design project (Torretta, 2014). As Julier (2013) argues Design activism “moves within the challenges of pre-existing circumstances, while also attempting to reorientate these. In this way, design activism also operates amongst its others. It exploits certain conditions of neoliberalism, to recycle and reprogram them” (Julier, 2013 p. 226). However, these changing relations between the design activist group and the ruling power, as can be seen with the Kääntöpöutä organization (Torretta, 2014) are not smooth and fixed, they are a constant negotiation and fight for power and space to sustain their action.

In summary, design activism is about taking power to make an envisioned change through collaboration. This change, is co-articulated (Julier, 2013) by a community that gathers around an issue and then lives in constant negotiation with the ruling powers. Design activism is dialectic action to take over power.

Humble designing

Humble designing (de Jong *et al*., 2016; Reitsma *et al.*, 2017) is an approach that emerged out of a discomfort with Design for Sustainability (DfS). Humble designing is an approach to counter DfS becoming increasingly prescriptive, especially due to the widespread approach in DfS of nudging behaviour change. Uncomfortable with the otherness implicit in DfS - of designers demanding others to change – Humble designing is asking “who are we to design for others?” and “who are we to tell others what to do?” (Reitsma *et al.,* 2017). This design approach for sustainability seeks the acknowledgement of diverse worldviews and states that people are always in a coming together of partial perspectives, where one cannot have a full understanding of the complete situation. Humble design is a call for designers and design researchers to learn from others and to learn to be guided by the people we engage with in design processes (Reitsma *et al.,* 2017). The goal is to design in a way that is beneficial for all involved and that, instead of colonizing, opens space for horizontal collaboration (Reitsma *et al.,* 2017).

Due to this characteristics, humble designing can come into being when designers engage with a community that they are not part of. In this case, the designer may have a stronger power as an outsider, which then demands humbleness to engage in a way to level the power balance. The aim of humble designing is for designers to seek the creation of a dialogical space, balanced in power hierarchies that facilitates the opening of design processes to the perspectives of others. Humble designing is specifically focused on respecting diversity, as it is about creating a space for mutual learning and exchange between diverse worldviews, where a new way of being together can emerge that challenges pre-existing power positions.

On/off or in Between. Kungsbacka, Sweden

One example in which a humble designing approach has been adopted is the *On/off or in between* project, in which the second author has been involved. This project focused on a micro grid area connecting different apartment buildings and public sector organisations. The electricity is produced and shared within this local system. Initially, the aim of the project was to make the apartment building dwellers shift their electricity use

in order to make the energy use in the local system more efficient. The first envisioned solution by the design team was to stimulate people in the apartment buildings to do their laundry during day-time when the energy is produced by solar panels. However, the designers considered it unfair to ask for such a shift from people. Firstly, because it is difficult for people to change their routines, especially if they do not have a personal motivation for doing so; and secondly, because they are part of a system, connected through the grid. Therefore, it would make more sense to focus on a systemic perspective rather than on individuals. From realizing the potentially oppressive nature of the design process, the design team decided to shift towards a more participatory approach in order to involve the different actors in the grid and to accommodate and understand the different relations that each had to the system. The designers came up with a game to ask all actors to contribute with their perspective and ideas for optimising the system. By becoming aware of the power difference, and potential prescriptive nature of the initial process, the designers decided to manage and balance the power relation. The shift resulted in an attempt of humble designing and through that of opening up for mutual learning. This way, the stance that was taken by the designers was humbler than the initial entry point.

It is important to notice that humble designing is not only about creating participation (as design activism also is), but it is about managing power and humbleness between all participating actors in order to create a way of being and working together that is special and specific for that group of people (Reitsma *et al.,* 2017). Humble designing is about managing power relations in design (de Jong *et al*., 2016; Reitsma *et al.*, 2017).

Radical Listening

Radical listening is a design approach that has listening as its core. Radical listening emerged from the field of pedagogy and was first articulated by Kincheloe (2008 cited in Moore, 2018) based on Paulo Feire's (1970) idea of Radical Love. Radical listening is about having listening as the roots of the process. Moore (2018) explains that radical listening is when one is open "to understand another person's point of view without seeking to change them" while also being open to change through this listening (Moore, 2018 p. 481).

Radical Listening in Design for Sustainability can come into being when a person in a position of power engages with a person/community in a less powerful position with the willingness of contributing to the community. This approach, aware of cultural sensitivity issues, trusts "community members to be the best solvers of their problems. It means asking for individuals' ideas and implementing their solutions" (Health in Harmony, n.d.). Perceiving the big power gap, as outsider (designer) who has the power to bring about action – by political or financial privileges – lets the community (people who want change and will be affected by it) guide the process and is open to change the design way of working according to what the community wants. The design outsider assumes a position sharing the privilege and using it as a way to bring about the demanded change.

Preserving tropical forests through health care - Borneo

An example of Radical listening is *Health in Harmony* organization's (see www.healthinharmony.org) work with communities in Borneo for preserving rain forests. The communities they worked with logged the forests, which besides causing harmful impact to the forest, was also harmful for the local fish stock, fauna and weather. For these communities, logging was their main source of income for the communities. However, these communities voiced the willingness to stop the logging. Based on this willingness, the Health and Harmony organization decided to take action to help locals in stopping it. From a privileged position as a Western organization, Health in Harmony's founder Kinnari Webb engaged in 400 hours of listening to local communities by asking what they wanted in order to stop logging. After the 400 hours, the common answer was high quality and accessible health care. Since the organization was a specialist in healthcare, they organized a local health care system with all functional details defined and decided by the locals. Health and Harmony had to change, through the process, their perspective of what they believed creating a healthcare system and forest monitoring system should be like. The organization was open, though radical listening, to change their own views. The project has been successful in spite of various conflicts with local governments and organizations that previously benefited from the logging. The benefits to the community are notorious and far from what the locals could expect from the local government (Health in Harmony, n.d.).

Radical listening is also about collaboration, but in a way that also opens up the design process to be led and changed by the community. In this case it is a collaboration across power structures for doing something that benefits the least powerful and not necessarily the ones in positions of power. The process of radical listening

runs on local knowledge and acknowledges the community as the biggest specialist in the issue they want to tackle (Health in Harmony, n.d.). Radical listening is about sharing power and privilege through listening.

Results & Analysis

Similarities and nuances

As can be seen above, all three approaches share various characteristics, but their differences are positioned in the degree and format to which each characteristic takes shape within each of the approaches. One common characteristic is that they are all based on collaboration, as they all acknowledge that no individual can decide and design for a whole community. However, the types of collaboration vary greatly: design activism is a bottom-up co-articulated action that starts from a community created around an issue (Fuad-luke, 2009; Julier, 2013; Torretta, 2014). In this sense, it is collaboration between insiders in order to act and take – through that action – power to change their reality. On the other hand, humble designing is a collaboration between different communities with different power positions. Humble designing is therefore a collaboration through engagement of different communities in order to – through realizing and managing power relations – achieve a unique way of being and working together (Reitsma *et al.,* 2017). Furthermore, while radical listening is also about engagement between different groups, it is between groups with a notorious power gap. It happens when there is a group asking for change, but powerless and the other group as powerful and willing to share the power to assist the other group in achieving their own goals. Radical listening is a collaboration by sharing power. The type of collaboration is intrinsically linked to the way each approach deals with power relations. Thus, another commonality is the awareness of power relations needed in all three approaches. These approaches are aware of the socio-political power structures embedded in the situations they are in. Nevertheless, it is how each approach deals with power relations that sets them apart. Design activism takes over power, humble design seeks to level and manage power while radical listening focuses on sharing power. It is this situational socio-political awareness that is very important in seeing the possibilities and dangers of each from a decolonial and anti-oppressive perspective. In the following section, we analyse and compare these approaches using the decolonial lens introduced before.

Applying a Freirean decolonial lens

Here we use the three items from the before mentioned decolonial lens to analyse dialectically the three approaches: (1) the relationship between people and the possible behaviours of prescription, (2) the position of people in the power structure of the modern/colonial world and (3) the possibilities for liberation or bondage in each based on whether spaces for concientização is opened or not. As these items are related in a way in which one can influence the other, and due to the shared commonalities between the three approaches for DfS described above, we do this analysis dialectically by focusing on each approach but simultaneously comparing and contrasting the different approaches which each decolonial lens' item.

Design activism

The first aspect, and most prominent in Freire's definition of oppression, is the behaviour of prescription. In this case, a process that has the possibility of being prescriptive assumes colonialist oppressive behaviour (Freire, 1970 p. 29). While all three approaches try to get away from prescriptiveness, especially humble designing and radical listening, the position of the designer in relation to the group affected can shift these approaches towards being colonizing. Especially in design activism, since it is a bottom up action by a community gathered through an issue, oppression can come depending on whether designers are outsiders or insiders. As outsiders, designers cannot start a design activism for sustainability process in a place where they are not part of the community or where there is no community gathered around a specific issue. Starting a process in a place they are not part of, designers would be forcing people around an issue chosen, and thus imposed, by the design team. As design activism is led by a community that comes together around and co-articulates an issue (Julier, 2013), designers have to be part of this coming together of the community. This aspect is problematic when we look at the second item of the decolonial lens: the position of people in the modern/colonial work. That is, a strong colonial behaviour can arise through design activism if people from colonizing countries, through structures of privilege get to carry projects in (former)colonial countries and chose design activism as the design approach. In this case, a more decolonial approach would be to support and facilitate existing design activist endeavours or open up for the possibility of it through processes of co-articulation of issues through, for example, humble designing and radical listening as we will see later.

When it comes to the third aspect, design activism is an act of liberation as it is about directly taking over power. Design activism has to start from concientização, from an understanding of one's position in the world through action and thus becoming aware of being in a lower power position and acting to take over power. However, the internal dynamic of a design activism group, in order to encourage liberation has to hold space for the praxis of critical reflection and action – it has to support the collective concientização through its action so that the issue to be acted upon is indeed co-articulated. Otherwise, internal dependencies between the actors of the group can be created, thus, forming an internal power structure that does not allow collective liberation.

Humble designing

As seen above, humble designing was created to counter the increasingly prescriptive behaviour of Design for Sustainability. However, we cannot take humble designing as innocent and naturally anti-oppressive and decolonial approach. Humble designing is an approach to be chosen by a design group with power to control a design process that involves more actors. The choice of humble designing can also be an imposition. Aimed at levelling power structures within a project team, humble designing can leave the greater modern/colonial global structure intact. A process that levels internal power relations but does not address greater modern/colonial structures, while it is not a colonizing approach, cannot be defined as decolonial as it does not contribute to changing the modern/colonial power structure. The strength of humble designing as a decolonial approach is when it happens with people from different positions in the modern/colonial structure. That is, humble design is fitting in situations in which the modern/colonial structure intrinsically puts the design team in a powerful position over the other project actors - such as western designers working in (former)colonial countries. In this case, managing the power structure by letting go of privilege and opening up for the creation of the dialogic space that is central to this approach, can allow processes of concientização. In this case, concientização can only happen if the dialogic space allows the praxis of critical reflection and action (Freire, 1970) throughout design process. That is, the design process has to be centred on a reflection and action of each person's positionality. Designers should not be in power to manage power relations, but rather, through the dialogic space allow the power management to be shared by all actors. This, in turn, relates to the third aspect of the decolonial lens. If designers choose humble design, but stay in power to manage power relations, there will still be a dependency on the designers. Hence, liberation through humble designing can only be achieved if the dialogic space allows concientização and if the power relation management becomes shared ownership.

Radical listening

Radical listening in Design for Sustainability also stems from the willingness to find non-prescriptive approaches. As radical listening has listening as the very beginning of a project, the design process is defined by what comes from of listening to the actors involved. However, radical listening implies there is one person or group that listens and another group that talks. This is where the position of the people or groups in the modern/colonial structure is important. Radical listening is fitting to when people with more power, open up to listen to voices of oppressed that were not heard before - not heard not for a lack of voice, but for a lack of willingness from the powerful to listen. Similarly, to humble designing, radical listening finds fit when people from colonizing countries engage in design work in (former)colonial countries. However, the position of people and how the process is carried can define whether radical listening leads to concientização and liberation or not. Radical listening happens in situations where big power gaps are present - when a local group relies on the external person to achieve a wanted change and the external person shares power (such as economical and/or political) to make the change possible. This process, in order to support concientização has to highlight and present the power differences between the two groups as a problematic structure to be analysed and acted upon. If the power difference is neglected – seen as natural and irremediable - and not tackled through the listening and through the action that follows, the process does not open for concientização. Furthermore, if the community in lower power position continues to rely on the powerful to achieve their goals, radical listening does not decolonize or change power structures. It becomes therefore a momentary opening for action that closes when the external design group leaves the situation, thus sustaining bondage in the long run.

Conclusion & Discussion

In this paper, we introduced three approaches in Design for Sustainability that are concerned with power issues in design. The approaches introduced were: Design activism, humble designing and radical listening. We

introduced the problematic relation between design, sustainability and the modern/colonial structure of our contemporary world. Using a decolonial lens based on Paulo Freire's (1970; 1996) work, we analysed these three approaches to see how each could sustain or change the modern/colonial power relations. From this analysis, we saw that none of these approaches are naturally decolonial but each has potential for being decolonial depending on the interplay between who, where and how each approach is carried. From the decolonial lenses described here, decolonial (that changes the modern/colonial global structure) and anti-oppressive Design for Sustainability (that does not prescribe) can only be achieved through reflecting on how the design approach affect the people involved in the design process. Thus, becoming decolonial is a relational issue. What is needed from us as designers is a critical reflexive concientização about how our positionality and the design approach chosen relates to power relations and modern/colonial structures – how our position in the world is linked to the creation of the world and of our position in it, as Freire (1970) argues. In this case, it is important to allow the approach to adapt and change as the project develops and the power structures understood, analysed and tackled.

To illustrate this, designers engaging with an external community in a lower power position in the modern/colonial structure could start the process through radical listening. Radical listening would allow the community to define the process and aims of the project. Once the process is defined and started, in order not to keep the community dependent on the designers, a humble designing approach could be taken to manage power relations. Through humble designing the management of power relations in the group would be shared by all actors and a dialogic space (Reitsma *et al.*, 2017) for critical reflection and action would be created. The dialogic space provided by the balanced power relations in the humble design process can then encourage critical reflection and action to allow concientização. This concientização would then allow project participants to start co-articulating (Julier, 2013) issues for critical action to take over power through design activism. However, while this example may read like a recipe, the appropriateness of each approach and how they interplay depends on the situation we find ourselves in and the power relations implicit in it. The appropriateness of design approaches can only be found if design(ers) are conscious and continuously reflecting on its situatedness in relation to power structures.

To conclude, we consider the work presented in this paper as a contribution to a more critical attitude towards the imposed colonialising character that Design for Sustainability often inadvertently assumes. This colonialising character often remains hidden or un-reflected, which we consider as a danger to achieving true sustainable action both on a local and on a global level. In this paper, we applied Freire's decolonial lenses to uncover those often hidden attributes. We see this approach as valuable in order to stimulate a more critical and reflective discourse in Design for Sustainability. We hope this article allows the beginning of a process of concientização of the reader and of design for sustainability.

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Track 2.b Introduction: Design & Democracy

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The issue of design and democracy is an urgent and rather controversial one. Democracy has always been a core theme in design research, but in the past years it has shifted in meaning. The current discourse in design research that has been working in a participatory way on common issues in given local contexts, has developed an enhanced focus on rethinking democracy. This is the topic of some recent design conferences, such PDC2018, Nordes2017 and DRS2018, and of the DESIS Philosophy Talk #6 “Regenerating Democracy?” (www.desis-philosophytalks.org), from which this track originates. To reflect on the role and responsibility of designers in a time where democracy in its various forms is often put at risk seems an urgent matter to us. The concern for the ways in which the democratic discourse is put at risk in many different parts of the word is registered outside the design community (for instance by philosophers such as Noam Chomsky), as well as within (see for instance Manzini’s and Margolin’s call Design Stand Up (http://www.democracy-design.org). Therefore, the need to articulate a discussion on this difficult matter, and to find a common vocabulary we can share to talk about it. One of the difficulties encountered for instance when discussing this issue, is that the word “democracy” is understood in different ways, in relation to the traditions and contexts in which it is framed. Philosophically speaking, there are diverse discourses on democracy that currently inspire design researchers and theorists, such as Arendt, Dewey, Negri and Hardt, Schmitt, Mouffe, Rancière, Agamben, Rawls, Habermas, Latour, Gramsci, whose positions on this topic are very diverse. How can these authors guide us to further articulate this discussion? In which ways can these philosophers support and enrich design’s innovation discourses on design and democracy, and guide our thinking in addressing sensitive and yet timely questions, such as what design can do in what seems to be dark times for democracy, and whether design can possibly contribute to enrich the current democratic ecosystems, making them more strong and resilient?

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Research Perspectives IN THE ERA OF Transformations

Redesign democratic debates

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As many scholars have stressed throughout history, healthy public debates are key to the revitalisation of democracy. There is currently a genuine cry to steer away from polarized debates and to work towards consensus. Over time philosophers such as Aristotle (384-322 BC), Arendt (1958), and Mouffe (2000, 2005), have convincingly argued that struggle, torment and dispute are an essential part of a healthy democracy, and that there is a need to design rules to enable these conflicts to be retained. How could design offer us the means, tools and spaces to better articulate differences, and to tackle current polarized debates? We will first sketch how public debates have evolved over time, mapping out the rules that were designed to prevent conflicts from getting out of hand. After that we will investigate a case study and based on the insights generated, try to demonstrate how design could offer us meaningful tools for constructive debates.

Keywords: democracy, concensus, dissensus, debate, design

Public debates through the times

Whenever the topic of democratic debates is addressed, the ancient Greek philosophers and their famous agora in Athens are often proposed as the intellectual and physical starting point of our modern democracy. In *The Human Condition*, Arendt (1958) stresses the importance of conversation in the ancient Greek culture, where well described rules defined who could participate in discussions, and how this should be done in a neutral, non-hierarchical space. Furthermore, according to Arendt (1958), and addressed by many others (Achterhuis & Konings, 2014; Thorpe & Gamman, 2014), the Greeks passion for contest, or agon, (Achterhuis, Konings, 2014, p. 459) was an important aspect of this Greek conversational culture. The focus was not on winning or losing the game, but primarily on the contest itself. A strong respect for the rules, as well as for one's opponents, was a key factor, as without these rules, a contest couldn't exist.

Although Greek debating has played a pivotal role in history, research by Foucault (2011), and by Achterhuis and Konings (2014), throws doubt on the claim that free speech, paressia, was an ancient notion, whereas it was, in fact, not entirely free – only those in positions of privilege had the opportunity to speak out against power. Women were also excluded from public conversations. A recent study by Leclercq (2018) points out that Greek rules for the use, function and regulation of their public space, were under constant negotiation, and that our perception of the agora and Greek democracy as a perfectly organised system, requires some nuancing.

Van Hooff (2011) suggests that we look instead to the Middle Ages as the basis of modern democracy. Throughout that historical period, citizens negotiated constantly with the forces of power, and experimented with self-governance. During these Dark Ages, the so-called Rederijkers movement was a strong driving force behind the culture of debate (Van Dixhoorn, 2006), and the public sphere in the Netherlands. The Rederijkers – a group of writers, poets and artists – organised public contests and performances based on topical issues of the time, using theatre as the main forum for public expression. These public activities – with well-defined

rules on performance and orchestration– were a key factor in strengthening group identities and in visualising communication between the elite and the general public.

Although Van Hoof uses coherent arguments to indicate the Middle Ages as a starting point for the development of the public sphere, the late 17th and early 18th centuries have been designated the golden age of conversation (Van Rijn, 2013, Habermas 1962). During this period, in France, citizens congregated in public coffee houses and salons. Habermas speaks in the widely quoted *Strukturwandel der Offentlichkeit* (1962) about these Tischengezellschaften as trailblazers for democracy, as they were a perfect space in between people's private lives and the spheres of authority. It is from this time onwards that one starts to design civil society (Van Vree, 2000).

Despite the fact that the coffee houses welcomed a wide variety of people, they were not entirely inclusive. All the participants had to be well informed and capable of participating in a rational debate, and, as a study by the Institute for Social Research (Van Dixhoorn, 2006) mentions, common public issues were generally resolved in a 'mob sphere'. Social and economic discrepancies at the time were somewhat tense due to with the fact that parts of society were excluded from the precipitated public sphere (Van Vree, 2000).

It is important to stress here that the culture of, and activities in, coffee houses throughout Europe varied widely. In England, for example, rivals could work out their differences in the coffee houses, whereas in France, the so-called salons were primarily meeting spaces for writers, artists and intellectuals to practice a culture of eloquence (Van Rijn, 2010).

In order to understand modern democracy and the role of debates, we should not omit to mention Rousseau (1712-1778) who considered public participation to be key for a vital democracy. His ideas about a social contract, co-created by citizens, policy makers and politicians, are still not outdated. Rousseau considered debates to be a perfect means of designing and shaping these rules together (Cohen, 1986), however a real social contract did not come into being at that time.

In the 19th century, debating clubs spring up all over Europe. In England these clubs were very popular – by offering a mix of debating and theatre, public performances attracted over a thousand visitors of an evening (Van Rijn, 2010). The debates however, owing to commercial interferences, were somewhat moderate in nature, nevertheless, toward the end of the 19th century, some of the clubs became more radical and, in consequence, were banned.

In the 20th century, journalistic media became the main arena for public debate (McChesney 2004, Starr 2004, Van Dixhoorn, 2006). Journalistic outlets provide information, instigate debates and operate as watchdogs, thus performing a key role in democratic processes (Kovach & Rosenstiel, 2007). Van Vree (2000) however stresses that the mediated public spheres of the media differ considerably from Habermas' *Offentlichkeit* because of the commercial interference with advertising, publishing houses etc., a phenomenon also framed as commercialized publicity (Van Dixhoorn, 2006). Habermas himself already predicted this decline of public culture in 1962. According to him, as with the rise of public culture in the 18th century, boundaries between governance and society would fade and specific interest groups would come to dominate and manipulate the public domain (Habermas, 1962) entailing its decline.

In the 21st century, debates have also moved to the online domain. Whereas in the first years following the inauguration of the World Wide Web, many had high expectations of the open and interactive capabilities of the internet (Aigrain, 2012; Bruns ,2008; Leadbeater, 2009), nowadays more and more scholars stress that our digital culture in fact has a rather polluting effect on debating culture. As the conditions and rules of online public debates are not defined, discussion becomes polarized, polluted (Van Stokkom, 2010) and fragmented (Poell & Borra, 2012; RMO, 2011).

It is not only the quality of online public debates, which are currently the subject of critique, but also the digital platforms that shape the conditions, as their interests are not aligned with public values (RMO, 2011, Van Dijk, Poel, De Waal, 2016). The architecture and design of the platforms define how we debate, as well as how, and with whom, we interact. These platform mechanisms (Van Dijck, Poell & De Waal, 2016) steer and shape our public debate, and since their guiding principles are neither transparent nor fully aligned with public interests, that is troubling.

Furthermore, questions are raised about how public online debates actually are, since it is a relatively small group that participates in online discussions (RMO, 2011, Pariser, 2012), as well as a succession of others, warns about filter bubbles – where algorithms filter out information, based on previous online interest and

searches, and customise information accordingly. This results in diminishing one's chances of being confronted with opposing or unexpected ideas or points of view. Flaxman, Goel & Rao (2013) speak of the rise of ideological segregation, or of the increase of interpretive communities (SCP, 2011). Others are concerned that capacity to deal with opposing views is diminishing (RMO, 2011; SCP, 2001).

In short, we have sketched out how, throughout history, we never fully succeeded in designing a debating culture where everyone was included, where free speech for all was guaranteed, and where we were confronted with opposing points of views. Furthermore, it is clear that the rules on how to debate, or whether or not to express emotions, fluctuated. At the Greek agora however, and within the Rederijkers chambers, the coffee houses and debate clubs, there were clear rules to safeguard the public sphere and make sure that those able to take part in public discussions, understood how to participate, discuss and disagree in an appropriate way. Nowadays, the absence of rules and regulations, and the fact that more and more debates are not publicly visible, as they often occur in an online realm, leads to the question of whether design could be of help in redesigning the rules and conditions for a healthy public debating culture?

Consensus, Dissensus

Arendt (1958) imagined active citizens' participation playing an important, active and reflective role in the common realm. Citizens who collaborate have the 'power' to transform conversations on common 'interests' into deeds. In her vision, this power is not given to them, rather it arises from their mutual collaboration. Unfortunately however, with current affairs such as Brexit in the UK, the Yellow Vests in France and the polarized discussion surrounding black-faced Zwarte Piet in the Netherlands, it appears that people are primarily coming together to express anger and despair rather than finding common ground. Nussbaum (2019) defines our political crises in her latest work as a *Monarchy of Fear*.

For Mouffe (2000, 2005), however, agonism is the basis of democracy. We will always encounter difficulties and conflicts, and so it is necessary to find new ways to deal with them. According to Mouffe, the paradox of our democracy is that we strive for a pluralism that never can be achieved (Mouffe 2000, p.15,16). Consensus is impossible, because the very possibility of consensus requires exclusion - there are always ideas and emotions excluded from the debate. Mouffe argues instead for an agonistic approach to democracy and encourages contestation. Citizens ought to relate to one another as adversaries, exploring where they disagree. They should work out their differences, instead of looking for their common interest.

Mouffe (2005) suggests that contestation should take place in a 'symbolic space', where by means of *artivism* one can work out 'conflictual consensus' – by this she means achieving temporary agreement. We need to 'work through' our differences, defining where we disagree. This means we should not only bring rational arguments into the discussion, but also the emotions that are at stake. Mouffe sees a crucial role for art and creativity in revealing these emotions by means of what she calls artistic activism or *artivism*. According to her, art and politics are not separate entities – there is an ethical dimension to politics, and a political dimension to art (2013, p. 91). Artistic practices can offer space for resistance, for counter forces, Mouffe speaks of 'counter-hegenomic struggles' because they can shape a new form of subjectivity. "If artistic practices can play a decisive role in the construction of new forms of subjectivity, it is because, in using resources which induce emotional responses, they are able to reach human beings at the affective level" (2013, p 96).

Can we use the theoretical frameworks of Arendt and Mouffe to discuss the role of design in democratic renewal? Whilst there has been a substantial amount of literature written about political agonism as a theory, there have been surprisingly few attempts to apply these theoretical assumptions to empirical case studies (Harvey, 2012). During a philosophy working session with the DESIS network (series of philosophy talks) and Design Academy Eindhoven, during the Dutch Design Week in Eindhoven (October 2018), we tried to shape the conditions for Mouffe's symbolic space and questioned how designers could be meaningful in designing new rules for contestation and agonism.

Thinking Through Making workshop

We invited 25 participants (a balanced mix of policy makers, design researchers, journalists and citizens) for this working session. All invitees received, three weeks prior to the event, a positioning paper expressing some of the aforementioned ideas in relation to Arendt and Mouffe. They were also asked to hand in a short statement (video, written, visual) a few days prior to the workshop (figure 1).

Designers can play a valuable role in democratic dialogues by creating platforms that allow multiple voices to be raised and heard, practice-based rather than by purely theoretical means, aiming for exploration rather than determination, and generating friction rather than shiny surfaces.

David Hamers. Reader in Places and Traces, Design Academy Eindhoven

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Figure 1: Statements handed in by participants prior to the session. In total 15 statements were handed in. These were used as conversation starters in the discussion.

We kicked off with a short presentation on the philosophy of Arendt and Mouffe, after which the participants tried to work out rules and regulations around a specific (real) case-study, presented by professor Meijer (Governance Studies, Utrecht University). The case concerned an area in the city of Utrecht (Netherlands) for which there are plans to build houses, plans which are opposed by existing residents of the surrounding area who fear a lack of green space, car parking spaces and excessive demands on existing public services.

We divided the participants into three groups of eight participants, one moderator, and a designer to visualise or map the conversation. Within the groups, we discussed how to deal with this particular conflict between current residents, incomers, and city planners – where and how the discussion should take place, and what the role of designers could be be. (Figure 2)

Figure 2: Working session, Dutch Design Week Eindhoven, October 2018

The first group, discussed how designers could help people to better understand different roles of the various stakeholders involved in this case – current residents, newcomers, city council etc. By sharing personal experiences about housing, conflicts with neighbours, etc., it became clear early on in the conversation that we don't have adequate tools to deal with differences. The root cause of these conflicts is the fact that we are not trying hard enough to understand other people's perspective. The participants in the conversation discussed what this implies for designers.

Within design research, the question of how designers should empathise with their users is an important one. One view is that designers need, by means of a 'particular kind of imagination' (Fulton Suri, 2003b), to understand the user. Others (Kouprie, & Sleeswijk Visser, 2009) think that this 'empathy' entails the ability to understand the users, and to be sensitive to them and their thoughts throughout the design process. Some (McDonag, 2006, Batterbee 2004) go even further, seeing it as the intuitive ability to identify with other people's thoughts and feelings, values and inner conflicts, and to internalize these.

Because a clear definition on empathic research in relation to the role of the designer and their methods, is lacking, Kouprie and Sleewsijk Visser (2009) suggest making a distinction between empathy and sympathy –

sympathy being a way of knowing, and empathy a way of relating (Wispé, 1986). This means that, during the process, designers need to be able to switch from one to the other (Kouprie & Sleeswijk Visser, 2009). Before and during the design process the designer requires sympathy or compassion for the users involved but there is no need to internalize their emotions and frustrations through empathy.

In the first group conversation, the participants thought up a process to stimulate 'sympathy' through an intervention to instigate the process of stepping in and out other people's shoes. They came up with the idea of using the game of 'musical chairs' to illustrate that, within participatory projects, we should aim to involve all stakeholders, whilst at times trying to take someone else's seat in order to understand the different perspectives and interests involved.

In a previous design research project at our research lab, we developed a game entitled *Value Pursuit* (Rygh, 2015) to help stakeholders visualise their different interests, points of view and preferences. In the aforementioned distinction between empathy and sympathy, this game, which was brought up in the conversation, would also be way to sympathise with different stakeholders. The participants in the conversation session, felt it requires more than a visualisation and discussion tool to understand other stakeholders, if one is to achieve more empathy. The game of musical chairs should therefore force people into different positions, to enable them to internalize different points of view.

After the workshop, the designers at each table, were asked to come up with a design proposal based on the insights gathered in the conversation. Designer Fides Lapiedere who participated in the first conversation, designed a musical chairs performance (poster, figure 3), stating her aim thus, "After the session I went further with the question of how we could magnify that almost uncomfortable closeness of working together. How we could we train that skill in our daily lives." This led her to the proposal: 'Share a seat, shape a thought… Shape a seat and share a thought.' Her proposal involves a communal activity whereby people take turns being responsible for public tasks.

Furthermore, as the group thought that making things together encourages the empathising process, participants should not only share a seat, but also shape ideas and seats together. This concept relates to Sennett's ideas – in Together (2012) he underscores how making things together doesn't necessarily mean people are working from the same point of view. Often it is the ability of the participants to make it work despite their differences, the social capacity to cooperate together (11), that brings things to realisation – makes it work. To practice this it is necessary to make things together, but as Sennett stresses, this is not easy in a digitalized context where we hardly ever get together and actually meet. To attain satisfying results one needs to overcome a certain form of resistance, "not to fight against it [...] but to employ a minimum force" (2012, p.208). Sennett also makes the distinction between empathy and sympathy stating that, "Along the one path cooperation is a tool, a means; along the other, more of an end in itself. (45)

Figure 3: musical chairs, designed by Fides Lapidiere

The second group discussed the affect that current digital agoras, which result in disembodied conversations, have on debates. Online agoras are becoming places where people express frustrations linked to a general

feeling of abandonment. Our digital interfaces reinforce individualisation – behind the screen there is only space for one person – the result is that we become disembodied from the debate. The lack of physicality in virtual spaces transforms the discussions into intangible narratives where the other becomes somewhat fictional, and the notions of truth and trust are more than ever called into question. Yet, when it comes to tangible spaces, our participants noted that for many years these locations have had a temporary nature, which makes it difficult for people to evolve a more durable relationship with these spaces for holding discussions.

Following the conversation, designer Maxim Benvenuto reflected on the ideas of architect Lefebvre, whose philosophies expressed in the Right to the City (1968) offer a more radical, more problematic, and more open-ended vision of urban politics (Purcell, 2002, p.100). In Lefebvre's point of view, neither architects nor planners, philosophers or politicians, can create new forms and relations out of nothingness. They can only, under favourable conditions, help the formulation and shaping of existing trends (Kofman & Lebas, 1996). Benvenuto observes the design of the Tuilleries in Paris, with a simple layout of the space and chairs, as being very effective for people to meet, linger and take the initiative for 'get-togethers' and conversations. The role of a designer or architect, according to Benvenuto and the participants in this conversation, is to create the conditions and the space for people to do precisely that. These public meeting spaces need be visible as places for people to meet, to discuss the future as well as to reflect on the past.

The third group, moderated by the first author, mainly focused on the role of design in conflicts, and came to understand that we could use public space to articulate differences more precisely. During elections, for example, public voting and debates, people are often asked for simple binary decisions.

The group imagined a 'wailing wall' (figure 4) where various complex ideas could be discussed and made visible in a more nuanced way. The idea came into being as one of the participants brought up the fact that in every conflict there are winners and losers, and these positions might change over time. When losing something you go through different emotional stages that, if better recognised, might make it easier for all involved to recognise what has been lost.

Based on this discussion, designer Martina Huynh created an interactive wall. The wall allows people to express feelings, ideas, thoughts etc. in a more precise way. The wall, installed in a public space, with a spectrum of choice options and colours, would visualise the 'public's opinion' and create a starting point for further discussions.

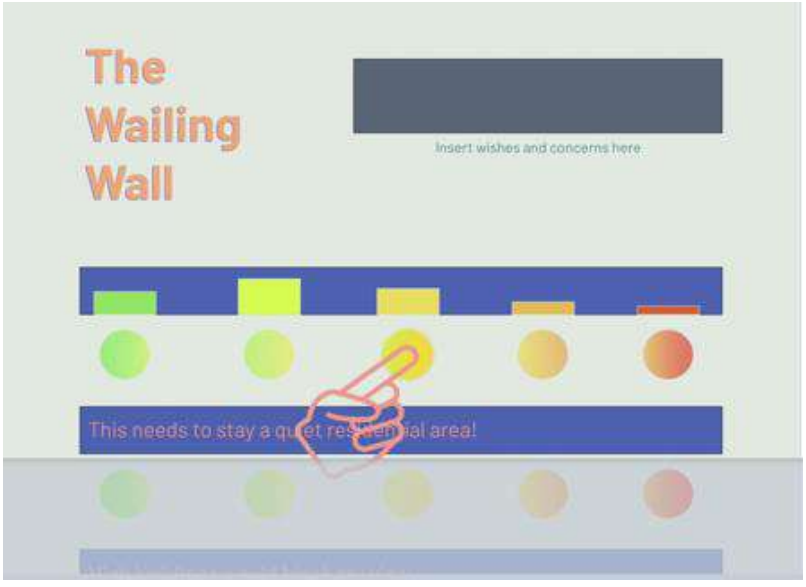

Figure 4: Wailing Wall to articulate differences more precisely in public space, design Martina Huynh

Reflection workshop

We concluded the workshop by sharing insights. Although each group worked on slightly different subjects, they all expressed the need to find new ways to articulate differences. The first group pointed out how we need to empathise more with different roles and stakeholders. The second group stressed the importance of tangible conversations in a public space where people could work on common interests and different points of view, and the third group emphasised the importance of disagreeing in a more nuanced way, pointing out the importance of tangible and visual designs in public space that could instigate debate.

Although in every session the designer proved to be very helpful in steering the conversation, making sketches, mappings and clustering ideas, the designer themselves were not positioned as an expert with unique knowledge (Schuman, 1993), instead, we emphasised how the co-creation process itself generates unique insights (Manzini, 2015).

The question of inclusion, was also brought up at the reflection session. Although we hoped to create a balanced group by selecting various disciplines e.g. journalist, designers, policy makers and philosophers, the group felt they were more or less part of the same strata of highly educated people with an interest in design research and participatory processes. Especially now that we are starting to realise more and more that differences are key for social innovation and for the levelling of power and resources (Westley, Zimmerman, and Patton, 2007), it is seen as necessary to involve as many different actors as possible in the participatory process. It became clear, that we could have included an even wider variety of people in the conversation.

What proved to be difficult in the workshop was the fact that in the particular case study of a new construction area in Utrecht, the new residents were not visible, and therefore not present in the workshop. Despite this, the other participants did manage to have a meaningful conversation by reflecting on personal examples. Almost everyone had experiences with neighbourhood arguments, or with conflicts in their working or private environment. “There is a huge need to develop tools to deal with conflicts”, stated participant Robert Elbrink, policy maker at City of Eindhoven, “Within policy making it is getting more and more difficult to deal with frustrated, angry citizens and we are lacking tools to deal with this.” Many others also recognised this through their practices as journalists or researchers.

Thorpe & Gamman (2012) acknowledge that we need to develop new tools for working through conflicts, as there are few in existence. Based on their studies (2010-2011) with the Design Against Crime Research Centre (DACRC) and Central Saint Martins (CSM) college of Arts and Design, they also came to understand that design tools and approaches to deal with conflicts are sorely lacking. This is rather surprising as more and more scholars acknowledge that conflict and dissent should be part of participatory projects (Björgvinsson, et al. 2012; Ehn 2014; Emilson in Ehn, Nilsson, Tolgaard, 2014).

Reflecting on the possible roles and tools for designers in dealing with conflicts, this conversation and the designed outcomes, led us to understand that the thinking through making (Raijmakes, Arets, 2015) session, where thinking and the actual making of a tangible outcome go hand in hand, is a very helpful strategy, as, commented participant, researcher Lucky Belder, “it gives everyone an equal voice in the conversation”.

Furthermore, the participants thought that designing open spaces, like the Tuilleries in Paris, for people to get together, and preferably also make things together (Sennett, 2012), would be very helpful. Many participants came to the conclusion that disagreeing in a more precise manner is key, expressing the need to design tools that make more nuanced debates possible.

Prior to many debates the opposing views are outlined. By focusing on the opposites of the spectrum, Brandsma (2016) calls them pushers, we stimulate polarisation. Instead we should focus on the silent, as Brandsma calls them in Polarization. We need to give voice to the silent people positioned in between the pushers, to make their ideas, thoughts and emotions visible. This also relates to the ideas of Rosanvallon (2014) who, in Le Parlement des Invisibles, writes that we should work towards narrative representation, making sure that the stories of the people who are invisible, are told. The participants of this session were convinced that design can be meaningful in achieving this.

To conclude

At a time when, in the context of disinformation, people are losing trust in media outlets and politics, and are unable to find common ground on the internet, which is a virtual space where there are no rules and

regulations to work out these differences, we should start to design the conditions for new public agoras. Designers could give shape to symbolic spaces (Mouffe, 2005) where this working out could take place, using artisvism as a means to also include the emotions at stake, in order to better work through, and out of, differences.

These symbolic spaces need to be designed in such a way that they accommodate differences and offer various possibilities for people to interact. The participatory practice of design can be very helpful here. Options could be co-designed through interplay between different stakeholders (Bason 2014). Furthermore, it is important to acknowledge differences (Mouffe, 2005) and 'work these out' by making things together (Sennett, 2012). We need to get more practice in doing this, by getting together in a physical realm. Finally, designers could help to find agreement in a more precise way, revealing stories of the silent.

Though we think designers have important roles to play in reshaping societal debates we should take a humble approach. Throughout history we have seen that it is very difficult to create inclusive spaces where a wide variety of people feel welcome and where they are able to their express thoughts and emotions and work out their differences. The good news though, is that over the years we are getting better at getting into non-aggressive disagreements (Achterhuis, Konings, 2014). Based on this workshop, and other case studies by the authors, we do however see a lot of potential for designers to apply their capabilities and mindsets to redesign public debates, creating symbolic spaces for people to interact, make things together, using artivism to reveal emotions, giving voice to the silent and helping people to disagree in a more nuanced way.

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An Immanent Criticism of Urban Design in Montevideo

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The debate about the so called “excluding design” has been a focus for applied philosophy for several years. The structure of this debate is constituted by deontological and consequentialist’s applied ethics and as well as agonistic democratic approaches. This paper asks for the applicability of these points of view to the particular socio-political reality of Montevideo. Examining this reality closer, I hold that we cannot comprehend the recent aestheticization of the excluding design there through these contemporary philosophical frameworks. As an alternative philosophical procedure, I analyze the aestheticization of excluding design in Montevideo from Rahel Jaeggi’s immanent criticism. I hold that this process of aestheticization implies an ideological regressive “form of life”. And I also argue that the Uruguayan democracy is affected by this ideological regression. Nevertheless, because this aestheticization is not an exclusive Uruguayan phenomenon, this paper intends to open one direction in applied philosophy of urban design.

Keywords: Immanent Criticism, Urban Design, Democracy, Aestheticization

Problems and Theses

Anybody who visits Montevideo and looks carefully at its urban landscapes will certainly find it has a highly heterogeneous architectural aspect. In particular, houses have a variety of fences, ranging from one with mere aesthetic purposes to notoriously practical uses. Italian style houses are still part of the urban landscapes, with fences clearly made to satisfy an aesthetic function (see Figure 1). The Italian-styled fences work, or almost worked, as aestheticized balcony. A second type of fences, which are now part of both the Italian style houses and the newer one, are those that cover whole windows and external doors. Hence, they obviously have a defensive function. If we pay attention, we can also find a third type of fences, those which are not covering windows and doors (see Figure 2). Moreover, there are other objects in the Montevidean urban landscape, such as flowerpots, garden gnomes, sculptures, and fountains (see Figure 3). It seems obvious that if we see ornaments in the houses’ façade, we tend to naturally think that they are merely ornamental, i.e., aesthetically oriented. However, recently, it can see in the city flowerpots and tubes recently and curiously posited in the same place of those unusual situated fences (see Figure 4). Are those new locations contingent? It does not seem trivial that these objects are sometimes located in similar spaces as the third type of fences, what I will call “unfamiliar fences”. In fact, the answer is very clear: they are alternative forms of defensive urban design. The flowerpots and tubes do cover neither doors nor windows, and they are not put in their traditional places (see Figure 5). This change of new practical uses for external house objects is a phenomenon that Montevideo only recently experiences, and that has been “excluding design”. Fences, flowerpots, and other objects are aimed not only to defend indoor spaces of Montevidean houses, but a lot of them are also strategically positioned to persuade people from resting (setting, sleeping) in outside locations (see Figure 6).

Although this phenomenon has different names, those are determined by two main case interpretations. Excluding design has been recognized around the world by a lot of institutions, such as academy and press. It is

not, therefore, a specific Montevidean social phenomenon. These main interpretations are organized in two sets of interlocutors: those who believe that using excluding design supposes, attending its diverse consequences, a morally wrong decision and those who believe that, by virtue of diverse practical principles, to using excluding design is the better political decision of a community. The use of spikes in London urban area, example that will be analyzed later, has had broad media coverage, big public response from the political authorities and of course a big response within London citizens. To many journalists and academics, those spikes are located by virtue of morally and politically wrong decisions. However, Karl de Fine Licht (2017) has questioned the legitimacy of the axiological negative perspective concerning excluding objects.

Figure 1: Examples of Italian fences (all photographs are mine)

Nevertheless, considering the particular Uruguayan case, I hold that the discussions about the legitimacy of excluding design have missed the point. The counter-arguments very smartly developed by the de Fine Licht against his interlocutors engages us to accept a specific form of applied philosophy. In accordance with his paper, the excluding design can be evaluated through deontological and consequentialist categories, i.e., by which have been called "internal" and "external criticism" (Jaeggi, 2018). In my opinion, however, it is necessary to change the framework to interpret this world wide phenomenon. In response to the perspective of agonistic on design and democracy (Di Salvo, 2010), I state that we can *normatively explain* the use of excluding design around the world. I argue that we can both comprehend and also criticize the excluding design in Montevideo, i.e., we can gain a comprehension of the ideological conditions of Montevidean *forms of life* materialized in urban design objects as, in turn, we can gain also a critical and transformative perspective of this phenomenon. My thesis consists in determining if the conditions which produce solutions to a socio-political problem by aestheticization of defensive objects are the same that produce such a socio-political problem. The corollary of this thesis is that this problem, recognized by the middle class and the Government as socio-political problem related to poverty (and in particular, to homeless people), cannot be solved by the middle class. Moreover, I point out that the city's embellishment process supposes an inner contradictory practice in order to solve such a problem recognized as socio-political one. We assist to a regressive state of social affairs, because the aestheticization of excluding urban design contributes to further invisibilize the problematic process of social polarization that the city has lived for many decades.

Therefore, I will defend here an immanent criticism of such a process of regressive forms of life. I will introduce the main problems which Rahel Jaeggi deals with in *Critique of Forms of Life* as well as her main theses in the same book in order to reorganize the debate on public urban design and democracy. The general aim, then, is to rethink the challenges of designers, given that their products are not isolated from political practices and discourses which produce not formal, but living instances of democracy.

Figure 2: Example of unusual fences in Montevideo

Antecedents: Common Perspectives

The identification of excluding design as such has become more common in the past decades. Particularly, in United Kingdom and United States, journalists have referred to the issues around the appearance of excluding design objects and procedures. In understanding the excluding design in *latu senso*, Robert Moses' architectural design has been used as example not only by the press (Powell, 6 May 2007), but also by academy (Caro, 1975, Schindler, 2015), due to their notably discriminatory approach. For instance, for some predominantly affluent, white New York neighbourhoods, he designed a parkway that was lower than the average of that time. This meant that buses, which were used mainly by poor black people, could not go underneath them. British press has also called attention to the use of spikes in United Kingdom's urban areas (Blundy, 13 Jun. 2014; Omidi, 12 Jun. 2014) as well as the curious case of using a certain pink light in Nottingham in order to exclude teenagers from some public sites (Omidi, 12 Jun. 2014). Finally, to mention one last example, for a time German train stations used atonal music to expulse people with 'anti-social' behaviour (Marshall, 22 Aug. 2018).

The use of architecture, light, industrial design, and music as tools to persuasion to push people from one urban area to another has been interpreted as a process of political, ethical, and juridical ordering. As Schindler (2015) pointed out, the objects of design, in *latu senso*, require an interpretation from a juridical and philosophical point of view, insofar as the laws and social practical rules are not the sole media to order social behaviours. Design is one of the wide set of social resources that rule human practices. Although there are

particular studies of the excluding design which focus on specific urban areas (Fainstein, 2009; Dawson, 2009; Newman, 1996; Petty, 2017), in fact there are not many researches in applied philosophy that have analyzed this specific phenomenon.

Recently, Karl de Fine Licht (2017) published what is probably the latest applied philosophy research on this phenomenon, where the author aims to evaluate arguments that find political and ethical faults of the excluding design. His starting point is a review by Giovanni de Grandis (2013) of Susan Fainstein's *The Just City*. de Grandis mentions Fainstein's previous work on urban planning and justice (Fainstein, 2009), showing that it establishes the whole discussion in relation to the disputes on the application of John Rawls theory of justice into urban planning. According to de Grandis, "Fainstein claims that justice should be the first concern in urban policy-making." (de Grandis, 2013, p. 37). In this text, de Fine Licht puts the emphasis on the discrepancies of de Grandis about Fainstein's theses, particularly in relation to the open field of research which, according to de Grandis, needed more academic attention. With this paper, de Fine Licht aims to evaluate a specific domain of urban policy-making, i.e., to philosophically evaluate the uses of the called "excluding urban design".

Throughout his article, de Fine Licht introduces arguments against the excluding design to then provide his counter-arguments. While academics, politicians, and journalists have stated that the excluding design has negative consequences for the whole society and especially for the well-being of marginalized people, de Fine Licht tries to refute this statements from different angles. First, according to de Fine Licht, (A) we do not know if, or at least it has not been proved that, there are a set of negative consequences from excluding architecture. Second, (B) de Fine Licht argues that even though some social groups are excluded by urban design, those are not necessarily the most marginalized groups of society. Third, (C) the author declares that "... defensive architecture may actually benefit those against whom it is designed." (de Fine Licht, 2017, 32). Fourth, (D) de Fine Licht holds that sometimes flowerpots, benches, fences, spikes, etc., are bought to satisfy an aesthetical desire, not to morally exclude. It is not ever a question of morals, but aesthetics. Fifth, (E) de Fine Licht states that the duty preventing us from avoiding marginalized people do not impel us to meet them systematically.[1] A sixth de Fine Licht's counter-argument (F) says that excluding design promotes the use of shelters, and, assuming that the shelters give to homeless better conditions of life than the streets, then the excluding design supposes the materialization of a ethical right decisions. Finally, (G) de Fine Licht analyzes the argument that asserts that excluding design is ethically wrong, because everybody has a right to use public places. Nevertheless, he objects that every one of us has the right to use the public spaces, but only if the users do not damage the private property of others.

The Problems of the Common Perspectives

In this section, I want to discuss de Fine Licht's counter-arguments, aiming to evaluate the fruitfulness of his whole framework. Although, I do not deny the philosophical richness of deontological and consequentialist's approaches in applied philosophy, by virtue of the particular Uruguayan social situation, I believe that it is necessary to revisit key philosophical notions about excluding design. As I said in the Introduction, the problematization of the debate's framework can be incidental to rethink the role of design in democratic societies and also the role of the designer in her socio-political context.

I will now analyze de Fine Licht's (A), (B), (C), and (F). Starting with (B), it is necessary to say that any problem of exclusion should be considered a real big problem for a community. If we ask which social groups are the most excluded in Montevideo, the answer is not "the skateboarders". Skateboarding is not practiced extensively in Montevideo and the different local governments have created specific spots to practice it. Moreover, there is not a record of relevant social tensions concerning such a practice. Nevertheless, in Montevideo homeless people are strongly ruled by not only private agents, but also by the local and the State Governments.[2] Against the de Fine Licht's counter-argument then, in Uruguay, the groups that are the most socially excluded are also the most economically marginalized.

[1] However, as we will see later, these last two counter-arguments set out by de Fine Licht are the keys to the better understand of Uruguayan case, because they suppose ideological perspectives which oriented the aestheticization of excluding design in Montevideo.

[2] In Montevideo, as Fiorella Ciapessoni points out, "... the problem of homelessness has become very publicly visible" (Ciapessoni, 2016, p. 113).

I will mention two sources of discrimination towards homeless people in Montevideo. Firstly, the Uruguayan Government has developed a strategy to solve the problem of public safety by promoting. It aims to fight against the insecurity by social integration (Ministerio del Interior [Ministry of Interior], 2012). The expected integration is achieved through the transformation of public infrastructure. For example, one of the most important governmental actions which include, among different spaces, the mentioned skate parks. In contrast, a lot of State buildings have clear excluding design elements, such as fences as those I mentioned above in the introduction of this paper, i.e., they do not cover windows and doors; they cover State public sites where homeless rest. Moreover, the new design of the Montevidean public garbage containers prevent of homeless people from sleep inside them or go through the bins and collect valuables, as these containers turn impossible to take out anything from within them. This governmental strategy is grounded in the law (Poder Lesgislativo [Legislative Power], 2013), which forbids everybody to rest in public spaces. The second source of discrimination has a double aspect. On one hand, to my knowledge there is just one article concerning the excluding design and homelessness (Ferreira, 30 Sep. 2016), i.e., the first aspect is the public absence or omission of the problem. On the other hand, some press journalists have written articles clearly discriminating a heterogeneous and marginalized population in Montevideo (Melgar, 7 Apr. 2016).

Both the Uruguayan self-comprehension and the governmental aim concerning the integration of Uruguayan people seem to clearly contradict the actual circumstances of everyday life. The question is if these contradictions are just mere contingencies or if they are related to a big structural problem. We Uruguayans tend, on one hand, to believe that we are very tolerant to different people (Achúgar, 2002) and, on the other hand, we seek an integration of all of us by designing objects and writing laws which produce the opposite expected effect. No one of these sources of ordering the social behaviour of marginalized people seems to emerge *ex nihilo*. The number of homeless people has increased considerably in the last decade. According to the last governmental census, there are around 1650 people living in the street in Montevideo (Ministerio de Desarrollo Social [Ministry of Social Development], 2016), which represented a 52,6 % notorious increase from 2011. The situation is critical. It seems that we are attending a whole social transformation of the city by virtue of the polarization of people. And, as I said, the Uruguayan press and the academy do not problematize the objects designed to exclude marginalized people and to an extent, they do not regard which are the ideological conditions behind the aestheticized design in urban spaces.

Let us now examine the counter-arguments (A) and (F). If we think that promoting shelters can benefit homeless people, we can also think that to promote excluding design has positive consequences. de Fine Licht's counter-argument (F) can be an answer to the counter-argument (A), because if excluding design foments the shelters and the shelters can benefit marginalized people, then it is possible that the excluding design actually helps them.

Nevertheless, that statement is easily debunked if we take into account the Uruguayan situation. In Montevideo, as in many other cities, homeless shelters aim to contribute to the re-integration their users into a 'normal' life. However, they face big issues. Psychiatrist Esteban Acosta stated in an interview done by journalist Betania Núñez that many homeless people in Montevideo suffer 'hospitalism' or 'shelterism', and the psychological, social, and psychiatric' literature on the topic supports the diagnosis (Núñez, 30 Sep. 2016). According to Arapoglou, Gounis, and Siatitsa (2015), the 'shelterisation' is:

> *[...] a type of institutionalisation specific to homelessness refers to the effects of prolonged dependency on institutional regimes that tend to colonize a homeless person's everyday routines in ways that render long(er)-term life paths and objectives impossible even to contemplate. Contrary to what may appear obvious meaning of the term, we view shelterisation as a structural condition [...], there is ample documentation of the ways in which these settings, as well as the wider array of emergency services for homeless persons, capture the time and exhaust the energy of those that have to stay there. (Arapoglou, Gounis, & Siatitsa, 2015, p. 140).*

It is unacceptable to think that shelters, at least in Montevideo, have only benefits to homeless people. de Fine Licht's consequentialist and deontologist approaches do not help us to decide the legitimacy or arbitrariness of excluding design in Montevideo, because the excluded population are mainly, it seems, a marginalized one and because the benefits of exclusion are not clear. The consequentialist's ethic theories, on the one hand, hold "... that normative properties depend only on consequences" (Sinnott-Armstrong, 2015). As we examined, the consequences of excluding design in Montevideo can not be the foundations to accept such a design. However, to deny these foundations, *ipso facto*, do not allow us to affirm the opposite thesis. Moreover, the deontological approach, on the other hand, does not allow us to understand, by its proper definition

(Alexander & Moore, 2016), the socio-political conditions of excluding design in Montevideo. This approach constitutes an example of "external criticism" (Jaeggi, 2018), because the choices are judged by normative principles which are not intrinsic of the forms of life in question. In other words, it does not matter what the context is, the norm used to judge choices is ever employed.

Hence, we need to satisfy two theoretical conditions to examine the excluding design in Montevideo. 1) The empirical information of the social situation in Montevideo seems relevant to analyze the excluding design, because we are facing big socio-political tensions. Therefore, the evaluation of excluding design needs an "internal" approach, i.e., to comprehend the proper characteristics of Uruguayan forms of life. 2) Nevertheless, such an evaluation requires transcending the empirical conditions which merely describe the phenomenon in order to achieve, in turn, a normative evaluation of such a particular phenomenon. Then, the internal criticism does not allow for itself to satisfy this second condition, because an internal criticism of forms of life, according to Rahel Jaeggi (2018), inhibits the possibility to transcending the *statu quo*. i.e., it does not question the initial conditions of one community's problematic practices.

Nevertheless, the contemporary theoretic landscape offers an alternative to consequentialists and deontologist's ethic approaches and also to the agonistic democratic approaches. DiSalvo, for instance, holds a perspective on design and democracy from the Ernsto Laclau and Chantal Mouffe's theses (Laclau & Mouffe, 2001). However, as Rahel Jaeggi points out (2018), we need not only to recognize the different conflicts and tensions of democratic forms of life, but also the possibilities to rationally thematize and discuss the achieved solutions which some forms of life employ to solve their socio-political problems. The idea of normativity cannot be strictly founded on the agonistic perspective of Chantal Mouffe (2016). Hence, it is difficult to satisfy the two theoretic conditions from her theoretical point of view[3]. For these reasons, I propose an immanent criticism to understand and evaluate the excluding design in Montevideo. I look for the comprehension of the contradiction between the discourses and the practices – we can remember, for example, the contradiction between, the self-comprehension of Uruguayan people and their practices, as well as the government's contradictions between its aims and its laws and practices. But I also look for to demonstrate that these contradictions are not contingent ones, but that they are structural ones.

Figure 3: Example of traditional ornamental fountain

[3] "In fact, it seems to me that contingency is incompatible with any particular normative claim that might follow from it." (Cross, 2017, p. 189). Ben Cross, by virtue of his own reasons, would be accept the critical theses of Rahel Jaeggi against the possibility of a normativity in a agonistic democratic's framework.

Aestheticization design as a Regressive Form of Life

I argue that Rahel Jaeggi's thesis is the best alternative to the discourses on deliberative democracy, i.e., to those conceptions which engage us with the principle of ethical abstinence (NOTA AL PIE) and I consider it to be the best alternative to agonistic democratic approaches, because Jaeggi recognizes the inherent conflictive processes of any form of life, and also she also recognizes the normative inherent character of them. The immanent criticism can make the social structures visible. Moreover, the visibilization of the contradictoriness of some social practices would open the social black box processes to alternative solutions. In this way, the naturalized solutions inherited by a form of life leave behind their fate character. In other words, to visibilize the inherited character of socially interpreted processes of problem-solving (social practices or forms of life) contributes to determining a *factum* as a historically interpreted problem-solving process. As I think, the whole framework of an immanent criticism allows us to evaluate the entire ideological conditions of a democratic system. Such a framework makes possible to determine the social tensions, identifying, in turn, their deep social axiomatic. All of that also gives the conditions to problematize the forms of normativity and rationality involved in social practices. In this theoretical context, the designers confront the challenge of reflecting on their role in a global form of life where, and by, they produce design objects. Clearly, that reflection can be the starting point to problematize the nature of the design objects as the materialization of forms of life. Therefore, I think that the hard problem of designers facing our democratic political organizations is precisely to ask themselves about the global process of social transformations where they live.

Following the example of immanent criticism analyzed by Jaeggi (2018), we can evaluate the excluding design in Montevideo. As Jaeggi points out, Hegel recognizes a structural relationship between the independence of modern individuals and the dependent character of their interests to social institutions – essentially, the market. The procedure of immanent criticism supposes, therefore, three pre-conditions and three active procedures as such. Firstly, the immanent criticism recognizes the necessary relationship between some social norms and practices, and then its primary task is to identify the no contingent character of such relationship. Secondly, the immanent criticism recognizes that one practice is necessarily constituted by a set of norms, and then its second task is to determine such a constitutive character. Finally, the immanent criticism finds the inner contradictoriness character of a practice by virtue of its constitution by a set of norms. And then, such contradictoriness character is not contingent, but structural. Therefore, the immanent criticism claims to demonstrate the structural character of the practice's contradiction by virtue of a norm. By this procedure, the evaluative moment of immanent criticism emerges from the research on the interpretations that one community makes of itself and the practices and products developed and associated to these interpretations. The process of transformation of a practice, then, is a process of the transformation of the interpretations of problems and solutions which a community has to deal with. The role of the Thomas Kuhn's thesis on scientific progress is not minor in Jaeggi's thesis. According to Kuhn, a successful theory depends precisely on the interpretations of one problem made by a scientific community. If one community holds the high capacity of a theory to solve its own big problem, then such a theory becomes the best candidate to guide the further subordinate problems and then to pilot successfully the future scientific researches. One theory is successfully only if it is capable to formulate a problem that is, according to its community, solvable without turning less economic or more obscure their original formulations (Kuhn, 1996). Hence, in analogous way, one form of life is successful if their solutions to its big problem do not imply some sort of regression, i.e., if they obscure or invisibilize more and more the social axiomatic structures which produce such a problem.

As I mentioned above, Montevideo not only has different fences, but also has ornamental objects situated in usual places. If we think about the differences not from a synchronic point of view, but by attending the increase of homelessness in Montevideo it is possible to hold one diachronic thesis. The fences have historically changed their function, because they reflect the transformations on the relationships among the Uruguayans. In the first place, we can recognize a first moment in the Montevidean 20th century when the fences were becoming aesthetic objects oriented by aesthetic functions (to use a balcony). Then, the defensive fences emerged, due to the socially interpreted problem of insecurity. By virtue of such a problem, the fences started to cover the whole doors and windows of Montevidean houses and buildings. More recently and in a third stage, we witnessed the emergence of fences that do not cover any door or any window. These fences clearly have a defensive function, but such a function does not seek to protect the indoor of houses. These fences do not fight, therefore, against the insecurity itself. It seems that these fences are designed and positioned to push homeless people out. As we can see in the Figure 2, these fences cover outdoor places used by the homeless to shelter themselves from wind, sun, and rain. Therefore, the problem is not only the insecurity, but the disagreement or distaste, because it is also a question of aesthetics of poverty, concerning

other forms of life. But, finally, we have a fourth big social transformation. In middle-class neighbourhoods the flowerpots and tubes are putting in the same places that could serve as potential shelters. But why are these decorative objects chosen to the detriment of the fences? It is just a mere variation of the practical decisions involved in using the newer fences? It is possible to find the primary answers to these questions in a lucid paper by James Petty (2016).

Treating the famous case of London spikes (Petty, 2016), if we examine not only the press reactions to these spikes in London, but also the point of view of the residents and The Mayor of London, we can conclude that one of the main focuses on such an issue is an aesthetic one. Quoting a Leonie Sandercock's paper (Sandercock, 1997, p. 30), Petty argues that the spikes controversy visibilizes the imaginary shared by some London citizens, i.e., the ideal image of a clean, sanitise, attractive, and safe London. This ideal image of London involves a tight implementation of the order, in particular, of urban control. However, this procedure visually shapes the urban landscape, sometimes contradicting the ideal image of the city. The spikes issue formulates, in *latu senso*, a contradiction between the ideal images of London and the seeking of the city's security. This case also sheds light on the protests against the installation of spikes, because they would affect as the homeless do such ideal images of the city. If we reflect on that, we can state that the process of aestheticization of the cities implies the update of the social answer to the spikes issue. If the materialization of social control is aestheticized, then we can shape a city where social tensions seem to be inexistent. Nevertheless, this process of aestheticization is a worldwide tendency. Choon-Piew Pow (2017) shows that the governmental urban city planning in China is increasingly oriented by aesthetic virtues, in particular, the idea of updating the harmonious experience of cities. In a previous work on the Shangai's process of aestheticization, Pow holds that:

> *By being thoroughly aestheticized, class relations are depoliticized and reduced to questions of lifestyle, consumption patterns, taste, and visual pleasure. Ultimately, the paper contends that in gated communities such as Vanke Garden City, the celebration of landscape beauty and appearance masks the interrelatedness of issues of aesthetic and class identity on the one hand and broader problems of urban inequality and segregation on the other. The seemingly innocent pleasure in the aesthetic appreciation of landscapes and the desire to protect the beauty and aesthetic qualities of landscape can act as a subtle yet highly effective mechanism of social exclusion and the reaffirmation of elite class identities.(Pow, 2009, p.387).*

Figure 4: Example of fences and flowerpots covering possible shelters

If an immanent criticism implies the determination of a structural no-contingent relationship between practices and norms, we find the relationship between the aestheticization and "urban inequality" around the world. It seems, then, that the Uruguayan process is not an isolated phenomenon of aestheticization of political ordering of urban spaces. In the imaginary of peaceful city produced by the Uruguayans, Argentineans, and Brazilians we can find Punta del Este as an exclusive beach town in Uruguay, hosting thousands of tourists from Uruguay, Argentina and Brazil. It is the most aestheticized city in Uruguay and the reasons for that is precisely associated with the idea of relaxing life which, in turn, supposes letting behind the urban landscapes of very conflicted places as Montevideo (Uruguay), Buenos Aires (Argentina), and Porto Alegre (Brazil). In fact, there is evidence of the increase in fences in public spaces in Buenos Aires, and specifically by virtue of the recent political and social conflicts in Argentina (Chronopoulos, 2014). Such an idea of a relaxing life is not clearly possible under conditions of homelessness which are not only the homelessness itself, but also the visual and material signs of such homeless people. The aestheticization of Montevideo has its model in Uruguayan beach towns as Punta del Este.

Figure 5: Example of flowerpots covering a possible shelter

Nevertheless, what is the nature of the structural relationship? I think that it is necessary to determine more precisely the perspectives of Petty and Pow from the Jaeggi's immanent criticism. The ideal of harmonious city materialized in aestheticized objects implies the conditions which produce the problems to the aestheticized solutions come from. The fourth phase of the middle class form of life supposes the pacification – control – by virtue of aestheticization of the urban landscape. If we attend to the de Fine Licht's counter-arguments (D) and (G), we can hold that, on the one hand, the politics are usually excluded from the aesthetics and, on the other hand, it seems that what the Montevidean middle class wants to do is to avoid any sign of poverty from its visual urban landscapes. If we put together both counter-arguments, we can hold that the aestheticization implies the exclusion of politics from the horizon of Montevideo's visual aspect. If we argue with Jaeggi that

the democratic system not only supposes the integration, but also the disagreements of different forms of life, the aestheticization has its ideal image in the dissolution of the socio-political conditions of democracy. Let us consider the moments involved in such a process. Firstly, the aestheticization of Montevideo seems to imply ideals of full safety, purity, health, and harmony of the city. Secondly, these ideas imply the dissolution of other divergent forms of life, especially the marginalized ones. Thirdly, the diverse forms of life are constitutive of politics and, in particular, of democracy according to Jaeggi's perspective. Fourth, for Montevidean middle-class, aestheticized design is the counter face of democracy. Fifth, the middle class seeks to solve the disagreements with others by using aestheticized design. Sixth, the aestheticized design, therefore, supposes both the claim to solve the disagreements and the dissolution of other divergent forms of life. In other words, the aestheticization supposes the solution of a problem and also the violence that it pretends to solve.

Figure 6: Example of tubes covering a possible shelter

If we consider once again these moments not from a synchronic point of view, but from a diachronic one, the aestheticization turns itself a late moment of the invisibilization of the disagreements of different forms of life. The fences do not cover themselves as defensive objects, i.e., they do not hide the disagreements. Therefore, they are urban signs of different forms of life in conflict, although these conflicts were understood as the obvious material exclusion of homeless. However, the aestheticization goes deeper in the divergence, as there are no any public sign of conflict. Because it does not produce an explicit sign of conflict, it presents the apparent image of the solution of its original problem. In this way, the aestheticization of excluding design strengthens the problem and, then, produces an ideological image of society – an inverted image of society. Hence, it is not a successful moment of the problem-solving process, because it does not visibilize the different phases of the conflict and the different interpretations of these phases. Therefore, we can say that the aestheticization of urban Montevidean design has a regressive nature.

Conclusions

If we do a close examination of the Uruguayan social reality, the deontological and consequentialist's ethic approaches to excluding design do not allow us to comprehend the relationships between democracy and design in the country. There is evidence that does not support de Fine Licht's counter-arguments against excluding design. The whole debate on deontological and consequentialist norms is under discussion, because the most excluded people in Uruguay are marginal and because such people are tensed by the Scylla and Charybdis of, on the one hand, being expulsed from streets by civil, private, and governmental dispositives of control and, on the other hand, the harsh living conditions of shelters. Nevertheless, it is possible to give another framework to examine and also evaluate the legitimacy of excluding design in Montevideo. The immanent analysis proposed by Rahel Jaeggi can satisfy the double nature of a descriptive and normative philosophical framework. Proceeding to analyze the Uruguayan aestheticization of urban design, it is possible to recognize this political role of such a design. It cooperates to increase the process of social polarization, since it covers the social coercion into an aesthetic turn. This aesthetic turn contradicts, for its part, the deliberative, agonistic, and immanent perspectives on democracy, because, firstly, it invisibilizes the social conflicts, then, secondly, it does not allow a public discussion about it and, thirdly, because it does not visibilize the historicity of its ideological structure. Therefore, such aestheticization inhibits the political development of democracy in Uruguay.

Although this paper deals with the different phases of Uruguayan social changes, the aestheticization of urban areas is not an exclusive phenomenon of Uruguay. This paper aimed to methodologically contribute to analyze the particular characteristics of the problem-solving tendencies embedded in the world wide aestheticization. Therefore, no matter the designer's particular social circumstances are, the most political challenging problems of design are, firstly, the self-consciousness of the forms of life materialized in projects and design pieces and, secondly, to question the political legitimacy of these projects and pieces. The critique of forms of life, therefore, is also one of the designer's tasks. The awareness of the ideological framework of design's practices is a condition to question the world wide process of the depolicitization of democracy triggered by aestheticization.

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A Framework for Civic Conversations

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Systemic changes in people's relation to democratic government and governance have been widely noted over the last 40 years. Concurrently, participation in civic life has declined. Drawing from approaches in service design, this article proposes a design-led structure for democratic engagement that serves two goals: the provisioning of people's expertise on policy decisions for governmental use, and scaffolding of civic life. The paper details a structure that has been tested and refined in over 30 community meetings, and suggestions for effectively evaluating meeting outcomes.

Keywords: civic life, conversation, deliberative democracy

Introduction

For democracy in the United States, and for democracies across Europe, it is becoming increasingly apparent that a combination of factors is contributing to a larger trend towards democratic deconsolidation. Over the last 30 years, increasing numbers of voters make critical choices informed by single-issue political organizations, vote for so-called populist candidates, or align themselves with political parties that claim to be anti-establishment (Foa, Mounk 2016). Social media networks like Twitter, Instagram, Facebook and YouTube have become a site for increased participation in political debate (Vaccari, Chadwick, O'Laughlin 2015), but that participation does not correlate to increased comprehension of the issues at stake (Kalsnes, Krumsvik, Storsil 2014).

Further, democracies exist on a substrate of a larger, supportive society. Yet the mid-level structures — civic organizations — that contribute support to civic life have been in decline over the last 30 years (Putnam 2000). In a review of recent scholarship of this critical mid-level of US society "What We Do Together" (2017), a report prepared for the US Senate Joint Economic Committee, details the decline of what the authors refer to as associational life over the last 45 years. The lenses through which associational life is viewed in this report are: families, religious congregations, secular communities, and workplaces. Across these domains, the report cites a trend where Americans "prioritized individualist goals and professional pursuits over the sustenance of yesteryear's robust associational life." (p45) Further, in the quarter-century since he conceived of it, Manuel Castell's (2010) space of flows (the digital communication network enabled by the internet and small computing devices) has displaced more traditional social structures organized around places. In Castell's space of flows digitally organized communities of affinity replace neighborhoods as key social units.

While it is not within the scope of this article to offer a full treatment of either democratic deconsolidation, or the implications of the network society and resultant major transformations of social life globally and in the United States, it is within this frame that contemporary democracies must work. Municipal governments are inherently place-based, and depend for their functioning upon an infrastructure of support that is also place-based. Municipal governments supply communities with very direct and instrumental needs, and rely upon residents of the community for feedback that directs and shapes the provisioning and functioning of

government services. In short, while the network might facilitate a set of relationships that are far-flung and time-shifted, municipal governments operate in a world that is circumscribed by local city limits, imminently material, and bound up with concerns of provisioning need to community members. In a set of social structures that were more place-based, where relations were structured principally around proximity, matters of concern (Latour 2004) might have been encountered at the workplace, in the parent-teacher association, again at the bakery or the greengrocers, and again at church. This suite of contiguous but independent institutions engendered more replete relationships based upon spatial proximity. Essentially, people worked, participated in religious and civic life, engaged with the schools near the neighborhoods where they lived.

However, many different agencies shape communities, besides the once dominant consideration of being physically proximate to one another. To put it plainly, geographic territory no longer exerts a dominating influence over how communities are formed. Yet, democracies are still primarily organized around the stewardship of a particular geographic zone, and constructed with hierarchical levels of authority within progressively larger geographic zones. Where participation in democratic government and governance might have once been supported by a number of civic organizations, membership in these organizations is declining as people elect to participate in more social structures organized around place-independent networks.

In 2012, speaking at Carnegie Mellon University, Victor Margolin offered three ways to consider the relationship between design and democracy. In Margolin's characterization, design of democracy is engaged with designing the institutions of democracy itself — improving the processes and services government provides; design for democracy is engaged with designing the mechanisms of citizen engagement such as voting; and design in a democracy, where the goal of designing is to support actions that are more broadly considered to be democratic in nature, or supporting positive outcomes for a broad range of community members. Margolin enumerates some exemplars of this: maintaining a clean environment, the provisioning of basic needs to people experiencing challenging circumstances, providing quality healthcare. Extending this dialog, Ezio Manzini with Margolin (2017) author an open letter to the design community, exhorting designers to take a greater role in countering trends damaging to democratic governance and participation. Margolin and Manzini add another aspect, highlighting the practice of participatory design: design as democracy.

With the challenges posed to civic organizations, the critical substrate of democratic institutions, in developing new social structures, residents have lost some of the literacy that civic organizations served to exercise and reinforce. Ultimately, this kind of designerly understanding alone cannot "save" civic organizations — the middle tier of social relations — but designerly understanding can approach democratic engagement by scaffolding the interactions of constituents within government. While this middle tier of social relations has begun to deconsolidate due (in part) to the organization of new types of social relation, design can serve to reshape democracy to be more accommodating to participants, as well as support people to reconnect with the local.

The Civic Conversation

Government can, however, work to more effectively support people to engage with policy matters, and can help people to engage more actively with governance and government, and offer scaffolded opportunities to reinvigorate participation in civic life. Supporting civic life could come in the form of design to support the practices of democracy. Margolin & Manzini's categorizations offer an effective way to think about how designers might support democratic institutions, and we designers must also think how design might effectively support democratic practices. One key way that government can help people to connect more meaningfully with civic action is to help people to surface their values in relation to matters of concern that lay before the government. A form that government can engage in to promote this social infrastructuring, is effective design and implementation of a civic conversation.

Conversation is a key component of human activity and civic life. In the context of governmental practice, conversation and speech-acts are components found everywhere. Debate, deliberation, speech making, negotiation, argument are all conversational acts. Conversation is a key act of governing, the fundamental act of human communication—and a principal way that human beings relate to the material world. The offering that occurs in James J. Gibson's affordances (1979) could be interpreted as the opening a type of conversation between the user and the object. Architect Louis Kahn advocated conversations with materials as a mode of discovery for designers (Turkle, 2011, quoting Nathaniel Kahn, 2003). The conversational mode of interaction—two or more humans conversing with one another—is the underlying principle for mediated

communication technologies like email, text-messaging, social networking, and for proximate communications like meetings and expert consultations.

Conversation theory, pioneered by Gordon Pask, created structured definitions and relations between concepts like agreement, understanding, and consciousness (Pangaro, 1996). Conversation theory has cybernetics at its foundation. It is a central aspect of design practice and encompasses the goals of designing for communicating. Within, and tangential to the field of design, practitioners and scholars such as Hugh Dubberly, Paul Pangaro, Terry Winograd and Fernando Flores, Jeff Conklin, and Horst Rittel have examined the theoretical underpinnings of conversation—both as a model for designing, and as a central concern of cybernetics. Following John Searle, Fernando Flores and Terry Winograd developed Language/Action perspective as a way to structure conversations for action to help participants move from irresolution to resolution in a conversational situation (Winograd & Flores, 1986).

Conversations are the medium through which people collaboratively deliberate, or together, make sense of complex situations. Deliberative conversations occur in every knowledge domain. A wide array of academics have researched the deliberative conversations that occur in their own knowledge domain and have provided models and best practices for practitioners to engage in those conversations. James Fishkin (1991), Robert Cavalier (2011), and Elinor Ostrom (1990, pp. 88–102) have offered models for democratic deliberation; these models have been operationalized through the work of Carolyn Lukensmeyer (2007, 2017) and others. Deliberative conversation is a particular type of conversation that has the following characteristics:

Participants are engaged in face-to-face discussion.

Participants conscientiously raise and respond to competing arguments.

Participants arrive at considered judgments about solutions to public problems.

(Fishkin, 2008)

Fishkin's definition of deliberation contains some key words—which we will return to later—that imply how designing to support this format can proceed.

Through the work with the PDD, I, working with Dr. Robert Cavalier (political and pragmatist philosopher, senior faculty at CMU and director of the PDD), Tim Dawson (then a doctoral candidate in CMU's English/rhetoric program) and Selena Schmidt (a public engagement consultant with the Public Broadcasting System) developed an agenda-based approach to serve as the framework for two series of meetings for different clients. Cavalier had been approached by the City of Pittsburgh to help plan new capital budget hearings. Once the initial development of the framework was complete, the practical work of designing and hosting the specific meetings was delegated to me and Dawson. PDD agreed to host the second set of meetings as part of a study in collaboration with the CMU Remaking Cities Institute (RCI). The goal of the meetings was to develop information for the Pennsylvania Department of Transportation (PennDOT) to guide further development along Route 51. At the time, PennDOT was already engaged with the CMU Robotics Institute to analyze traffic flows and develop algorithms to increase throughput and reduce pollution. As a component of that larger infrastructure, the RCI applied for and received funding to create a master plan to guide development. RCI engaged the PDD through Cavalier to conduct the community engagement efforts along the corridor. Dawson, Schmidt, and I were recruited to support this endeavor. The community meeting format was developed collectively over a series of meetings by the PDD group in consultation with architects from RCI. The PDD group elected to use this format for nearly all subsequent meetings.

This format is designed to accommodate a larger number of participants at a formal meeting. Over the course of three years conducting meetings in this format, we have hosted between four and 162 participants at a single meeting. Generally speaking, from the perspective of a participant, a deliberative community meeting designed in this framework takes about 2½ hours. This was done for several reasons: it was generally felt that the longer form of meeting (all day, or two days during a weekend) was extremely burdensome for participants (especially lower-income participants), and not practical from the perspective of executing events that were either unfunded or poorly funded. Perhaps most significantly, the time window was chosen because the City of Pittsburgh hosted similar meetings in the past using that time window, and 2½ hours would fit neatly.

To operationalize Fishkin's deliberative characteristics, PDD works with the following structure for each deliberative forum.

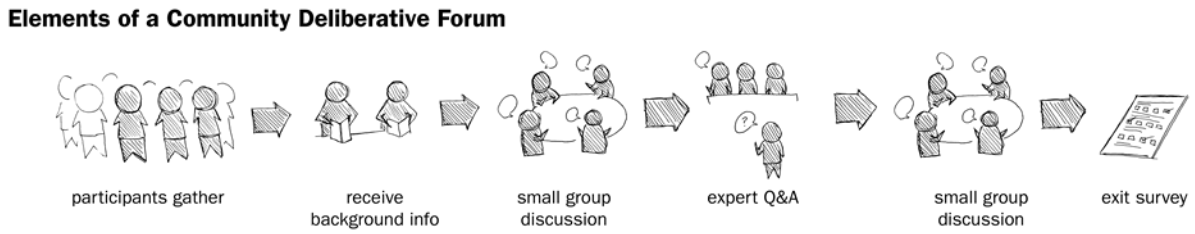

Figure 1: the 6 aspects above are the minimal elements of a deliberative forum

Arrival: **participants gather** and receive table assignment and briefing documents from event staff.

Informal Greeting: participants are greeted by the table moderator, **receive background information** and given time to meet other participants and read the briefing document. We strongly encourage the convening organization to set aside part of the budget for a light dinner for the participants. If food is provided, the participants eat at this time.

Pedagogical Introduction: a nonpartisan "teacher" gives participants a short overview of the topic area(s), what is to be achieved by the deliberation, and an explanation of how data generated by the participants will be used.

Deliberation: led by the table moderator, participants engage each other in free-form **small group discussion** of the agenda issue(s). The briefing document is referred to as a source of additional information.

Question Writing: led by the table moderator, participants write a question or questions to pose to the expert panel for the Expert Questions and Answers (Q&A).

Question Asking: participants pose their **questions to the expert panel** and receive answers.

Post-event Survey: participants fill out an **exit survey** indicating their opinions on the agenda issues, suggest new agenda issues.

Departure: event staff thank participants for their time and thoughts. Participants chat informally with each other and expert panelists.

All of the elements above were iteratively and intentionally designed to create a "smooth" experience. The meetings are staffed by a number of volunteer facilitators and registrar(s), an emcee, a member of the convening organization who shares key information about the context of the discussion, and a panel of recruited experts.

This information is offered for background and a richer understanding, as the focus of this paper will be principally my reflections on the design process that supports these fora and directions for further research. During the development of these fora, I was involved principally as the document designer and collaborated iteratively with the writer (Dawson) to develop briefing materials to support the conversation. This paper details my personal experience with writing, designing, and developing these critical pieces. Data were collected through participant observation throughout the development and planning process. Further data were collected at public meetings, at a post-event debriefing with the table moderators, and with a post-event debriefing with city, county, and committee representatives. During this process, I observed several aspects where the design process of the creation and iteration of briefing materials impose a kind of discipline on the way organizations understand the issues they deal with, as well as the way the deliberative process is informed and even structured by the design process.

Developing supporting materials

Designing a deliberative forum begins with the question, "What is it that we want to know from the people we are convening?" One approach to answering this question is that the initiating organization (city government in this case) has a plan or concept that they want analyzed or validated by a representative group of subjects. In this case, the initiating organization wants to use the deliberative forum as a filter that will pass through validated information, goals, or approaches (Fishkin, 2008). In another approach, the organizing group wants to understand how citizens might prioritize a set of goals or actions, as pertains to their local situation. On some occasions, the organizing group has a general concept for engagement but no clear questions. One

approach that was useful in this situation, is to frame the civic conversation as a learning opportunity, asking what the conveners might want to learn from bringing this group together.

Regardless of the content of this critical question, one of the first steps in preparing for a civic conversation is to prepare a briefing document, which contains background information necessary for the participants to have a legitimate and conscientious conversation of the matter(s) of concern. In the course of the design process, this briefing document becomes a MacGuffin, the object which drives inquiry, prioritization, and the structuring of many other components of the forum. The MacGuffin is a dramatic plot device used in films to introduce tension in the plot and drive action. The reason the character's behavior is driven by the MacGuffin is usually left unexplained. The device was first introduced by Alfred Hitchcock in his 1934 film The Man Who Knew Too Much (Ackroyd, 2016). Following is Ackroyd's description:

> *It is, to use a more familiar phrase, the red herring, the device that sends the plot and the characters on their way—such as the attempt to assassinate a foreign leader in this film—but remains of little or no interest to the audience; it is simply an excuse for all the activity on the screen. (Ackroyd, 2016, p. 61)*

Dan Hill (2012), brings to design the concept of the MacGuffin as a force at work in design projects. Hill asserts that the development of a relatively unimportant object can drive forward a strategic process:

> *The MacGuffin helps drive this process through its gravitational pull, through its requirement for rigour. [...] It is a classic MacGuffin; not especially relevant in itself, but the entire plot cannot exist without it. It is the reason for the entire story, and yet beside the point. The wider story is ultimately more interesting, more affecting. (pp. 55, 57)*

The briefing document is used in the forum, but the participants view the briefing document as ephemeral and not a central aspect of their experience. The process of creating the briefing document, however, drives regular meetings with all stakeholders in the project and forces an in-depth examination of the issues and the language used to describe the issues. These issues in turn structure the agenda for the deliberative event and prefigure the questions that are on the exit survey. The briefing document is that thing that, as Hill states, has enough importance that the design team will be compelled to carry it forward, and will also drive the development process. Though Hill's example of MacGuffin-in-action drives a strategic goal that is largely extrinsic to the design process, the writing and design of the briefing document drives learning and crystallizes a new understanding of the issues within the client organization.

Some challenges of designing for civic conversations

Approaching designing for a civic conversation holds key differences from other design activities. If a designer did not approach the matter in a considered way, a civic conversation might mistakenly be thought of as a conversation between two groups: an expert (members of government) and a client (residents). Yet in actual practice, considering a conversation such as a civic event, the dyadic model of the expert/client expands into a more complex structure. Agency for decision making is effectively owned by elected officials or government staff. The civic conversation exists to provide input on that decision for residents access to the agency of the elected official or government staff, otherwise understood as influence. Minimally, residents gain the perception of agency. While the decision rests with agents of the government, the stakes of that decision are born in different ways. Residents are at the forefront of people who experience the consequences of decisions.

As described by Pelle Ehn (2008) the two central values of participatory design are legitimating democratic participation, and informing a design process through participants' tacit knowledge. Though civic conversations are not participatory design, civic conversation is a closely related activity. Within the context of the work I have done, the central value of an event is to evoke the gradient of opinion and understanding that exists within the room. Because participants construct their perspective of the issues based upon relations to others' perspectives, (Spinosa et al., 1997) this activity is highly relational in character.

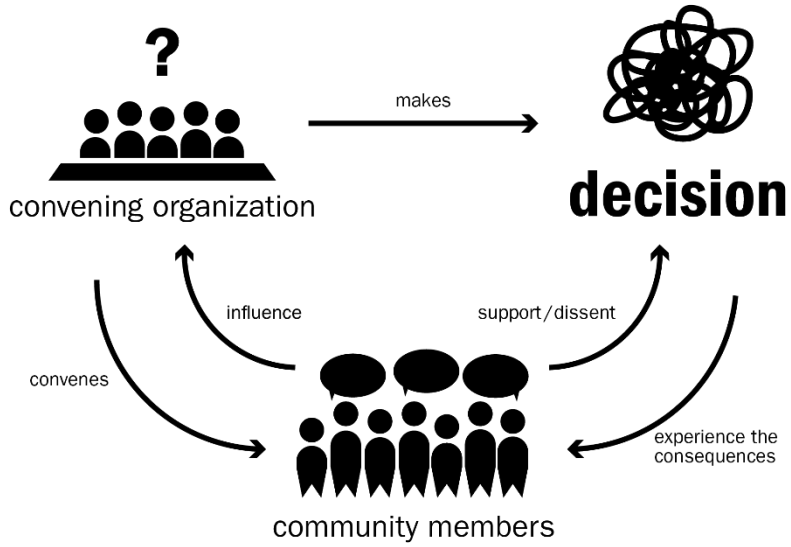

Figure 2 Civic conversations are more complex than the more common expert/client decision-making process.

These civic conversation events can provide a rich psychosocial frame for participants. The act of coming together as a community to articulate a shared future is a powerful metaphor. In his 1991 book, Human Scale Development, Manfred Max-Neef, a Chilean economist, pens a most compelling and thoroughgoing systemic architecture of human need. Max-Neef's approach understands needs across nine categories of human engagement, and four contexts. He suggests various satisfiers that operate across the matrix of 36 contexts/engagement pairings, and describes a number of satisfiers that are synergistic satisfiers that meet multiple contexts/engagement pairings. For instance, in the context of having (things), only the engagement of subsistence deals with material accumulations. One might have a need for symbols of belongingness, values, customs, all of which would fall into a context of having and an engagement of identity . These civic conversations are synergistic satisfiers, in the sense that they offer the experience of satisfiers over several types of engagement of interacting, (understanding , participation) as well as types of planning (doing/protection) and expressing opinions (doing/participation).

How to evaluate a Civic Conversation

Considering the power relations as described above, the question of "who evaluates" these events is worthy of consideration. Typically it is the convening organization, or agents of the convening organization who perform an evaluation of the deliberative event. More rarely, a participant or witness will write an evaluation of an event. In the course of my work I have only encountered these accounts when a participant has what could be termed a "significantly negative experience". Caitlin Luce Christiansen (2017) authored an evaluative account of the public organizational meeting of Indivisible Pittsburgh focused on a conversation that happened after the meeting ended, where two women of color (an attorney and a community activist) confronted a meeting organizer (a CMU faculty member) about the lack of inclusion of people of color in the meeting and the organizational structure of the new organization. The particulars of this account are compellingly written, and it details that significant challenge that was experienced by a number of people, a crucial lapse that was made by the organizers of the event. However, as a tool to improve participant experience from a design perspective, this account principally underscores well-understood foundational principles of constructing an inclusive dialog in a public space. An aggregate of personal accounts serves to construct one aspect of understanding of events.

This is not to say that informal or de-institutionalized evaluative accounts have lower value to the design process. An important consideration when designing to engage with communities that have experienced trauma at the hands of other groups, is centering accounts (like Christiansen's above) that question the trustworthiness of the conveners, or the convening organization. For many participants, civic conversations are not one-off events, but are perceived in the continuum of a history of acts by a political administration or other organization. The above account details a broken trust. Trustworthiness of an organization is a compelling aspect. Considering the organization by extending the idea of interpersonal trust, people come to a

civic conversation with a history of relationship, but also with some hope that positive outcomes will result from the engagement. People from groups that have experienced trauma at the hands of another group may have a deep-seated mistrust of such events. It may take concerted outreach, followed by years of successful experiences with an organization for people to begin to believe that that organization might be trustworthy. (Stalvey, 1989)

For a citizen to desire to be a part of a civic conversation and consequently attend implies the existence of three states.

Table 1 Heuristic of factors that support civic conversation

Trust (memory)	**Need**	**Hope**
Past	Present	Future

Another possible way to evaluate the civic conversation is to use the heuristic above: does the event provision for these states of a person? Does the planned experience offer an opportunity to explicate needs that the person is experiencing? Does the event as a process validate that explication by offering the potential for a positive future vision to be realized? Is the event hosted by trusted entities?

Over the three years of fieldwork I have met only a handful of people who have attended more than one meeting that I have hosted. Even those who have attended multiple meetings have an engagement with the topic, a need that is a part of their present life-moment that intersects with the topic of the meeting in some fashion. Need is one aspect (perhaps the primary aspect) that contributes to a desire to attend. While experiencing need is not enough alone to ensure that someone will attend, need is one compelling factor that drives participation, even in the light of low trust and low hope.

The more overt needs that drive attendance are typically tied to a perceived threat to one's neighborhood or business, or the potential for a perceived gain. This is known colloquially as NIMBY (Not In My BackYard) politics. But this solipsistic point of view merely replaces other politics that are inadequate to the challenge of approaching complex, systemic issues. NIMBY politics can be interpreted as a rejection of decision-making by experts (Ravetz, 1999) or as a symptom of "low resolution" within the broader system of civic feedback. (Boyer & Hill, 2013) For Boyer & Hill, NIMBYs would like green projects accomplished, but do not want to bear any of the burden of those projects, or experience any consequences. However, in spite of Boyer and Hill's characterization, NIMBY-ism should not be viewed as a problem that must be dealt with. It is important to understand that, especially for people attending a civic conversation for the first time, there exists a strong likelihood of attending because of a NIMBY-related need. NIMBY-ism, far from being a potential negative is merely one aspect of viewing an issue that will motivate a person to take action and initiate action through civic conversations. The other side of NIMBY that drives attendance at civic meetings is what I would call a "pothole mentality" is where participants think about the issue that they are passionate about (e.g. potholes on the roads that they use regularly), without considering the broader context of that project, or thinking about their needs in light of the needs of the entire street or neighborhood. Essentially though, these needs – whether they are framed positively or negatively – are what inspire someone to be involved in a civic conversation. Perceiving that the civic conversation might be a site to speak about a matter of concern means that participants are properly connecting their foregrounded, perceived needs to the opportunity to speak back into the system of government.

One important aspect of this work centers around the designer's reframing of people's conversation. When people come to a civic or public conversation bearing their matters of concern, the conversation has the potential to be a veritable potluck of matters. Through framing the process with scaffolding documents, framing the experience as a search for what neighbors need to discover about problem, the designer has the opportunity to help people organize their matters of concern, and understand them in the light of the concerns of their neighbors. Ultimately, these meetings represent the potential for opening of neighbor's worlds to other worlds through disclosive conversation. The designer is part of the process to design the physical environment, but also to shape the social and conversational environment towards inclusive discourse that evokes participants' lived experiences. Through considered research, through engagement in the network

of stakeholders that surrounds these issues, designers play an important role that isn't taken up by other actors.

Conclusions

Design and designing are acts that are inherently bound up with the creation, shaping and maintenance of society. Democratic government offers explicit and structured opportunities for participation through voting, but can also support richer engagement with people through the medium of civic conversation events. These events, in addition to providing rich data on people's situated knowledge and experience of the effects of policy, can also act as a support to and an opportunity to practice re-engagement in civic life. Through a series of successful events, designers have an opportunity build trust, surface need, foster hope, and strengthen democracy and civic life.

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Research Perspectives IN THE ERA OF Transformations

'Democrazy', designing for democracy in Eastern Europe

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For design to attend to democratic endeavours it is not enough to rest on the claim that design is implicitly political, but to understand how democratisation — often in the name of political modernisation — has designed different social realities. Focusing on the 'how to' of infrastructuring for democracy has advanced a designerly politics-in-practice, and exploring political concepts in design experiments have made design more aware of the democratic conflict. Theoretical work-in-progress, this paper asks whether the concepts internalised within design literature are valid enough to think about infrastructuring for democracy in the context of Eastern Europe. We depart from the theoretical and practical difference between *design for politics* and *political design* to 1) understand how each of these concepts enable a *democracy to come* in Eastern Europe's Romania, and 2) what are the entry points for design research to understand the *democratic experience*. We explore this through a participatory intervention in Bucharest.

Keywords: infrastructuring for democracy, political design, design for politics, Eastern Europe

Introduction

Within the past decades, design has gained a rich repertoire of methods and techniques to argue for its capabilities in shaping democratic processes and democratic systems. By now there is a general shared consensus that design is both about *technical capabilities* and *ways of thinking*. It has explored democratisation by intervening, amplifying and building various movements with distinct democratic endeavours and priorities that came to be labelled under diverse design approaches such as participatory design, cooperative design, design activism or community infrastructuring to just name a few. The literature that has grown around calls to explore relations between design and democracy merges inspirations, readings and adaptations from scholarship on critical reflection *in* and *for* a democratic society, on publics coming together to address the democratic conflict, on how object-oriented politics can challenge social orders and representation, but where **infrastructuring (by design)** is an always-relational politically committed task. At the same time, there are nascent discussions on how **democracies (by design)** have played out in *the political* and *politics* of different socio-cultural settings. Theoretical work-in-progress, we are less concerned about the **'how to' of the infrastructuring for democracy**, and more focused on what it entails to **understand the democratic experience from the lens of design research.**

To attend to questions of democracy, design has been building on concepts from democratic theories and political philosophies to inform *the design object* (the material/immaterial result of designing)*, the design process* (activity, organisation, system and conduct of designing), and *the design agency* (mode of expression and the designed object as it acts on the world) (Willis, drawing on Fry, 2006). While these categories made use of the political concepts to inform the dialogue on design and democracy, they have not been studied

specifically in relation to democracy and not contextualised within different democratic experiences. The recent 'Democracy Design Platform' by Manzini and Margolin (2017) provides an opportunity for that, but it also begs for more rigorous investigation whether the conceptual arrangements borrowed work in democracies other than Western.

The call departs from the assumption that democracy is 'the condition that citizens wish to live with in a political system' but leaves it open to interpretation: "We do not have to share exactly the same idea of what democracy is: to defend it as a core value, it is enough to recognize the strong convergence between democracy and design" — a huge 'design project' that could be approached as follows:

> *design of democracy - improving democratic processes and the institutions on which democracy is built; design for democracy - enabling more people to participate in the democratic process, especially through the use of technology; design in democracy - building access, openness and transparency into institutions in ways that assure equality and justice; design as democracy - the practise of participatory design so that diverse actors can shape our present and future worlds in fair and inclusive ways. (Manzini & Margolin, 2017)*

The first three pillars seem to attend to the *sociotechnical dimensions of modern democracies*, while the last one suggests the *free practice of participatory design within a liberal social order*. Critics point out the open-endedness of this mission as a 'vague commitment' that positions design in support of liberal forms of democracy over alternatives (Tonkinwise, 2017). For design to respond to this challenge means to deal not only with the political principle and the structure of modern democracy but also with its sociomaterial histories and practices and their political and cultural dependences, as well as with its 'undemocratic designs' (ibid.).

For us the call means, first, a provocation to think about the *design-democracy relation* as linked with the *design-politics nexus* (Keshavarz, 2015) to challenge existing democratic frames, and consider ***ways to infrastructure for democracy*** **that are responsive to already produced** *democratic experiences.* In this, we approach **design as a philosophical/practical quest about democracy** that allows us to think about this relationship in terms of possibilities of **theories and praxis for *politics* and *the political*.** We ask whether the concepts internalised within design literature are valid enough to think about infrastructuring for democracy in the context of Eastern Europe. To respond to this, we first discuss the key conceptual developments within design literature in relation to the democratic theories design draws on. We then correlate this with democratisation in Eastern Europe, and sketch out an illustrative example of a design intervention in Bucharest in Romania.

Infrastructuring for Democracy by Means of *Politics* and *the Political*

Learning-by-doing has made design more aware of the democratic conflict[1] that is a shared concern as well as a polarising debate in democratic theories. Participatory Design (PD) has been exploring a mutual learning between **participatory democracy** and **radical democracy** by combining concepts from both theories in 'democratic experiments (in the small)'. These explorations have found conceptual guidance from various strands of the socio-technical, systems development, action research tradition and sociomateriality, as well as pragmatist philosophy. They supported PD to theorise *designing (for) politics-in-practice* from the perspective of *participation* and *representational collaborative practices*.

As PD increasingly engaged with the public sector, scholars made use of Chantal Mouffe's agonistic democracy to frame the sociomaterial struggle for hegemony of the publics that come together to articulate and address issues, and their consequences (Björgvinsson, Ehn & Hillgren, 2012ab; CAL Dantec & DiSalvo, 2013). Here, the Deweyan public and Mouffean agonism are combined to enable infrastructuring for democracy through *participation in design Things* and *strategies of infrastructuring*. In this, design must consider the rights and world of nonhumans too, if it is to restore a liveable human-nature relation and address ecological democracy (White, 2018). By doing the work of agonism PD practices such as *thinging, infrastructuring* and *commoning*

[1] Mainstream thinking about the democratic conflict focuses on reaching consensus in conflicts that entail decisions about ways of ordering and organising human existence in a society. While pragmatist approaches tend to rely on human capabilities generating aims and methods to solve problems for public interests (e.g. Dewey, 2012), radical theorists stress to recognise the conflicts and division inherent in politics, their irreconcilability and the antagonistic nature of social relations that emerges from the practice of political, symbolic regimes of the social (Mouffe, 2015; Rancière, 2014).

have tried to address the key questions that radical democracy, according to critics, has struggled to address: that of institutionalisation and institutional change (Lotado & DiSalvo, 2018). But as acknowledged by design scholars too, it is becoming increasingly insufficient to only design processes for participation (Tonkinwise, 2017; Bardzell, 2018; Bannon et al, 2018) that diversify adversaries through agonism to eventually challenge the status quo, or to examine the political potential of nonhumans in politics in order to democratise sociotechnical practices (Marres, 2013; Bardzell, 2018).

Infrastructuring[2], conceived as a strategy, practice and analytical lens, has enabled PD to think beyond the temporal and spatial event of a designed project in relation to democracy (Bannon & Ehn, 2012). However, scaling up from the 'democratic experiments in the small' continues to be a struggle. Furthermore, within PD's rich practice-based explorations there continues to be a productive tension between infrastructuring as perceived within design literature and political concepts rooted within deconstruction. This becomes even more relevant when considering *infrastructuring for a 'pluralist democracy to come'* and address questions of inequality beyond the liberal democratic context. While radical democrats, such as Mouffe and Laclau, Rancière and Wolin, draw attention to the weakened preconditions for participatory democracy and deconstruct institutional critique, participatory democracy of Carole Pateman has been concerned with empowerment, citizen participation, and has developed tools for institutional change and institutionalising participatory forms to sustain democracy (Vick, 2015). While radical democratic thought sees disagreement inherent within democratic politics via the concept of agonism, participatory democracy is focused on decision-making and designing the conditions where participation can happen. Both theories have much to teach design, just as design can contribute to articulate forms, shift action and make concepts work in practice. Thinking about infrastructuring for democracy, design might benefit not only from understanding how different democratic theories have treated participation but also how democratisation projects have carried out infrastructure(ing), and how, within those infrastructures, social movements mobilised participation for democratic ideals (Della Porta, 2011).

Focusing on '**how to' infrastructure for democracy** has equipped design with a variety of tools and repertoires. But in order for these to work *in* and *for* distinct social realities, it is important to understand the **democratic experience**. In this, the conceptual and practical difference between design for politics and political design, as differentiated by DiSalvo (2010) based on the Mouffean distinction between politics and the political (2005), is highly relevant. Drawing on Derrida's approach of the democracy 'to come' and a Wittgensteinian practice-based approach to political rationality, Chantal Mouffe develops her view of agonistic pluralist democracy as a response to the universal-rationalist view and the deliberative approach to democracy. 'To come' seems to keep a necessary distance to grasp the tensions occurring between politics and the political, specifically to reflect on how different conceptions of democratic logics get inscribed within a given social order. For Mouffe, the political is the dimension of antagonism that can emerge from any social relation, while politics thrives to set an order and organise social conditions that are inherently political.

Accordingly, **design for politics** supports and improves the mechanisms and procedures of governance (by e.g. increasing the efficacy of voting, mobilising voters, making the government more transparent and efficient), whereas **political design** is concerned with questioning and challenging issues and conditions of existing structures (DiSalvo, 2010). By doing the work of agonism, political design's purpose is to 'create spaces of contest' through objects and processes of design that equal 'sites and means of agonistic pluralism'. These might enable investigations into different democratic experiences to formulate alternative conceptions of democracy. One objective, according to DiSalvo, is to 'identify new terms, themes and trajectories for action that sit opposite the known practices and discourses of design for politics' (2010). In terms of infrastructuring this suggests, that **both design for politics and political design constitute a set of practices of infrastructuring**. While design for politics by improving existing structures and mechanisms 'infrastructures (already) hegemonic relations', political design works to reveal and deconstruct those to then reconfigure them. Design's strength, accordingly, lies in 'giving form to a political condition' (or some aspect of it) and in 'shifting towards action'. In

[2] *Infrastructure* has been the focus of sustained inquiry of STS, history of technology, media studies, anthropology, literary and cultural studies too. *Infrastructuring* within PD, as borrowed from information infrastructure and developed by PD scholars, refers to an 'ongoing designing' that defers some aspects of design until after the completion of a design project as a way to support the potential for redesign for unanticipated use or other unanticipated change (A.Telier 2011). It 'entangles and intertwines with the potentially controversial composition of priori infrastructures, previous design activities, along with everyday design activities in actual use such as mediation, interpretation and articulation, as well as actual design-in-use such as adaptation, appropriation, tailoring, redesign and maintenance' (Bannon & Ehn, 2012, p.57).

the case of Eastern Europe, the political condition is marked by the frustrations of post-communism and failures of previous democratisation processes. To infrastructure for democracy in Romania, for example, one must deconstruct the democratic experience, make sense of the what went wrong with previous democratisation projects and the blind alleys of the existing infrastructures. In order to be able to contest the hegemonic relations ingrained in civil society practices and revitalise democracy as a political system, political design must **identify the terms and conditions of citizens' hopes**. We next draft a brief overview of the democratic experience in Eastern Europe and reflect on a pilot for citizen's manifesto in Romania.

Democratic Experience in Eastern Europe (EEU)

Democratisation projects have been complicit in geopolitical games that made use of conceptual divisions and structural boundaries to promote their ideological self-interest, which in turn created imagined communities, such as Eastern Europeanness, and defined their **democratic experience** (Wolf, 1994). Visions for democracy in (Central) Eastern Europe have focused on testing and implementing conceptual schemes, typologies and patterns that were based on Western democracies but have failed to actually support the *transitions* in new democracies (Ágh, 1999; Roberts, 2006; Gagyi, 2015). Here, *transition* meant a linear change from the socialist realism of the 1980's to a market economy and democratic capitalism associated with wellbeing, competition and freedom projected by the Western 'open society' that would bring along all kinds of modernisation of established liberal democracies. Instead, what emerged was a 'multiform development' or 'hybrid' regime with 'new patterns of governance' (Roberts, 2006) that copied and stitched together elements that would apparently meet expectations of established democracies but missed to respond to local hopes: to identify the experience, knowledge, resources and design necessary to reach for a transition to democracy.

While international media reports have been focusing on issues of global structures and the shared crisis, such as the anti-democratic measures introduced in Hungary and ongoing anti-corruption movements in Romania — both concerns of the European Union project –, there continues to be nascent talk on how citizens have organised to improve their living conditions since the regime change. Understanding the socio-political context of the region from how movements mobilise for change sheds light on 'existing power-relations, political and economic blocs, symbolic fields and historically constructed political vocabularies' (Gagyi, 2015) which could inform, for instance, infrastructuring for democracy by means of political design.

In the case of Romania, **recreative activism** is put forward as a concept to explain the particularities of collective action in the region (Gubernat & Rammelt, 2017). It is also used by the scholars as a way to bridge concepts such as space, participation, leisure and classic approaches to movement studies enabling 'relational and cognitive social capital during protest participation, possibilities of online mobilization, and various forms of cultural consumption through scenes' (2017, p.145). Here, 'scenes' refer to sites that have become part of a 'lifestyle where part-time communities gather and mobilise through various engagement forms.' These part-time communities or publics emerged as result of recent movements in Romania that stood up for social (Colectiv, in 2015), political (#rezist, #totipentrujustitie, OUG13 in 2017, #farapenali 2018) and environmental justice (#rosiamontana in 2013). Along with street mobilisations, cultural producers have organised festivals that lined up debates, civic ateliers and exhibitions to contest the dysfunctionalities of the current system. Gubernat and Rammelt see the expansion of this protest culture as a 'recreative activism' that "has its roots in the concomitance of cultural consumption and non-institutionalized political participation, as well as in a certain disenchantment of protest participants with post-communist politics" (2017, p.158). Another study assigns the anger behind such mobilisations to how conditions of modern democracies — the rule of law and to suffrage — have been disabled by transnational kleptocratic networks (Chayes, 2018). Here, returning demands are not personal liberties or the act of voting but submitting the power elite to the rule of law, equal justice, and most importantly to pressure those in public office to exercise in the interest of the people. But while protesters demand adjustments in constitutional structure and its mechanisms, the government is deliberatively playing on the cultural divide and political polarization by distorting the claims and demands saying they are 'engineered by the opposition for partisan purposes' (Chayes, 2018).

Despite the growing body of documentation on creative activism part of such movements in Romania, there is no coverage of where and how *design* exists or intervenes in their changemaking activities. Departing from our research question which seeks to understand the democratic experience from the lens of design research, we set up a pilot event that invited citizens to reflect on what democracy means to them. This would inform the basis for a **citizen's design manifesto** that could work together with ongoing initiatives and movements.

'Democrazy' in Romania

The pilot event organised was hosted at the Balassi Cultural Institute in Bucharest (a diplomatic cultural institution of Hungary) as part of the 2018 Late-Night Galleries, a yearly one-night event with multiple exhibitions and talks running simultaneously across various cities. Given the recent anti-pluralist and anti-democratic waves both in Romania and in Hungary, this cultural event was an ideal platform to host a workshop that would open a discussion on the relevance of the Democracy-Design initiative in the region.

Participants were invited to create banners out of tablecloths that record messages about citizens' *imaginings, demands* and *actions* for democracy. These would be compiled and displayed in store fronts, (e.g. abandoned window displays) creating a communication channel to mobilise citizens within and across cities in Romania before the elections in 2020. Window displays used to have a particular aesthetic emblematic of the communist era, and even today they carry a sense of nostalgia. Following the regime change they have been taken over by brands, products and trends of Western democracies. We chose to replace the static setups of commercial design products with the banners that would depict visions for democracy. For the purpose of this event, the venue acted as a site for discussing a 'citizen's design manifesto for democracy' (Figure 2 & 3). Making use of the particularities of the space and the activity of the institute, the setup mocked old-time coffee houses where intellectuals and revolutionists used to gather to debate and plan for change. The Romanian Renaissance Brâncovenesc styled basement — a venue now hosting events organised by the Hungarian Balassi Institute — was converted into a quirky installation where citizens reflected on what is to be done about today's democracy. Five conversation tables were covered with linen and each equipped with a 'resource basket' and a series of postcards that pictured old and contemporary window displays. Participants were invited to replace goods and brands from the cards with messages about democracy. These conversation starters would then guide them into making a banner out of the tablecloth.

Figure 1 Speaker's and media corner

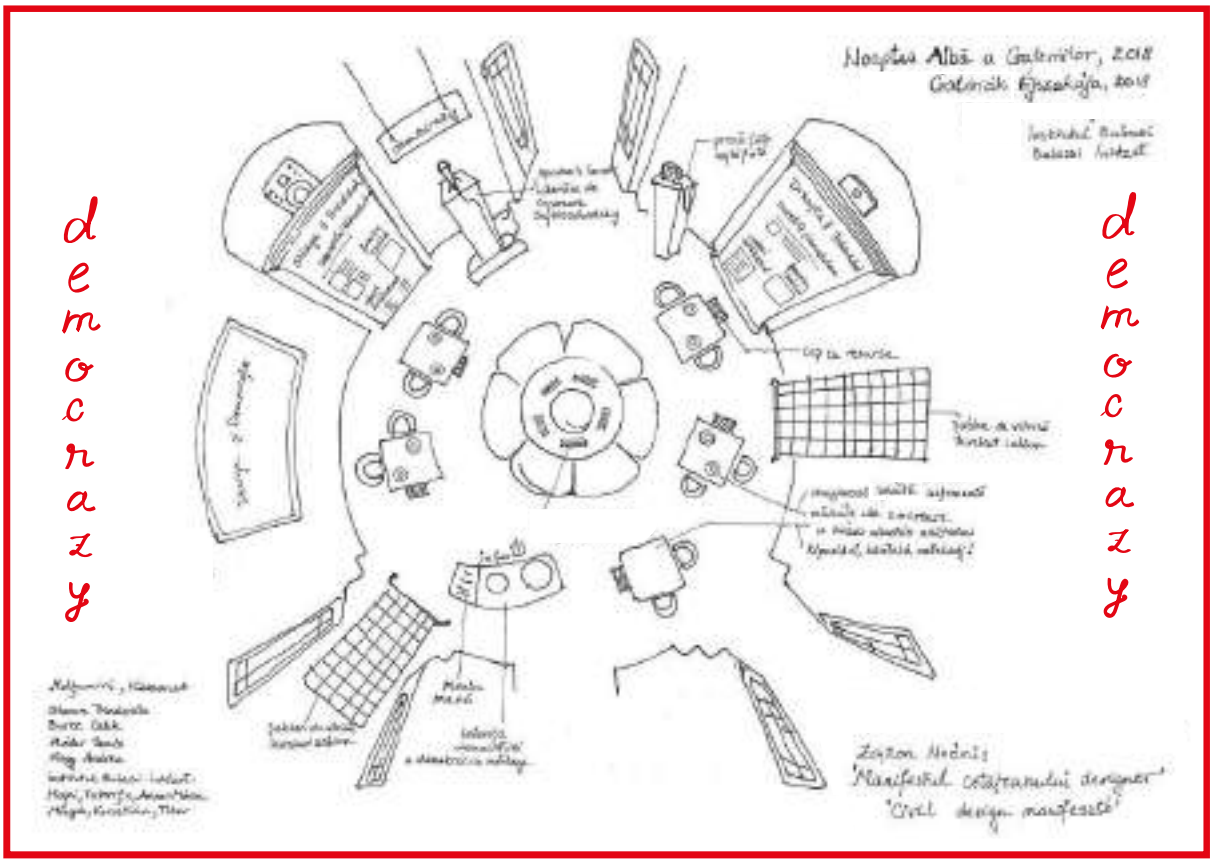

Figure 2 Democrazy Welcome Map (front)

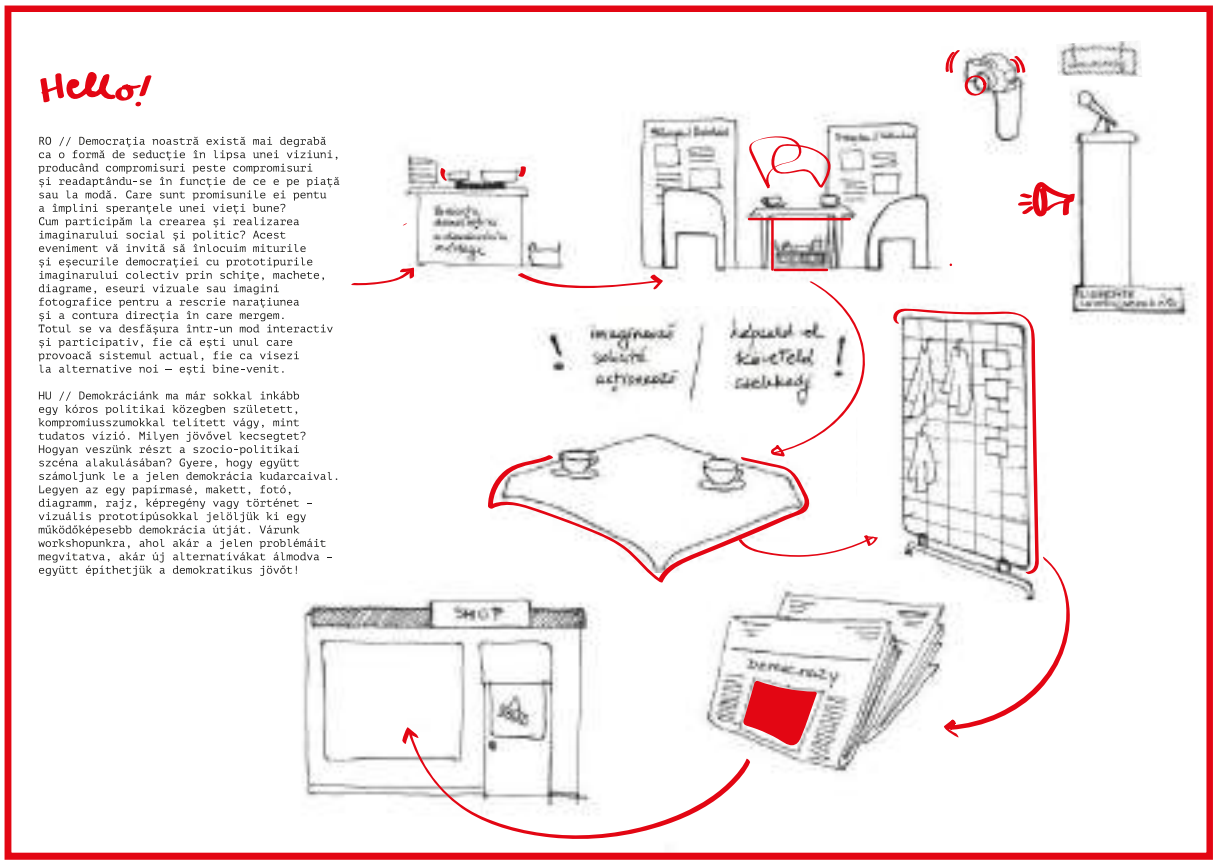

Figure 3 Democrazy Welcome Map (back)

A 'speaker's & media corner' (Figure 1) had a mike for anyone wanting to share a call for action and a photo camera for e.g. shy participants to document the event. As visitors walked in, they picked up the welcome pack next to the ‘weighting scale of democracy’ and could join the conversation in whichever way they wanted (Figure 4). The weighing scale had messages depicting promises and values made by political parties mocking the current fragmentation of political infrastructure and confusion around ideological structures.

Visitors varied from diplomats to groups of students and designerly or artistically engaged activists. Tendency was to drop in from one event to the other happening simultaneously, so participation was relaxed. Responses from participants have been positive, but most seemed either to expect a tangible outcome from the conversation or preferred to just discuss rather than contribute to the tablecloths, or if contributing they stressed to remain anonymous. As intended, the event generated curiosity from the public based on its somewhat quirky installation (the *democrazy* window displays). While people seemed eager to discuss ‘doing something about democracy’, there was an underlying scepticism whether anything can be done and perhaps not specifically ‘for democracy’. Among the visitors, a diplomat couple representing the Hungarian government in Romania spent around three hours reflecting and debating the topic. Another group of four people have spent time discussing about the ongoing local movements and creating a banner that pictures four pair of hands showing conflicting emotions about democracy (Figure 5). Two of the participants have been actively documenting the protests happening over the past years.

Figure 4. Venue

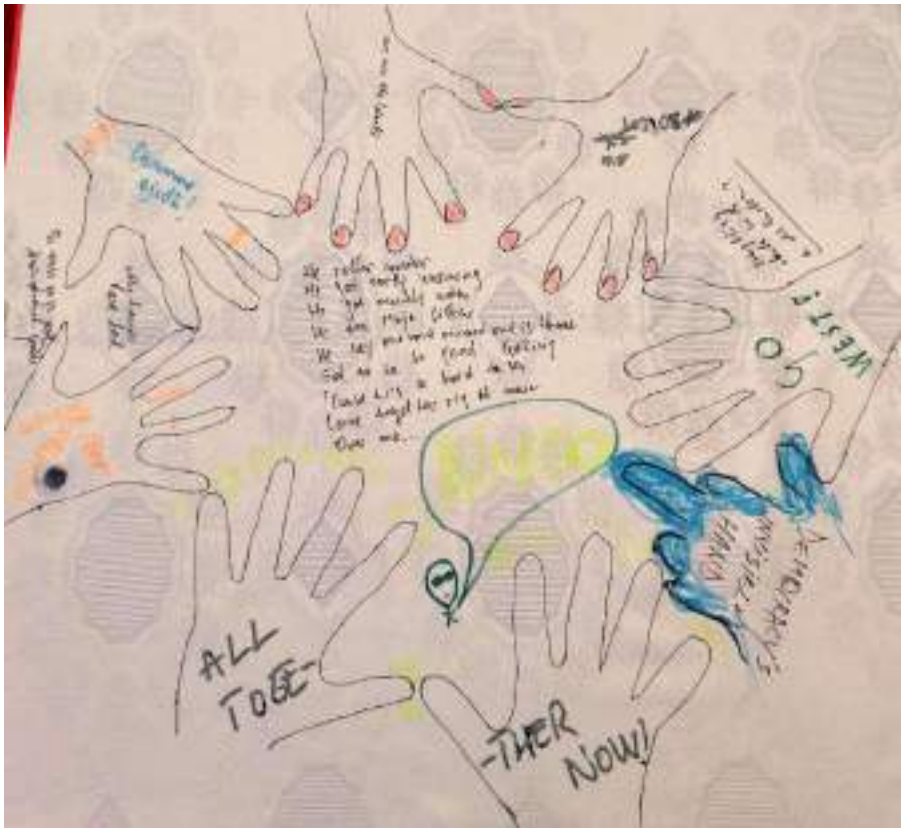

Figure 5. Citizen's Manifesto Banner

Discussion

Our pilot event confirmed a sense of urgency towards 'doing something about democracy', even though participant' responses were tinted with black humour that questioned democracy as a political system. Reflections converged on that 'democracy is not good but for now no better system has been invented'. Words such as 'demos' and 'rezist' (resistance) seemed to be key, even for the diplomat couple who showed an uneasiness about the political establishment in Hungary and Romania but also questioned the efficiency of the ongoing socio-political movements. The banner created by the four participants shows how divisive it is even to come to terms with the concept of democracy (Figure 5). It depicts four pairs of hands with conflicting messages as they join forces. One pair of hands voices 'togetherness' but with a human figure trapped in-between shouting an unclear demand. The other pair notices democracy's invisible hand backfiring the people while pointing direction Westwards. The third participant trusts in that 'we are the world' while her other hand hashtags 'boikott'. Meanwhile, the forth participant appeals to God for help as her hands are tied. Together, the banner with the four pair of hands mirrors **the paradox of reconciling with democracy**: the cry for a demos-friendly democracy and the frustrations with a hybrid regime where the political system is guided by those who distorted the very substance of democracy.

Surely the messages conveyed on the banner are symbolic and relaxed but this echoes what Gubernat and Rammelt call **recreative activism** (2017). They may provide little evidence of the democratic experience in Romania, but are illustrative of the existing scepticism towards democracy as a (universal) political system which is grounded on a systemic distrust towards decision-making practices of implementing change at a policy level. This attitude towards democracy and the welfare associated with it, also varies from generation to generation. We are tempted to say that coming to terms with the democratic experience must be addressed from an intergenerational perspective. What this means for design research, is that in order to be able to talk about a 'democracy to come' (or any future vision of democracy), political design must confront the distrust dividing the youth and the older generation. Furthermore, it must rebuild confidence in citizens' power in contributing to change through participation beyond the streets, and uniting around perspectives that can drive more collaborative strategic actions.

While the notion of recreative activism may be perceived as depoliticising by some, it has grown as part of the anti-corruption, pro-democracy and environmental movements. Despite converging on similar issues, sharing slogans and mobilisation repertoires with other global movements, these movements diverge in structural differences: when and where in time and space they are launched, and whom they directly concern (Gagyi, 2015). For the struggle for democracy, this implies that capacities, resources and conditions to organise will depend on how a given social order performs, what is set in motion that will reproduce a variant of democracy. In the case of Romania, the messages depicted on the banner **illustrate the struggle to overcome the ills of democratic transitions that have marked the political condition**. What this means for design is that in order to address democracy here, it must first deconstruct what has gone wrong with democratisation projects in the region, and make sense of structural problems vis-à-vis mainstream democratisation agendas and mechanisms. In doing this, the organisational life of local movements can provide social and participatory resources and entry points for political design to amplify citizens' demands that ask for a more honest governance.

Furthermore, recreative activism has **designed workarounds** within the same system that have become part of the infrastructure that mediates and organises the lives of its community, or as Lauren Berlant would call it, the 'lifeworld of their structures' (2016). These workarounds remain opportunistic about the principles of a capitalist welfare system. Scholars see this as a form of 'social therapy' or a way of coping with the frustrations of post-communism (Gubernat & Rammelt, 2017) and the pitfalls of infrastructures promised by democratic transition agendas. Transition approaches to democratisation have been seen as reductive, deterministic, and caught up in dichotomies not only by social movements scholars (Gagyi, 2015; Della Porta, 2011; Ágh, 1991) but also multicultural citizenship scholars (Kymlicka & Opalski, 2001) and foreign policy experts (Carothers, 2002; Carothers & Young, 2017). By focusing on a linear path of regime change and speaking the terms of international politics, it has dismissed the dimension of the political and by this, eradicated symbolic alternatives (Valantiejus, 2014). For instance, the liberal democratic category of pluralism could not make sense of the ethnocultural diversity, relations and the conflicts arising in the region after the regime change (Kymlicka & Opalski, 2001) and the political representation of minorities and politics of ethnic parties. In the case of Romania, a further complexity constitutes the representation of the Hungarian minority by the ethnic party called Democratic Alliance of Hungarians in Romania, which is also closely supported by the Hungarian government. This exists within a political landscape that has been continuously shifting between the ruling Socialist Democratic Party's oligarchs, the liberal bloc and the technocratic movements supported by international actors and the anti-corruption agency. Continuously adjusting to meet the western standards, while developing strategies to cope with austerity measures implemented by the government, has not made it easy for the ordinary citizen to open up to the pluralist holistic worldview expected of them. Nor did the interests, strategies and discourses of minority politics in the region. With tensions around globalisation and the politics of migration, soon the 'open society' came to carry not the meaning of freedom but danger and fear from the 'other' (Krastev & Holmes, 2018). In their account for the nationalistic rhetoric and the so-called 'illiberal' turn in the region, Krastev and Holmes trace this back to an ongoing, and now reversed, 'imitation game' since post-1989. This now sweeps across and beyond Europe, turning narratives and issues into 'branding opportunities' that would keep established parties and their networks on power (e.g. the anti-Soros campaign).

Looking through the lens of design, the rhetoric and materiality of the 'imitation game' is dismantling democracies by **infrastructuring (by design) for nondemocratic structures** and paving the way towards autocratic policies. In the case of Romania, for now, this looks more like **patchworking mechanisms and bargaining processes** that favour the political elite, e.g. removing judiciary systems, passing laws by night to decriminalise corrupt politicians, and releasing inmates pretending to solve the overcrowding problem of local prisons, while these threaten the safety of the public. Such thinking and practices serve (by design) the established system and keep the existing leadership on power, thus assisting what DiSalvo identifies as *design for politics*. In turn, *political design* is then concerned with mobilising to resist these forces. This consists not only of staging conversations that challenge the status quo but speculate about processes and make use of resources to provide alternatives. The pool of resources and participants within the scenes of recreative activism are already **infrastructuring pathways back to democracy by deconstructing existing conditions and contesting hegemonic relations.** For political design to formulate alternative conceptions of democracy in Romania it must **first make sense of the lived frustrations with previous democratisation processes, and the workarounds implemented by citizens to overcome a failed democratic vision and make incomplete infrastructures work**. It must also find the **political vocabulary** and **cooperative enquiry** that relates to the part-time communities already engaged within these scenes. For now, only by keeping these scenes active

scrutinisers of the established structure and dismantling mechanisms that enable corruption, could the system be reversed in favour of the citizen, and trust rebuilt in a democratic political system.

Conclusion

Attending to wicked problems has revolutionised what came to be seen design and expanded possible infrastructuring practices. But to infrastructure for democracy and make sense of democratic visions that are historically and culturally contingent, *designing for democracy* will mean to engage with the *democratic experience of a civil society*. If it is to contribute to democracies beyond Western democratic socialism, it has to understand the failures of democratic visions exported, the material, discursive and organisational practices of civil society actors, their interrelations and collective actions within the given political and economic system, and how, in a sense, design *for* politics has depoliticised the power of the people.

By drawing on concepts internalised within design literature that sustain a democratic horizon in the nexus of design-politics and by discussing them in relation to democratic theories, we asked what are the terms and conditions necessary to think about infrastructuring for democracy in Eastern Europe. Within our *Democrazy* pilot in Romania we have tried to identify through citizens' imaginings, demands and actions for democracy what could be the conceptual entry points for design to infrastructure for democracy in Romania by first understanding the democratic experience through the lens of design research. In a context, where the general understanding of design is still rooted within the consumer society that came along with democratic modernisation, and where recreative activism contests the dysfunctionality of an incomplete democracy, we staged the conversation as an invitation for a citizen's design manifesto. For political design to identify terms and shift action, to articulate the collective will and amplify political frontiers necessary to respond to local hopes of democracy, it must build on what movements have already set in motion. In the case of Romania, make use of the pool of resources and participation of the recreative scenes as well as the opportunistic mechanisms and workarounds that the community has carved out in the lifeworld structure of the civil society.

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Track 2.c Introduction: Gender of/in design practice and profession

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Introduction

Social constructionist feminist research of the last decades has shown that if we look closely enough we can see that artifacts are gendered by design. Some artifacts are gendered explicitly through their direct association with the traditional binary of women or men users; while gender is inscribed into others in more subtle ways through the normative conceptions regarding (1) their use contexts (public/private), (2) gender symbols and myths (strong/weak, rational/emotional, dirty/clean, adventurous/safe etc.) and (3) relationship with technology. This dualistic view serves as a useful strategy in design and marketing to create new segments to expand the market. Yet artifacts shaped by this view embody, represent and reproduce asymmetries in gender power relations (Kaygan, Kaygan and Demir, 2019).

These asymmetries also find form in the professional work cultures and power dynamics of design practice (Armstrong, 2012; Kaygan, 2016). Gender dynamics are both seen and unseen; played out in the everyday interactions of the design office or studio and in the public performance of the designer's role for client or public audiences (Rossi, 2009). As such, implicitly and explicitly, gender roles have the capacity to enable or inhibit the role of designer as an agent for social change.

This track seeks to open up a new avenue for feminist scholarship and trans/gender research in design innovation by exploring the relationship between design and gender and its implications for design as both practice and profession. To this end, we invited papers addressing the questions including but not exclusive to:

- What is the relationship between gender and design practice and how is this changing in contemporary design culture?
- How and to what extent can designers act as agents of change by formulating gender inequalities in terms of design problems?
- Are there any design methodologies and tools that encourage inclusive and gender-sensitive design practices?
- How can contemporary post-colonial theory and trans/gender research generate new approaches?
- What insights can gender and design histories bring to contemporary research?
- How can design educators better contribute to creating an awareness in young designers to design for a more egalitarian world for people with various gender identities?

The two articles from five authors approach the theme of this track with two different focus, being informed by different theoretical perspectives.

In *Queer-Sensible Designing*, Silas Denz and Wouter Eggink explore the ways of challenging normative gender in industrial design practice. Drawing on actor-network theory, and specifically on the concept of 'gender script', the authors devise and conduct a co-design workshop, through which they demonstrated the co-

design practice could open up the design process to non-normative gender scripts by unmasking binary gender dichotomies in industrial design.

In the second paper, *Towards the Exploration of Gender Awareness in Human-centred Design*, Bahar Khayamian Esfahani, Richard Morris and Mark Erickson demonstrates how products are gendered via product language and packaging, and their perception as gendered shapes the consumption preferences of male users. Similar to the previous paper, the authors in this paper also carry out a participatory design workshop, which is concluded by generation of design ideas.

Both papers, despite their different focuses, provide evidence for the rising interest in gender issues in design practice, particularly in the question of how can we design for non-normative and non-binary gender constructions.

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Queer-Sensible Designing: Challenging Normative Gender through an Industrial Design Practice

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Conventional design practices regard gender as a given precondition defined by femininity and masculinity. To shift these strategies to include non-heteronormative or queer users, queer theory served as a source of inspiration as well as user sensitive design techniques. As a result, a co-design workshop was developed and executed. Participants supported claims that gender scripts in designed artefacts uphold gender norms. The practice did not specify a definition of a queer design style. However, the co-design practice opened up the design process to non-normative gender scripts by unmasking binary gender dichotomies in industrial design.

Keywords: Design Practice, Gender Design, Participatory Design, Queer Theory, Gender Normativity

Introduction – Co-Constructions of Design and Gender

Despite numerous revolutionary changes in many European and North American societies, gender roles did not mitigate their power to discomfort until today. #metoo, gender pay gaps, mocking awards or homophobic crackdowns are recent symptoms of the unease with every day (hetero-)sexism. As gender studies establish as a research field, the influence of gender on engineering and industrial design processes are illustrated. At the same time, queer theory extends previous gender theories beyond the dichotomy male-female and criticises it as being of discriminatory nature. While design processes do not yet have adopted an attitude towards gender stereotypes in its discipline, post-structuralist and non-essentialist theories produced insight to the social impact of designed artefacts and the resulting responsibility of designers.

As early as in the design education, the designer's female or male gender already predefines their career orientation (Stilma, van Oost, Reinders, & Eger, 2005). Professionally designed goods also communicate design cues correlating with the designer's gender (Stilma, 2008). Accordingly, practical techniques available to industrial designers, which aim at designing for a specific gender, reproduce concepts of masculinity or femininity by defining subcategories of binary gender based on statistical data and endow them with product requirements (Stilma, 2010; Schroeder, 2010).

The aforementioned established techniques or approaches consider gender as a predefined human characteristic and do not target gender as a social construction. In contrast, the actor-network theory (ANT) from science and technology studies presents an understanding of how technology and society mutually shape each other. As a key assumption, Latour (1992) explains how designed objects or non-human actors, so called actants, serve as supporters of another actor's "program of action" and are balanced vs. their "antiprograms". A designer thus delegates their creation to serve a certain program that influences the behaviour of its user. Similarly to film scripts, which define what actors do, Akrich (1992) calls these delegations "scripts" in which

the designer inscribes their "vision of (or prediction about) the world in the technical content of the new object." (p.208).

This concept of scripting was extended to or specified on gender identities of users of technology. Van Oost (2003) describes that "gender and technology shape each other mutually" (p. 208) whereat designed objects define their users through "gender scripts". According to her, designers implicitly or explicitly make assumptions about the user's gender. Her research on Philips shavers showed that they configured the user's masculinity as technologically versed by offering additional settings and functionality, which was also expressed through the styling of the casing. Users of the Ladyshave were scripted contrarily. They were not only assumed to be female but also to have a lower affinity to technology. The shavers targeted towards female customers hid all reference to the inherent functionality underneath their round white casing. According to this model, the designers of Philips used the gender dichotomy of technology affine men vs. technologically alienated women and scripted it in the design of the different shavers.

Engineering or designing objects also unintentionally establishes gender scripts. The construction of the user is influenced by the personal context of the author and thus "gender neutral" design is said to be impossible (Brandes, 2010; Brandes, 2008)

Materialised **Morality**

Though ANT's script concept serves as an analytic tool, it cannot supply the designer with predictions, whether a user will appropriate the artefact in the scripted manner; it remains open to resistance (Ingram, Shove, & Watson, 2007).

Another point of criticism is that the ANT is rather amoral. Verbeek's (2006) theory of technological mediation extends therefore the script concept and argues that a human actor enters a relationship with a non-human actor. The newly shaped entity has experienced mediation, while the designer delegated the roles of both actors. Verbeek acknowledges that thereby society is steered technologically and ethical questions are raised. Designers are moralising technology depending on how they anticipate the mediating role of their artefact: "designers are doing 'ethics with other means'" (Verbeek, 2006, p. 369). He names already two options to anticipate mediation: by imagination and by Constructive Technology Assessment (CTA). The former is solely relying on the designers themselves while the latter is meant to "involve all relevant stakeholders"(p. 376) to shape a "democratic way to 'moralize technology.'" (p. 372).

The contradiction that established design practices construct gender, however regard it solely as a natural binary, supplies us the challenge to extend design processes beyond male and female to a conscious and responsible practice. It directly leads to the question of how a design can deliver a materialised gender that is substantially open to queer and sustainably shifts its stakeholders towards an ethical characterisation of gender or in other words: how can design sustainably shift the persons concerned to adopt ethical opinions about any forms of gender?

Materialised Normativity

The designers' role in the social (and technological) construction of gender can be concluded, that they as the protagonists in design processes are not only constructing and re-constructing products, but also gender. Their scripted artefacts are representatives for their assumptions about gender. A designer may change their claims on gender, however the product remains the same. The user's or owner's context is then deciding on the interpretation of these gender scripts and might accept or violate them; however, the artefact remains as a supporter of a particular ideology of gender. While it remains open how individuals perceive, accept and repeat these statements about their identity, queer theory can explain these dynamics and serves as a source of inspiration for a design process.

Butler (1990) describes gender as performed through repeated acts and "real only to the extent that it is performed" (p. 527). By implication, there would be no objective, natural gender or gender decoupled from social processes. It is not a user characteristic but rather an apparatus by which the normalisation into male and female occurs and defines what existence is worth living (Butler, 2002). She uses the example of Trans*-students who became victims of death threats after using their school's gendered bathrooms. This gender performativity is not described as a choice of consumerism, but rather as "the repetition of oppressive and painful gender norms" (Butler, 1992, p. 84); people cannot perform their gender by freely selecting the props

associated with masculinity or femininity. In design, Sparke (1995) identifies these gender norms in a hierarchical binary language system as in “universal values” vs. “fashionable” or “minimal form” vs. “surface ornamentation” (p. 222). She finds design terms associated with femininity are generally subordinate to their masculine counterparts.

Design seems to be subjected to these gender norms of which subversion is difficult. At the same time, people self-identify as Queer and offer an understanding of a gendered human beyond a heteronormative male or female. However, Queer itself cannot serve as *the* subversion of gender normativity and cannot refer to a particular community. The term was used pejoratively for LGBT and reclaimed by a younger generation in order to resist the “institutionalized and reformist politics sometimes signified by ‘lesbian and gay’” (Butler, 1993a, p. 20). Recently the term is also expressed through the definite binarism male-female i.e. by defining it as LGBT. Especially in continental Europe, e. g. in polish mass media, Queer serves as an umbrella term for LGBT (Szulc, 2012). More open and sensitive to the various definitions is Jagose’s (1996) explanation of queer being “always an identity under construction” and Sedgwick’s (1994) inference “that what it takes —all it takes— to make the description “queer” a true one is the impulsion to use it in the first person”.

To escape the determinism of heteronormativity and respect excluded queer individuals, practical acts have been designated as subversive to normative gender. Butler (1993b) mentions that drag could be subversive to the extent that it “disputes heterosexuality's claim on naturalness and originality” (p. 125). Very similarly, Sedgwick (1990) uses deconstructive analysis on dichotomies such as hetero-/homosexuality or male/female, describes them as already irresolvable instable and pleads to apply “material or rhetorical leverage” (p.11).

Deconstructive and Sensitive Design Methodologies

The aforementioned theories supply our work with numerous implications for a conscious and moral design practice that can be categorised in implications for stakeholders, implications for designed artefacts and implications for methodology.

About concerned stakeholders:

- Might be content with normative gender
- Might be Queer, which is true if the term is used in first person
- Gender scripts delegate how gender is performed

About designed artefacts:

- Delegate users gender role in gender scripts, e. g. manifested in the design language
- Gender is no commodity and subversion not a decision of consumerism
- existing designs script gender through the use of hierarchical dichotomies
- Gender scripts are interpreted depending on the context of the addressee
- Successful subversion of gender norms is not predictable

About methodology:

- Designers are responsible of delegating their users with scripts
- Involvement of stakeholders, i.e. by CTA, could democratise and morally justify the design process
- Deconstructive analysis enables to display and resolve gender binarisms
- “Cross dressing” may dispute heteronormativity’s claim on originality

Recent design works that treat gender beyond the female/male binary exist. For instance, Ehrnberger, Räsänen and Ilstedt (2012) introduced a practical approach with emphasis on the design language. The work orients primarily on deconstruction as they interchanged the power-suggestive design language of an electric drill, as a male-targeted “tool”, with the clean and tender design language of an immersion blender, as a female-targeted “kitchenware”. By that, they claimed to have designed beyond social norms and one identified their graphical design language as a reference to drag.

In a different approach, queer identities are considered using unconventional design practices. Canlı (2014) argues that in design gender norms need a deconstruction or reconstruction to shift boundaries towards queer individuals. She calls this process “queering design” or later “queerying design”, which Canlı (2017) applied in form of three workshop-based co-design sessions with feminists, LGBTI+ and queer activists. In her workshops, she focused on an applied generative approach to disrupt normativity in fashion, abstractly on linguistic

dichotomies with a word game and in a third workshop participants analysed and reconstructed spaces in a discussion setting.

Alternatively, the use of empirical methods to research on non-normative gender may fail, as it supports only observable categories, which are already assumed by how they are measured (Brim & Ghaziani, 2016). The addition of further categories of gender misses to open for queerness, instead these categories lead to a regulation of the intangible queer and suffer from "queer illiteracy" (Tsika, 2016). Additionally, the various contexts in which LGBTIQ terms exist prevent from practically gathering data, e. g. estimating people's homosexuality might refer to sexual behaviour, arousal, romantic affection or identity and leads to different outcomes depending on the question (Savin-Williams, 2006).

As already implied by Sedgwick (1994), a notion of queer, is then true, when it originates from those affected personally. In design processes, inclusion of personally affected stakeholders is satisfied through participatory design. Similar to Verbeek's understanding of democratically moralized designing such as CTA is context mapping, a set of participatory methods. This generative research technique, structures co-design workshops by combining several methods such as modelling toolkits or disposable cameras, and enables diverse participants to share their personal experiences and reflections (Sleeswijk Visser, Stappers, van der Lugt, & Sanders, 2005). Sleeswijk Visser et al. (2005) note about the participants that small groups (four to six) are advisable while non design practitioners may deliver less aesthetic and more personal results. Further, they present a preliminary phase to encourage participants to reflect about their personal context, the "sensitization" (p.5). Sensitisation is completed prior to the workshop but connected in terms of content and may consist of small tasks or activities e.g. prepared toolkits.

Qualitative research offers also applicable techniques such as deconstructive analysis. Translated to the materiality of product design, the design language is receptive for detailed analyses. Van Oost (2014) introduced a multidimensional matrix to analyse the relation between a product and its gender scripts. It serves to identify gender scripts implied through product design. The product design is here divided into form, function and user interface. Gender scripts are composed of three levels: gender symbolism, gender structure, and gender identities and additionally their effects on gendered users. An analysis is performed by investigating an artefact element by element and thereby completing the scheme (Table 1).

Table 1: Product Design – Gender Scripts matrix based on "Heuristic scheme for product gender script analysis" (van Oost, 2014)

Product Dimensions	*Gender Script Dimensions*			
	Gender Symbolism (dichotomies) e.g. control/obey	Gender Structure (Context) e.g. location (domestic/public)	Gender Identity (Personal Characteristics) e.g. daredevil	Effect on Gender e.g. perpetuating gender stereotypes
Form (Design Language) e.g. symbols on identities	…	…	…	…
Function e.g. gendered activities	…	…	…	…
User Interface e. g. presupposed competences	…	…	…	…

A different model, which is rather focused on the design language and serves to identify the relation between explicit design language, implicit symbolism and abstract ideologies, is a framework of triangular or pyramid shape (Figure 1). Mulder-Nijkamp and Eggink (2013) originally developed the framework to translate explicit two- to three-dimensional design cues of a product portfolio to an abstract brand identity and vice versa. The abstract construct of a brand identity consists of symbols expressed through design features. Similarly, the social and technological construction of gender or rather a person's gender identity is, among others, performed through gender scripts, which are again represented by symbols and design features in a single

product. Hence, this framework can offer an alternative method to support the identification of their inherent gender scripts.

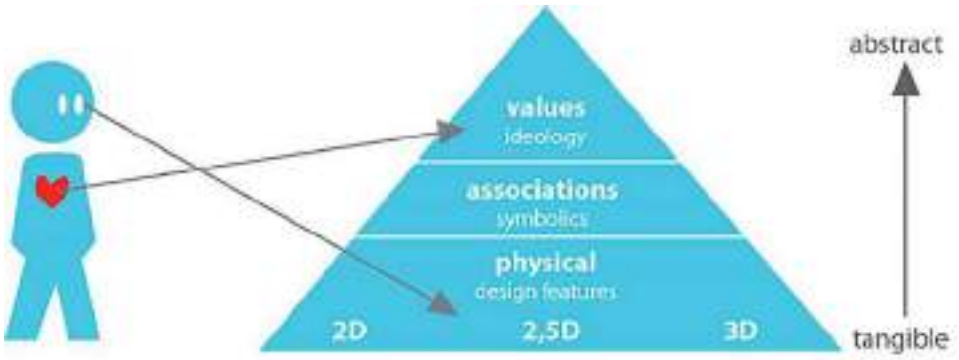

Figure 1: Adapted brand translation framework (Mulder-Nijkamp & Eggink, 2013)

Open-to-Queer Co-Design Workshop

We assume that applying empirical methods to assess Queers and their positionality to design poses a paradox or intricate application, while qualitative studies, especially those that include "queer" participants, promise to deliver intimate perspectives, preferences and suitable design features. Methodologies available to co-design are able to include identities entitled to violate gender norms. The scope of this work limits already the frame for a practice and partly predefines the resulting approach.

Firstly, the further work was limited to three main issues: (1) the real and personal impact of artefacts on queer or open to queer people, (2) the perception of gender (scripts) in objects, and (3) the personal ideas to counter possibly discomforting design. The identified challenges as well as the suitable techniques were concluded to a co-design workshop under the title "Queering Design" and the theme "bring your object". The allusion to previous work is intended as well as the temporal context generated through arranging such a study during pride month June. The resulting generative research workshop is sketched in Table 2 and elucidated more precise thereafter.

Table 2: Structured workshop scheme

Workshop Phase	*Duration*	*Content*	*Material*	*Means of Documentation*
Preliminary Organisation and Sensitisation	-	Invitation and task to select an object	-	None
Welcoming and Organisation	10 min	Workshop programme and declaration of consent	Screen, pens and printed documents	None
Information about Queer Theory and Design	20 min	Theoretical information on the subject matter, presentation	Screen	Minutes
Introduction of Actors	15 min	Making and telling introduction game with nameplates for participants and objects	Screen, paper, coloured pens, glue, scissors, screen	Minutes, photos
Discovering Gender Scripts	45 min	Fill in the blank of gender script translation framework	Screen, whiteboard, markers, post-its, pens	Minutes, photos, video
Break	15 min	Free for small talk, coffee or tea and snacks	-	Minutes
Deconstruction of Gender Scripts	60 min	Focus group discussion, making and telling	Screen, clay, Lego, trash, pens, paper, glue, scissors	Minutes, photos, videos
Wrap-up	15 min	Acknowledgement of participation and open discussion	Screen	Minutes
Total	3:00 h			

Preliminary Phase

We address with our workshop “queer” identities or those who are open minded about potential violations of heteronormative gender. The reason is self-explaining: participants who are content with essentialist claims on gender and heteronormative structures in technology are assumed to either lack motivation to participate or feel offended and probably offend or discomfort Queer participants. Potential participants were invited directly through personal requests or invitations sent via social media, messenger app and e-mail. Additionally we invited by spreading flyers. The addressees were LGBTIQ activists, members of “LGBT+” associations, Industrial Design Engineering students, friends and acquaintances, however everyone who was interested and open minded about the topic was welcome to participate.

These invitations (Figure 2) urged the potential participants to reply and sign up for the workshop in order to receive further information, while it remained open to anybody who could relate to the issue. This enabled also to communicate changed details of the workshop such as time and location.

The procedure started even before the gathering for the workshop. Preliminary, participants were asked to decide on an object they would like to bring. Since this task serves as a “sensitisation”, we offered implicit suggestions on possible items, in order to stimulate a personal reflection about the objects shaping their life.

However, not actually part of the practice, the eight participants were asked to sign a declaration of consent, that photos and videos can be taken and anonymised photos are allowed to be used for reporting the session.

One participant did not fill in their name and another one signed with a name other than known to the group. Further, the participants were instructed that their attendance was voluntary; they were free to interrupt at any time. To make the group feel experienced enough to participate in the workshop, they were told that their knowledge and attitudes would be all correct, as the facilitator is not omniscient. Since we did not expect participants with racist, Anti-Semitic or other group-focused enmity, we were able to express this statement without risks.

Figure 2: Invitation poster and flyer for the workshop

Information about Queer Theory and Design

All with different socio-cultural backgrounds, participants were introduced to the subject matter in a condensed presentation of gendered design processes (Figure 3) and the concept of Butler's gender performativity as a mediator of queer theory. Participants were encouraged to understand how the repetitive acts of gender performativity upholds the normative binary of gender. On that account, participants should be able to open up to a more diverse understanding of gender than male and female and grasp it rather as an apparatus by which the normalization occurs (

Figure 4).

Figure 3: Simplified gendered design process

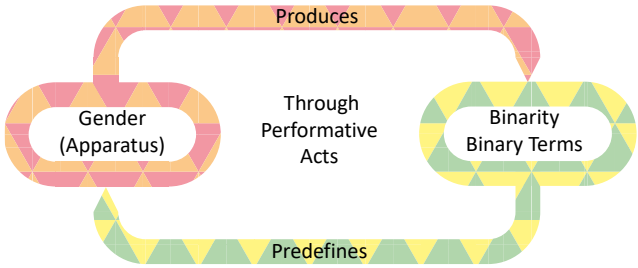

Figure 4: Repetitive performative acts constructing gender

In an example, the role of industrial design was illustrated with product pictures of obvious gender scripts in products, i.e. their graphic language. Further, the concept of ANT was introduced by calling these objects actors, which perform gender.

Introduction of Actors

Though the participants were made familiar with the social construction of gender, the facilitator did not answer what queer could be in an oppressive binary gender system. Instead, the participants were intended to present themselves and their objects with the help of self-made nameplates (Figure 5). Nameplates were crafted mostly without extra features but only with text. All participants used their real names and gave descriptive names to the objects they brought. By introducing themselves and objects, the participants explained the reasons why they attended the workshop and why they chose the objects they brought.

Participants attended mainly because of personal interest about “gender in objects” and “mad” normative gender roles, or interest in queer theory and politics. The objects were heart-shaped sunglasses, a “man’s” perfume, a clip on lens for smartphones, a Casio watch, a pink chapstick, a “Dopper” bottle, a novel and a smartphone protective case.

Most participants had an intimate story about the object such as that their mum bought it for them (perfume and chapstick) or that it gives them “self-confidence” (heart-shaped sunglasses). For the participant who brought the “male’s” perfume, the relation became even more intimate since the perfume was bought while the participant identified as male, however now identifies as female and still wears the perfume. The participants who brought the book and the bottle regarded them as “gender neutral” objects.

Participants thought differently about the term queer and barely used it for themselves. One participant explained that she understands it as an “umbrella term” for LGBTI and would identify as queer.

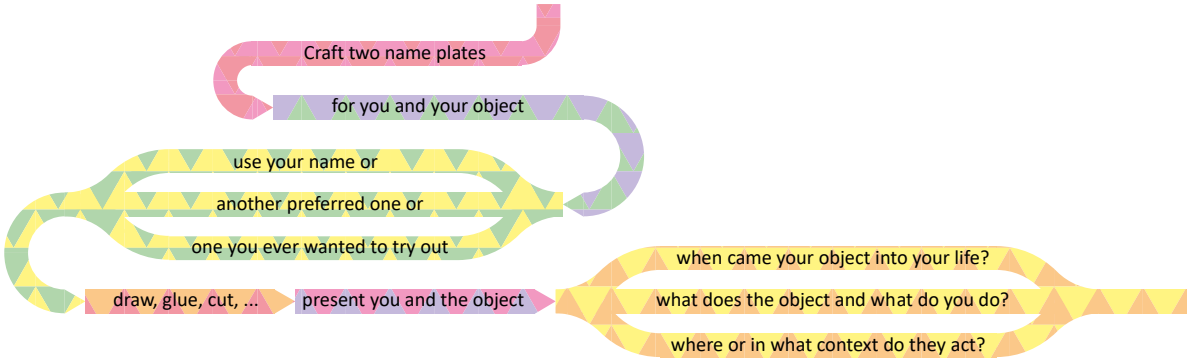

Figure 5: Guiding workflow of the introduction game

Discovering Gender Scripts

How gender is perceived and materialised is always dependent on context. With the help of the second part of the workshop, participants can express what inscribed gender roles they perceive. The gender script would then no longer be the perception of a single gendered user but a collective non-heteronormative perception of scripted gender in distinct objects. Not only the graphical design language, but also the multisensory characteristics as well as indirect knowledge e.g. from advertisements or etiquette are observed in this task

Mulder-Nijkamp's and Eggink's (2013) brand translation framework was revised to a gender script framework and drawn on a whiteboard. Participants were split up into two groups of four and asked to choose one object – or rather "non-human participant" – they would like to investigate. The separated groups selected the chapstick and the perfume and filled in the blank of the triangle from bottom to top – from explicit design language to gender scripts (Figure 6).

When the participants were stuck, the facilitator explained that the transfer of a design language cue to a gender script as the core of materialised construction of gender is implied through dichotomies. An aid to discover these biased gender dichotomies was inspired by Wittgenstein's (1967) letter to architect and interior designer Paul Engelmann: "the unspeakable is -unspeakable- already contained in the spoken". In contrast to Wittgenstein's interpretation of "the unspeakable" as "the mystical", we translated the term to the concept of gender scripts. To us, the unspeakable is an imperceptible design cue when trying to identify a gender script. Usually, only one part of a gender dichotomy is scripted into products. In order to identify gender scripts we can also focus on how an object cannot be sensed, e.g. a perfume that does not scent sweet was probably scripted to smell "male", while "female" scent is expected to be sweet. In this case, the user is unable to identify a certain dichotomy with the unknown smell, however the absence of a known design feature may identify the inscribed assumptions.

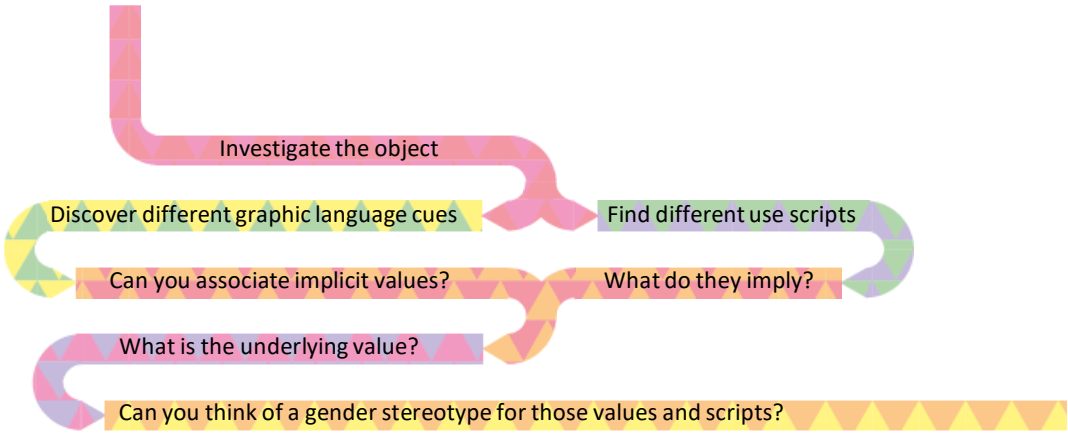

Figure 6: Guiding workflow to discover gender scripts

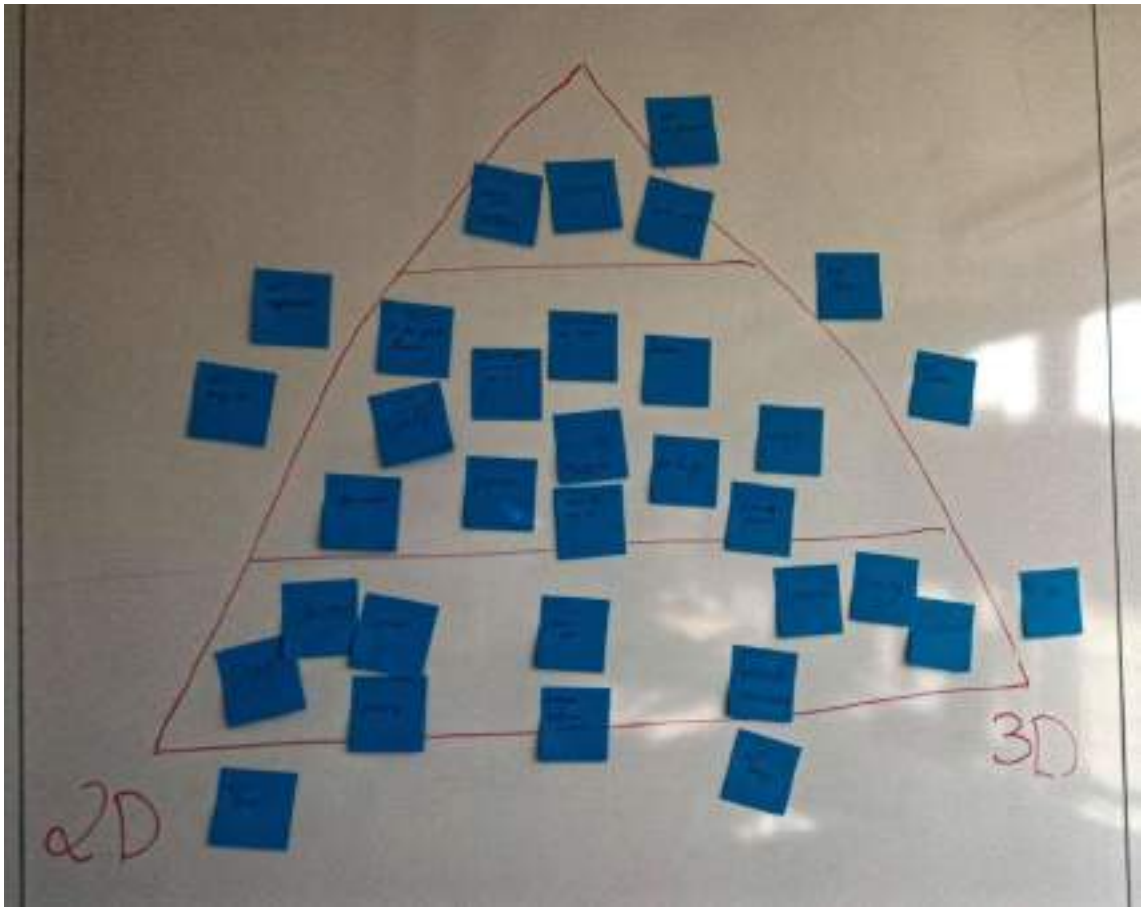

Figure 7: Gender script identification framework in use

The part was closed by presenting the outcomes to each other. A participant remarked that she is “annoyed by pink” while looking at the chapstick. The group found that the round shape and the pink colour are already symbols for femininity as blue marks products for boys. The shape was found to be simple “it’s round, you can see it, it’s pink, and not much to say there”. However, more associations were made: “cute”, “girly”, “use it every day, I don’t use it every day, but still.” Also the implicit cues such as “handy”, “on the go” use”, “trendy” and “to feel good or beautiful” support femininity, so that the actual value was found to be “girly everywhere” (Figure 7).

The perfume was perceived as slightly more complex and also with clearer gender scripts. Participants explained that it “has a masculine scent, because it’s a strong smell and it’s not sweet” and it is applied “for [male users] themselves, so even when they don’t go out” but that would “really depend on the person who wears it”. The communicated values were presented as “from the marketing campaign, when we were googling the product”. They found a corresponding product for “women” and described it as the “same product that was marketed for women, was saying it will make you irresistible”. They mocked that the “female” counterpart is called “playful” which would objectify women as “pussycats”. However, the presenter mentioned that she is not sure whether “it’s in the object itself” because the perfume bottles had “exactly the same shape” only the “golden, pinkish” lid and tinted glass. Everybody could then decide on either being “adventurous or irresistible”.

During the following informal coffee break, participants were invited for coffee and tea with cake. They used the opportunity to ask questions and express their thoughts or concerns about gendered products.

Deconstruction of Gender Scripts

Though, the critical identification of gender scripts is already an essential part in designing open to queer or non-heteronormative individuals, it is not drawing consequences for an actual change in materialised gender. Therefore, the most practical part of the workshop is set as a follow up to “Discovering Gender Scripts”.

Participants are stimulated to share which gender scripts they accept and which they reject openly. In a second step, participants focus on negatively rated gender scripts and bend or reconstruct them in order to fit to other values that do not reproduce normative gender dichotomies.

The previously analysed products were still meant to serve as the object matter that undergoes a *subversion*, *queering* or *deconstruction*. The stimulation of creativity and unconventional solutions is obtained by the co-design technique of "making and telling". In "making and telling", participants ideate in small groups about the question and imagine what their idea looks like or it is used. This idea, which may serve as a scenario or script, is visualised by crafting with available material. The result itself does not serve as a usable design object but rather as a non-human assistant, which helps participants explaining their vision of a beneficial design.

In the workshop, this phase started with a group discussion on what gender scripts are most problematic. To help them expressing their ideas we offered them Plasticine, Lego, cardboard, paper, glue, pens, scissors and trash parts from old design prototypes. Second, participants were asked to find alternatives that suit their beliefs or that subvert normative gender dichotomies. Binary gender categories became thus obsolete while a new design concept was proposed. Explicitly the idea of deconstruction as applied by Ehrnberger et al. (2012) was proposed to the group: they can change the view on a gender dichotomy by adding or changing symbolism that dissolves the binarism or disputes its claim for naturalness. In a final statement, each group or each participant described their ideas on how the inherent gender scripts could be altered. With the redesigns of gendered products or deconstructed gender scripts present, instead of the original items, the group was newly configured. New materialised genders or subversions of gender were then present as actants. The final statements already gave enough input to be able to be critically discussed again.

Since the workshop dealt with subversion of social norms it was possible and desired, that participants added their own ideas on how to progress through the co-design session. Therefore, the planning needed to be open to changes and flexible to add, skip and integrate parts.

A participant mentioned that the gender script of pink as a colour for femininity, was once a colour "for boys", and left her puzzled what colour could be used now in its place. Strong dislike was also uttered about the way the female gender is (re-)constructed in the gender script of the chapstick: women are rather "preparing" their lips to be always ready to pleasure men. The status of the product would have a "structure" that makes it "necessary" for women to use the chapstick. However, "some boys would need it, but wouldn't use it" because it suggests that the product is for women only and heteronormative men would not need a chapstick.

As a solution, a participant suggested to let it look rather like a medicine product in white, to claim lip lotioning as a general human health issue. One noted that there is a wide range of lip balms available that would better suit her perception of gender or queerness. She would miss a motivation to change the object as better ones already exist. In addition, other participants were stuck and they could not think of a way to use the object further to create a subversive version from it. It was "difficult to overcome specific categories" as "maybe the product is not easy to change".

Thus, the perfume was also used as a subject matter in this part. A participant also mentioned that she would not buy it if it would violate her own gender identity. Another participant said that the name for the perfume called "playful" for "women" should definitely be changed. She offered to call the perfume "let's play" and make the bottle longer, because it seems "not connected to any category" to her.

Further, she suggested to give the perfume a number instead as "Chanel calls it N°5". Alternatively, the perfume could have no name at all and it could be described solely by a natural symbol. An attendee claimed that the scent could be more "back to basic" with a strong "not sweet" smell and the category "after shave" might be called differently. A participant took some trash parts, namely wood and chicken wire and modelled a bottle-like shape.

In the end, the owner of the perfume was arguing that the product might be marketed to "men" and therefore it might propagate stereotypes accordingly just to "sell it". "The product was given [to her] because of this stereotype", but "now that I don't want to be seen as male I would still use it just because I like it." She would like not to deconstruct her perfume "but at least just saying never mind and still doing just like questioning them". Further, a participant supported her view by mentioning that "if you want to design something adventurous and girly at the same time or maybe just girly, why not?"

Another participant's crafted object had "a lot of colours, which was showing the variety of personalities people have". By personalities, the participant also meant "genders". He stated that it came to his mind

because the group was discussing the colour of the perfume bottle. In contrast to that variety, he assumed that his book is “gender neutral”. He finally concluded that the act of questioning the inherent gender scripts in artefacts was already subversive to normative gender and limited the painful repetition of gender performativity in itself.

During the discussion, the making and telling objects (Play-doh, Lego, trash, drawing material) served less as a tool of expression than to fiddle around while talking and thinking.

After the possibly intense or exhausting workshop, the participants were thanked for their attendance. Though the crafted results could not serve as usable models, we explained to the participants that the input in the discussion was already the main goal of the workshop.

Evaluation

It is possible that participants experienced discomfort or had thoughts they were not able to share publicly in the workshop group or personally with the facilitator. For that reason, a final anonymous feedback questionnaire was published online subsequent to the workshop. The previously described techniques were evaluated separately and their impact on the participants was estimated. Participants were also able to answer freely what they would like to have changed or improved.

All participants answered to remember the different parts of the workshop, however two participants did not understand the making and telling technique “Deconstruction of Gender Scripts”, while the rest understood everything. In general, participants felt that they acquired new knowledge, especially about queer theory and about how gender materialises in designed artefacts. For one participant “The term “queer” isn’t really defined” after the workshop.

In general, participants appreciated the different sections of the workshop and agreed with the information supplied. An explanation for that was given: “But I do believe all participants were very open minded. I can’t help but think how someone who’s very attached to gender norms would have reacted, which leads me to the next answer.”, “I think what the gender ‘norms’ or ‘roles’ are could have been discussed more at the beginning, just to be more explicit why queer theory is handy for a lot of people!”

Since the facilitator did not particularly ask about any gender identity of the participants during the whole workshop, we asked a closure question: “Would you have liked to tell what gender you have (perform/identify with) in this questionnaire?” The question mainly serves to estimate the participants’ mindsets about the importance of publicly making claims about gender after the workshop. Three would have liked to, one did not, and three found it irrelevant.

Discussion

The co-design practice aimed at enabling design processes to be queer-sensible i.e. to regard those who were excluded by normative materialisations of gender. We consequently avoided all binary gendered assumptions, such as pronouns and gender identities of the participants in correspondence. Reporting about this workshop however, we used gendered pronouns to refer to certain participants. Most participants made claims about their gender identity and accepted to be assigned to either male or female gender. In their case, an accurate use of established pronouns was possible. The notation of they, them, their or theirs can be used to refer to non-binary individuals, but neither is the term unambiguous nor is it accepted by all designated people. By using languages with grammatical gender, stakeholders obtain easily male gender scripts, when the generic masculine is used to refer to them. We suppose that this is especially the case in a professional design setting.

By asking people to bring their own object, the practice gained increased personal significance. The impact of designed products on the owner’s gender could be identified effortlessly. The implications of ANT were made tangible; however, participants brought small low-cost, low-tech products, which made it difficult for the objects to be the equal of participants. The objects, in contrast to the participants, were replaceable. Furthermore, when a particular object is delegated to the participants, they might be unable to personally relate to it and do not experience how objects influence their definition of gender and even their own gender identity.

The participants, who experienced a gendered determinism of design cues, support Uta Brandes’ statement that ungendered design does not exist. The participant who claimed to have brought the ungendered item, a novel, probably only referred to the concept “book”, but neither to the content nor to the cover artwork nor

to the author. The gender binary apparently claims that all design cues produce either male or female implications. However, the same does not count for critical design research. The introduced practice could unmask inherent gender scripts of product design. Even though, the targeted two artefacts came from a similar domain and time, personal care products, 2018, the inscribed gender constructed the user substantially different. While the perfume scripted its user as a man who is a successful ruling businessperson, the lip balm considered their user as female, a weak pleasurer for men.

Associations to design cues are not universal and depend on the context of the audience. While some participants urged to change certain product properties, because they felt irritated, others insisted on their freedom of consumption and ability to ignore. The workshop resulted in several suggestions about how to improve designed objects. Participants urged to process rather natural than synthetic material, to avoid pink colour, to give abstract or neuter names to products, and to refer to basic human needs in place of socially constructed needs of normative gender. Some participants remained in the perspective of passively consuming goods or not. While gender cannot be regarded as an act of consumerism, it appears to be a general issue of design that potential users are defined by their ability to consume, their propensity to purchase.

The fixed perspective from consumerism further limited the generative outcome of making and telling. It made the participants experience the determinism of gender norms, as Butler already mentioned: subversion is not easy nor predictable. Introducing new symbolism may fail and establish an equally strong norm that is oppressive towards queer individuals. Besides, the use of highly participatory co-design makes the practice dependent on the participants and their current state i.e. their availability, openness, gender identity, mood, creativity and curiosity. The facilitator can mediate these effects through a carefully chaired execution of the workshop; however, the setup itself also limits the outcome. The rather short and direct treatment of the matter constrained to less creative and artistic contributions, while a higher level of gamification may lead to lower direct involvement of the participants to the problematic. Moreover, the used materials and the design of the session determine the generative outcome of the applied techniques. Dependent on the analysed design artefacts, those require adaptation.

Compared to the established design processes presented in the introduction, such as Schroeder's (2010), our practice also first analysed how users experience design objects and later on re-constructed them, however we avoided essentialist claims on gender. This reflects also in the choice of our methodology, instead of empirical studies, we applied qualitative research through participatory design. By implementing our proposed practice in alike professional environments, results that repeat essentialist normative gender might be avoided.

The practice did not cause any irritations to the gender identities of the participants. Applied techniques were mostly perceived positively, except by a few participants, who perceived the abstract step of reformulating disturbing gender scripts to introduce a new ideology of gender too theoretical and unmotivated. In subsequent utilisations, the design practice could overcome these limitations by illustrating the methods more detailed and by longer or multiple sessions. In professional settings, extrinsic motivators such as an allowance can attract participants. Future applications may be shaped around particular industrial design products and integrated into other design processes.

Conclusion

We reassigned a framework from brand design to identify those gender scripts, which are communicated through the design language. In contrast to Ehrnberger et al. (2012), it was not central to our work to recreate the design language. The participatory approach to respect queer in design or to "queer design" is similar to parts of Canlı's (2017) work, however the applied methodology and perspective is substentially different. In our work we did not strictly condition all participants to identify as queer, feminists, or LGBTI+. Further, Canlı's approach consideres many additional queerfeminist discourses such as about post-colonialism and intersectionality, while we based our work more on the explanations of the actor-network theory and in particular on (gender) scripts. Consequently the results differ in many aspects: the presented workshop in this paper is elaborating on existing industrial design products by applying analytic participatory methods, whereas Canlı's work produced tangible and abstract de/re-constructions of normative gender.

We developed a practice that focused not on finding *the* essential queer symbolism, but rather to include a queer perspective on else biased industrial design research methods. Applicable for early design research

phases, it critically identified and avoided oppressive gender norms. With our workshop, we opened the field of industrial design engineering to non-normative ideas of gender.

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Towards the exploration of Gender awareness in Human-centred design

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The primary aim of the human-centred design (HCD) approach is to identify the user needs. However, we argue that there is a lack of understanding of, and even awareness of, gender in HCD. This approach sees gender as static and stable regarding male or female such that the implication of principles in products, systems or services appeals to one gender or another linking gender differences, and stereotypes. To illustrate this, the investigation was conducted in the context of fostering sun protection behaviour in young men. Participatory design sessions were deployed to investigate the role of gender in the HCD and how it can be used to foster sun protection behaviour. We have concluded with the development of a novel gender aware HCD approach which opens avenues for design research and practice for increasing emphasis on the influence of the designer's own gender and their gendered perceptions in their designs.

Keywords: Human-centred design, gender, participatory design, sun protection, young men

Introduction

Skin cancer caused by exposure to sunlight and sunburn is the second biggest killer of young men and the most preventable cancer (Cancer Research UK, 2014). Young men, age 18 to 24 are at higher risk of developing skin cancer due to the low levels of sun protection behaviour. This is despite the growth in the market for the health promotion products produced by the cosmetics and sunscreen industries aimed to raise awareness about the risks associated with sun exposure and sunburn. This paper presents the development of strategies to foster sun protection behaviour in young men by designing new human-centred interventions.

Human-Centred design (HCD) has been applied in numerous disciplines including engineering, social platforms, business and industry, and healthcare. The HCD approach guides designers to understand human interaction on a daily basis through the psychology of human actions that impose its narrative on the field of design of objects. The primary aim of the HCD approach is aimed at understanding the users' needs and how to influence their behaviour. HCD is focused to improve the communication process and interaction between the products and the user through understanding the meanings attached while interacting with an object, and this could be improved by focusing on how the user interprets the product in terms of their gender. The lack of understanding of, and even awareness of, gender in the HCD principles were identified. So far, very little attention has been paid to the role of gender in the design of products (Moss, 2009). The aim of this paper is to explore the role of gender in the human-centred design and how it can be used to foster sun protection behaviour.

The paper proceeds as follows: Section 2 is concerned with the literature that surrounds the HCD. Also, it reviews the importance of gender and masculinity and its role in young men health-related behaviours. Further, this

section reviews the HCD approach to achieve the desired health-related behaviour. Section 3 discusses the deployed method to investigate the role of gender in HCD. Section 4 draws together the key findings emerged through participatory design sessions. Lastly, it opens suggestions for design implications and future research in the field of gender and design.

Literature review

Human-Centred Design

HCD is a creative approach to problem-solving that prioritises understanding human needs. HCD is based on the key principles of human psychology in order to develop products, services, and systems that are understandable, usable and desirable for people (Norman, 2013). Norman describes the interaction between the user and a physical object through the HCD principles such as 'affordances' and 'signifiers' (Norman, 2013, p.45). Norman defined affordances and signifiers based on the interpretation of how an object is perceivable to define the possible actions for interacting with an object based on the physical characteristics of objects such as size, shape, and colour which act as signifiers to show how users can interact with the objects. He also clarified the concept of affordances and signifiers as perceivable cues related to our interpretation and our past knowledge and experiences applied to our perception.

Objects targeted specifically at male or female audience, highlight differences based on gender stereotypes targeted at men and women (Karin et al., 2012, p.88). For example, products targeted at the female audience are using aesthetic characteristics such as soft, clean, organic shapes, and bright colours (Moss, 2009). We can see this when we look at, for example, Gillette razors targeted at the male or female audience; the way these differ in terms of shape, colour and material indicate the deployment of pre-existing stereotypes regarding gender and gendered norms. In this context, affordances and signifiers can be influenced by gendered based clues according to the designers' own preconceptions and pre-identified gender stereotypes.

While HCD accounts of design principles is based on a social psychology approach that explores human needs, this approach is based on a broad understanding of the shared values and common actions of all people as men or women but is not aware of the concept of gender as performative and relational. The HCD approach sees gender as static and stable relating male and female stereotypes to one gender or another. However, gender is performed and is multiple, dynamic, fluid and relational and is constructed in various ways over time in a particular context. But HCD links gender differences, gender inequalities and stereotypes to the products, services and brands. This contributes to the design products that are influenced by the designer's own stereotypical norms such as '*blue for boys*' and '*pink for girls*. In contrast, we can see that gender is socially constructed over time and understanding young men experience requires us to move beyond traditional, stereotypical and pre-identified gendered characteristics.

Gender

The concept of gender has been challenged and widely used as a social constructionism. Harriet Bradley, who is a sociologist and a major contributor in the field of gender studies refers to the sociological concept of gender as a lived experience and the nature of gender relations. Bradley, discusses that gender is socially constructed in contrast to the biological determinations and provides an explanation for the social patterns by men and women in society. The implication of this is that gender is based on the social understanding of people in relation to their gendered social groups (Bradley, 2013). More broadly, to understand gender we need to determine what is meant by sex and in particular sexuality. The concept of sex is biologically determined and fixed at birth. Sex explains the biological sexual orientation of a person and classifies people based on their natural biological characteristics as male or female. However, expressing sexuality is embedded in our cultures that are in relation to the person's sexual orientation and the way people represent their gender that reflects different characteristics associated with gender roles that form masculinity and femininity. According to Bradley (2013), gender is described as the cultural definitions of masculinity or femininity and the power between men and women that are not stable and fixed, but it develops over time in interaction with cultural and social values (Bradley, 2013, p.3).

According to Bradley, gender is persistent, everything from TV programs to car designs is gendered artefacts, and society and the world are gendered. Gender is described as the cultural definitions of masculinity or femininity and the power between men and women that are not stable and fixed, but it develops over time in interaction with cultural and social values (Bradley, 2013, p.3). Masculinity is the core theme of understanding

young men, defined by Connell as men's endorsement of traditional attitudes and behaviour that is socially constructed (Connell, 1987). In order to understand the concept of masculinity, we need to move on to the core concept of gender.

As a result, masculinity and femininity are constructed around specific cultural and social norms linked with gender inequalities in the society. This shows the connection between sex, gender and sexuality associated with authority, power and gender inequalities and the discourses of masculinity and femininity. Therefore, the root of masculinity and femininity is formed through the gender differences associated with the social and cultural impacts in the society related to being a male or female (Bradley, 2013, p.4). In line with the debates concerning gender by Harriet Bradley, Frosh et al. discuss the construction of gender not from the biological sense or genetically formed but as set of performative acts or actively 'doing gender' with a relational nature. Gender is culturally formed in accordance with the norms of society produced over time through our behaviours performing being a man or women. Frosh et al. describe masculinity as a dynamic process of gender or actively performing gender influenced majorly from a leading gender theorist; Judith Butler (Frosh et al.,2002, p.11). Frosh et al. acknowledge that there are multiple modes of masculinity or approved modes of 'being men' constructed by men that are socially constructed and fluid in dynamic ways and open to reconstruction in different contexts (Frosh et al.,2002, p.12). As Frosh et al. (2002, p.55) note: "masculinities are made into, and lived as, natural or essential identities". Overall, masculinity is a performative act; gender is a performance, and it changes in relation to our interactions and the environment. However, the HCD fundamental model of human action is based on a broad understanding of the shared values and common actions of all people.
Norman holds the view that despite the given variations and experience that affects individuals, fundamentally people approach the world in the same way regarding their perceptions, activities and the way they approach objects. Based on this model, human behaviour can be predictable on many occasions. However, gender is not simply external to us, but are built up and constituted over time and through interactions. This can be seen particularly in the dynamic patterns of our behaviour over time. This means that new designs transform over time in relation to particular contexts. Having identified this gap in the literature, this paper brings together the HCD approach and understanding gender performances to address the poor sun protection behaviour in young men. HCD provides guidance to explore the elements that fulfil the needs of young men through understanding the underlying meanings people attach while interacting with objects. For this purpose, the methodological approach taken in this research is an interpretive methodology to explore the underlying meaning people attach while interacting with object related to their gender.

Methods

Participatory design sessions

Participatory design sessions were deployed mainly focused on the act of participation, where the user was involved in all the stages of the HCD process and went beyond the traditional concepts of 'design for users' to 'design with users'. This study was conducted through eight participatory design sessions. A total of eight groups with four to six participants took part in this study for 120 minutes. In total, 23 male participants and seven female participants participated, and each session followed the same structure.

The main criteria for selecting the participants is in relation to the demographic factors including their age and gender. Since the nature of the methods including participatory design requires small groups of participants for the more focused and in-depth result, each session of the study involves direct user involvement with four to six participants. The participants were divided into two main categories including the users who are experts in the context and the subject expert demonstrated below.

The Participants will be recruited from the University of Brighton for a selection of young men and women age 18 to 24. Criteria for selecting the groups are as follows:

- User experts: male only group: male participants age between 18 and 24
- User experts: male and female in mixed-gender group: male and female participants age 18 and 24
- Subject experts: male and female experts from the fields of design, gender studies

The first stage of the study explored the participants' interpretation of products language, including the colours, shape and form. The interaction between the participants and the objects provides an opportunity to get participants thinking about product language, gender and how they interact and communicate with

objects. Also, this stage explores product language towards non-gender specific language in relation to the interpretation of the physical aspects of the products such as colours, material and shape as well as the internal meanings embedded in their interactions. In the review of the literature, the latest products targeting non-gender specific are evoked in a gender-specific language. Although, the market's shift towards gender diversity and gender-neutral products are growing in the lead brand companies such as Apple. However, the language embedded in these products are still gendered specific.

The second stage of the study was the design phase where the participants themselves designed sun protection interventions. This stage empowered the participants as designers, helping them to express their creativity, while aspects of their interactions were observed in relation to their gender. This led to innovative interventions for improving the low levels of sun protection use in young men.The co-design technique involves the user in the design process to meet their needs from their perception when the user is in full control and empowered in the sessions (Holtzblatt et al., 2005). In this technique, participants are actively involved and exposes the deep experience of participants in relation to the context through the illustration of their tacit knowledge including the hidden needs that are not fully known to the user. Tacit knowledge is subconscious, personal and known to the user but cannot be expressed explicitly in words as it is linked to skills and experiences, "knowledge that people can act upon, but cannot readily express in words." (Visser, 2009, p.4). On this basis, the user experts and the subject experts were able to communicate their tacit knowledge through the visual articulation of their ideas and needs in their designs. All the conducted sessions took place in the Creativity Centre at the University of Brighton and involved male-only groups, mixed-gender groups and an expert group. The purpose of this was to highlight the differences in group dynamics, specifically the participants' behaviour, and the enactment of their gender in relation to these different groups. The different dynamics of male-only interviews, as opposed to mixed-gender interviews, provide an opportunity to look at the group dynamics in both categories and see how this was linked with the participants' enactment of gender and masculinity.

The procedure

Phase 1: product language

Initially, the participants were introduced to a number of products, as presented in the following subsections. This phase of the study aimed to explore gender values embedded in the design of products and the ways in which they were perceived by both male and (when present in other sessions) female participants.

The investigation involved the exploration of product language in terms of 1) products targeted at both male and female genders, and 2) gender-specific products and advertisements. This phase of the study aimed to explore the interaction between the products and the participants, and the language and meanings the participants perceived. Initially, the illustrated products below (Figure 1) targeting both male and female target audience advertised as gender-neutral were presented to the participants.

The participants sat around a table while images of the product examples were presented to them. The researcher asked participants to share their opinions about the products, their motives for using the products. For the next stage of the study, a range of products (Figure 2) targeted only at the male or female audience was outlined to the participants.

Figure 1: Apple watch and Kettle and toaster by Marc Newson, Alessi's hob kettle by Michael Groves (the product photos are printed with all rights reserved)

Figure 2: Gillette razor and Bic Pen. The Dove products targeted towards women are on the left and products targeted towards men are on the right (the product photos are printed with all rights reserved)

As illustrated above, the most successful leading brands have embedded masculine or feminine attributes in their advertisements. Advertisements portray patterns that feature specific gender subjects. This includes popular gender representations focused on displaying gender differences between males and females based on stereotypes (Goffman, 1987).

The next stage of the study was an investigation of gender patterns portrayed in product advertisements aimed towards specific genders. This was the final stage of the product language phase and focused on the participants' perception of the advertisements shown in the following section. The researcher is focused on the participants' interactions and attitudes in relation to advertisements featuring human subjects linked with their own gender and masculinity. Various leading brands have embedded masculine or feminine attributes in their advertisements, with gender-specific advertisements portraying popular gender representations focused on the differences between males and females, based on stereotypes. The Dove Men+Care cosmetics advertisements featuring male subjects were discussed. As illustrated in Figure 2, the Dove brand is designed with a specific name (Dove Men+Care) and features grey coloured bottles with a bold font. This brand is very popular and successful, and its advertising campaigns are centred on using 'real' people, rather than professional models. The Dove 'Men+Care' advertisements depict ways of being a real man and promote an image of real men with real strength (Dove, 2018). This is linked to the concept of masculinity, as it portrays popular concepts associated with being a man (Frosh et al., 2002,p.17).

Key themes

The following section overviews the key themes emerged from an in-depth interpretation of the gathered data from phase one: product language. Initially, the collected data were transcribed and coded using thematic analysis in order to gain insights into identifying and analysing patterns and themes from the perspectives of the participants (Braun & Clarke, 2006).

All the conducted sessions produced a range of qualitative data including images, audio, video recordings, observation notes as texts. The collected data is discussed and analysed using an inductive approach as the data emerge new themes through the comparison of collected data in the mixed, male-only an expert group. The key findings from the analysed data suggest the expression of gender and the dominant discourses of masculinity (Connell, 2005) in commonly reoccurring patterns and themes collated are developed in connection with identifying the meanings, motivations, and experiences of the participants.

These themes portray the ways the participants seem to be concerned with 'being' like others, young men don't want to be seen as different(Mac an Ghaill, 1994). Their responses came across as their fear of being seen different as it seems they want to be accepted by being like others. The results outlined the participants' gender identity influences their perception and understanding of the appearance of products including affordances and signifiers.

Theme 1: Gendered responses and meanings

Almost all participants in the main study expressed their interest in the products which were targeted towards their own gender. In particular, they identified the main characteristics of products such as colours, shapes and materials associated with specific gender and products as targeted for either male with masculine characteristics or female with feminine characteristics. However, they recognized a range of features and meanings attached to the products as 'naturalized'. For them, these features of products are an important consideration when buying and using them targeted towards a particular gender. Many male participants feel this way and they recognised the gendered features of the products aligned with the construction of their masculinity. As the following participants explained:

[JS, M, 21]: *Male colours are dark blue and black, female products are curvy, and I usually buy the products that are dark colours and are for men, the font and packaging of products for men are with straight lines or as a square.*
[EA, M, 20]: *I buy products that are dark colours and are for men, if a product is designed for women, it will have bright colours and will be soft and smells girly such as Nivea creams, flowery smells are for girls*
[SH, M, 24]: *I always buy Gillette shaving cream that is specifically designed for men, in general, products that are designed for men look more reliable as it's guaranteed that it will do the job.*
[EH, M, 19,]: *all the men's products are dark coloured like black and blue and women are more pink and white, if a product is for men then it's for him.*

Almost all the participants recognised products targeted at their gender through stereotypical colours such as 'pink for girls' and 'blue for boys'. This seems to be something they expect and an important consideration when they use a product. Almost all male participants avoid using products that are not designed for their gender. In some cases, this attitude was expressed repeatedly by the younger male participants aged 21 and under.

Theme 2: Masculinity

The primary motivation in choosing products by the male participants shows a link with products targeted at their gender. Here are a few examples of the way they described their unwillingness in using products that are not designed towards their gender:

[JS, M, 21]: *I would never use female shampoos because they are smelling different to male products and I don't want to walk passing someone who thinks 'he smells like a girl'*
[EA, M, 20]: *there shouldn't be any difference between male and female products because if it's the same product but I always buy men's products because it's important to me.*

[JP, M, 20,]: *James said he won't use female products because it's very different like Lynx for men and lynx for women, they are completely different and the difference is massive*.
[KE, M, 21]: *I won't buy the pink pen because it says Bic for her and its pink, I rather blue or transparent.*

[SM, M, 20]: *there is no way I wear a feminine watch, also I don't like flowery patterns products like the blender, it's cool but I won't buy it, but I will buy it for my girlfriend.*

[JP, M, 20]: *Men buy first thing it comes across to them when they want to buy something such as shampoos and they prefer something that does everything and it's less detailed and it says that it's for men so it's what they want, if it says for men so it's designed for men. The female products are very different like Lynx for men and lynx for women, they are completely different and the difference is massive, most people will think you are weird for using a female product*

The demonstrated comments refer back to the fragility of masculinity and it needs for protection (Frosh et al., 2002). However, a few male participants indicated more flexibility in using products that are not targeted towards their gender. As they explained:

[AD, M, 22]: *I don't mind the flavour of shower gels and I usually buy the cheapest product. For example, I won't necessarily choose the boy's shaving cream as it doesn't bother me if it's marketed towards girls or products with flowery patterns.*

[SH, M, 24]: *I don't mind wearing thin watches because it's cool, in fact, I'm wearing one now that is with thin straps and rounded screen. I think it looks friendlier as Stephen's watch looks rigid, not friendly, not welcoming, over the size, over the top and Hefty. I would buy pink tools if it works better as I have worked in the construction sites before and you can see the tools better because of the contrast.*

[AL, M, 21]: *If there is no other pen in a shop I will buy the pink one.*

These participants explained their motivations and reasons behind their choice of objects and their openness to use products not designed specifically for their gender.

The variations in attitudes and behaviour of the male participants in comparison with the female participants indicate their gender differences created and reacted in their responses associated with displaying patterns of masculine or feminine attitude and behaviour. This is relevant in developing of understanding of the male participants' attitude and behaviour in relation to their gender characteristics and masculinity embedded in their motivations. At this point, we should note that almost all male participants expressed views and ideas associated with different versions of hegemonic masculinity. Given their social class and age, this is not surprising (Connell, 2005).

This analysis also indicated that understanding of the ways in which the male participants express their masculinity is in relation with their age as the male respondents seem concerned about their masculinity as came across as defensive and it needs the protection of the male participants' masculinity through choosing particular products.

Theme 3: Same-sex body contact

All the male participants indicated that their main worry for sun protection and applying sunscreens is regarding the application of sunscreen on their body. It is understandable from the ways they present themselves towards stereotypical gender boundaries related to the ways heteronormativity shapes their perceptions (Connell, 2005). This indicates the understanding of masculinities related to the participants fear of seen as homosexual and expression of heteronormativity through expressing their avoidance of same-sex body contact.

As they said:

> [RM, M, 21]: *I would never ask a guy to put sunscreen on my back. It is not a guy thing to do.*
>
> [JP, M, 20]: *I won't put sunscreens on his back and won't ask friends.*
>
> [SM, M, 20]: *if I go to the beach as just guys they won't put sunscreens on each other's back because it's sexual,*
>
> Then Stephen said 'so you think it's awkward' and then Sam said 'I didn't say it's awkward'.
>
> [EM, M, 22]: *I won't put sunscreen on guy friends back because people around us will judge and guys back is hairy.*
>
> [AH, M, 21]: *if I go on a family holiday I will use the sunscreen but when I'm with my friends and there is something awkward about using sunscreens, I am not worried about what suntan to buy but how to apply it and avoid body contact with your friends' back, something that sprays sunscreens everywhere would be good*
>
> [RM, M, 21]: *I would never ask a guy to put sunscreen on my back*

In response to these comments, almost all the male participants in the group agreed with their comments. However, a few of them indicated more flexibility with body tactile as outlined below:

> [SH, M, 24]: *you just say I just need to get through this awkward moment and you apply the sunscreen on someone's back.*
>
> [JB, M, 23]: *My girlfriend put sunscreen on my back and because I've got tattoos on my back I don't mind anyone else put sunscreens on my back.*

Although it is apparent that they still need to justify themselves and in need to protect their gender boundaries and masculinity, they show more openness and flexibility. Overall, Table 1 provides the number of participants who are in need.

Table 1: Attitudes toward same-sex body contact

Positive and negative attitude to same-sex body contact	*Male Participants N=21*	*Female Participants N=6*	*All Experts participants N=3*
Positive attitude to same-sex body contact	20	0	2M
Negative attitude to same-sex body contact	1	6	1F

In this case, in terms of ways in which they are in need to assert popular ways of being a man such as being heterosexual is important in the construction of their masculinity (Connell & Messerschmidt, 2005). From this analysis, fear of being seen as homosexual is one of the main reasons for the way young males present themselves towards the stereotypical ways of being like other men.

In addition, the participants also indicated various forms of asserting their masculinity such as playing rugby. Playing sports such as rugby is very popular among men and very significant in ways men construct their gendered identity and masculinity (Murray et al., 2016).

Phase 2: Design

The final phase of this study was the design phase, which was facilitated through various co-design techniques, such as ideation and brainstorming (Simonsen & Robertson, 2013). Ideation and brainstorming activities engage the participants to articulate their creativity and innovative ideas while empowering them as designers. The participants were guided through the practical activity of ideation to generate new sun protection interventions. During this stage, the participants were encouraged to ideate sun protection interventions to improve young men's sun protection behaviour. This involved them reflecting on the information from the session and applying it to new and innovative interventions.Overall the design outcomes were a range of sun protection interventions including the following categories based on the researcher's inferences: 1) Sunscreen bottles 2) Sunscreen applicators and 3) Wearable technology. The outcomes designed by each group and the participants from the discussed categories are mapped in Table 2.

Table 02: Overall design outcomes produced by each group, the number of each participant is presented numerically and indicated by their gender, Female (F) Male (M)

Main study groups	*Participants (male and female)*	*Sunscreen Bottles*	*Sunscreen applicators*	*Wearable technology*
Group 1	4M	1M	2M	1M
Group 2	3M,1F	2M,1F		
Group 3	3M,1F	1F		3M
Group 4	3M,2F	1M,2F		
Group 5	2M,2F		2F	2M
Group 6	4M	4M		
Group 7	4M	3M		
Group 8	2M,1F		1M	1M

As discussed in Section 2, affordances and signifiers are fundamentally important in understanding how an object can be used by a particular actor and is the key principle of good design (Norman, 2013). Norman defined affordances and signifiers based on the interpretation of how an object is perceivable to define the possible actions for interacting with an object. He also clarified the concept of affordances and signifiers as perceivable cues related to our interpretation and our past knowledge and experiences applied to our perception. Giacomin added the usefulness of affordances and signifiers related to the importance of

understanding the way people interact with physical objects (Giacomin, 2014). He indicated that the implication of HCD principles through a wide range of affordances in a product, system or service results in good interaction design that brings out commercial and business success.

The discussed elements pinpoint the participants' own gender reflections embedded in the design outcomes. Also, their reflections have influenced the design of the affordances and signifiers. This analysis is pushed further through a consideration of the male participants' accounts of their gender and masculinity expressed in their designs. A potential association is expected between the male participants and their designs, validating their gender and protecting their masculinity. The analysis of the design outcomes outlines a range of characteristics in the participants' design related to stereotypes, expression of gender and hegemonic masculinity. A few examples of the design outcomes are illustrated in below (Figure 3). As illustrated below, the male participants expressed their interests towards designs inked with their heteronormativity such as the sunscreen applicator in the form of a roller ball. The male participants in the expert group were also concerned with the application of sunscreen on their body and avoiding same-sex body contact. Avoiding same-sex body contact was often presented as something which usually the male participants are concerned in these outcomes. This provides evidence in the discussed material that the preferences applied in the design of affordances and signifiers towards the protection of their masculinity.

Figure 3: Examples of the design outcomes by 4 male participants on the top and 2 female participants on the bottom

The design outcomes indicated a link in the outcomes designed by the male or female participants and the reflection of their own gendered characteristics. Amongst the discussed aspects of the HCD principles, we draw out the role of gender embedded in the design of affordances and signifiers and how these elements are influenced in each design outcome. The results highlighted links with the influence of gendered characteristics in each design in relation to masculine and feminine attributes.

It is clear from the participants' comments that their behavioural patterns are asserted in relation to their challenges of being the same as others and to conform to their gender roles. As it was shown both male and female participants portrayed their perception of masculine and feminine attributes in the design of affordances and signifiers. A possible explanation for these differences is related to the participants' general preference amongst their design with an inclination towards their own gender. This goes beyond deconstructing affordances and signifiers influenced by gender roles and developed through a range of features such as lines, material, shapes, typography, colours, labels and use of details. The continues patterns of the participants' behaviour towards conforming to preconceived ideas and stereotypes is related to the ways the individuals try to conform to the normative gender roles and need various ways of showing their masculinity as the society has become more individuated.

Conclusion

The results outlined the participants' gender identity influences their perception and understanding of the appearance of products including affordances and signifiers. The reoccurring emphasis on the perceived characteristics of products targeted at the male audience showed a clear preference of male participants towards maintaining their masculine identity. Their preferences towards the appearance of popular male-targeted cosmetic products such as DOVE MEN+CARE and NIVEA MEN was an additional influence on the overall appearance of design outcomes. In addition, further explanations of their preferences were related to the product properties including chunky shapes, dark colours such as navy blue, grey and black, the appearance of silver chrome material. This suggests the deployment of their gendered tropes to understand these objects and have a gendered view of products.

In this context, affordances and signifiers guide the user to understand how to interact with an object based on the designers' gendered perceptions associated with traditionally male or female gender roles. The purpose of a gender-aware HCD is to add awareness for the influence of designers' gender perceptions in the HCD process before they are applied in the characteristic of products through affordances and signifiers. The designers' perceptions have a direct impact on how affordances and signifiers are designed and interpreted by the user which can contradict their gender identity. Male participants' perceptions of products were clearly influenced by their gender. This clearly links with the ways the HCD characteristics including affordances and signifiers were influenced by the participants' own gender. The participants' gender and masculine attributes were linked with the gendered characteristics applied in various features of the design outcomes. We saw the interplay of gender in the way affordances and signifiers were designed in these products.

This analysis guides design research towards understanding the way that gender, being a male or female designer, affects the designer's perceptions. This can suggest the way designers' gender identity play a key role in influencing affordances and signifiers which emerge in a range of physical features of a design such as lines, material, shapes, colours, and labels. The implication of adding gender awareness in the HCD approach for designers can result in addressing the gap between the world of designers and users. Bridging this gap requires designers to go beyond their gender perceptions and focus on the users' gender identities. Making the role of gender visible in designers' perceptions broadens the design of affordances and signifiers beyond the stereotypical perceptions of gender.

In addition, to foster sun protection behaviour in young men it is important to consider how gender is implied in affordances and signifiers of the sun protection products. We can facilitate this by combining HCD principles and practices with an increased and reflexive gender awareness. Doing this produces design outcomes for sun protection that are more appropriate to young men. Taking this kind of approach will move designers to consider affordances and signifiers in new and innovative ways, and this will have considerable implications in areas beyond sun protection design. The implication of GAHCD approach for designers can result in addressing the gap between the world of designers and users. Bridging this gap requires designers to go beyond their gender perceptions and focus on the users' gender identities. Making the role of gender visible in designers' perceptions broadens the design of affordances and signifiers beyond the stereotypical perceptions of gender.

Future work

This paper has opened new avenues for future research in the following direction: considering the role of a gender-aware HCD approach for the wider design community. This means to consider the implications of employing gender aware HCD in the wider design community. This would include academic design research, design education focused on HCD (product design and industrial design), and design agencies. This could include design research and practice to increase the emphasis on the importance of gender, helping to support and encourage gender-awareness in the HCD process to address user needs in their design solutions. Designers' reflections on the influence of the designer's own gender and their gendered perceptions in their designs is a starting point. This lack of gender-awareness neglects the user's needs to be addressed as it is a crucial element of how the product is established as human-centred. The whole design community should consider moving away from normative gender stereotypes when developing new designs in terms of gender identity of the user to represent fluid and dynamic gender perspectives that are socially constructed in different contexts. Our suggestion is for the Design community to avoid neglecting the designer's gender role influence and move to a closer understanding of user's interpretations of products.

Designers perceptions based on their own pre-conceptions and past experiences produces products based on their perceptions can be in conflict with the user's gender identity. Designers should avoid the influence of their perceptions based on gender stereotypes and enhance understanding of gender, the ways in which the designers can engage in GAHCD to avoid the mistakes of the previous design related to gender bias when designing new products

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Track 2.d Introduction: Power and Politics in Design for Transition

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Power and Politics in Design for Transition

This track sought to contribute to design's potential to shift, redirect and transform power relations to achieve sustainability. We sought to direct attention to the political potential in and politics of transition design with a focus on the many ways that power flows through the systems in which design operates. Our intention was to address, directly, the commentary from the DRS2018 track on Designing for Transitions, which noted that authors had tended to "stay on the safe and perhaps conventional side" of the subject. Instead, we hoped that the papers in this track would address "'politicised issues such as migration, decoloniality, the politics of climate change mitigation… and other complex and controversial problems" (Boehnert *et al.* 2018) that must be considered in planning and implementation of ongoing sustainability transitions. The politics of design transitions remains marginal in design research. With our call, we hoped to receive contributions that problematised design's current roles and conceptualised new roles for design in the context of sustainability transitions to attend to issues related to how power is and should be dealt with.

The five papers selected for this track respond to this call with an eclectic understanding of Transition Design, also known as Design for Sustainability Transitions. They reflect the broad span for design research as it starts to engage with subjects that have previously been the domain of social sciences. Ranging in scope from a systems level description of a project for the Dutch Government, to an individual's reflection of their practice as a zero-waste designer, these papers describe alternative models of expanded design practice for transitions. The authors also describe tools and methods for designers working in the area of transitions such as action research, ethnography, experience mapping, journey mapping, personas, focus group workshops, user research for the re-organisation of socio-ecological and politico-economic relationships to shift power relations, with a sustainability focus. The authors explore strategies for navigating the politics of design for sustainability transitions on a variety of scales with diverse strategies.

Sofia Bosch Gomez and Hajira Qazi presented **"The Disconnect Between Design Practice and Political Interests: The Need for a Long-Term Political Engagement as Design Practice**" which reflects on the gap between the importance that politics plays in designers' lives, and their willingness to be overtly political in their work. Bosch Gomez and Qazi view political participation by designers as having "untapped potential… to facilitate and be involved in a transition towards more inclusive and equitable socio-political systems." Arguing that designers already possess many of the skills needed to design for systems-level political change, the authors contend that "Designers' expertise lies in materializing imaginaries—bridging what we know, what the present is and what it ought to be—in order to enable new futures and possibilities." However, design for political change is clearly absent from most design programmes. To address this absence, the authors introduce a workshop framework and tool that enables design students to recognize their political agency and become comfortable with the notion of using design to influence political change.

Rebecca Anne Price's **"In Pursuit of Design-led Transitions"** describes a transition design project in the food sector run by the Dutch Government to promote sustainable daily cooking habits. Reflecting on methodological developments within design-led innovation, Price introduces 'timing' and 'velocity' as conceptual foundations for transitions, with the aim of designing to dismantle 'lock-ins' in socio-technical systems on predominantly large-scale systems. Using a S-curve model to describe growth in relation to time, Price reflects on how this informs ideas on velocity of change (gradual or abrupt). The paper includes theoretical implications of transitions analysed through the lenses of timing and velocity. As the most technocratic of the five papers, this work assumes that particular moments can be identified as "windows of opportunity" with particular velocities of transition: e.g. creative destruction, robust coexistence, illusion of resilience, robust resilience, in ways that are heavily abstracted from social and political contexts in which this project is situated. Whether or not this abstraction obscures the political complexities of particular problems with models (that might not always be as robust as we would like) is an ongoing subject for debate. Nevertheless, Price's assertion that design endeavours in the contexts of transitions should go beyond disruption, radicalism and new perspectives to focus consciously on destabilising and restabilising socio-technical systems enables reflection on the politics of these destabilising and restabilising efforts.

Also using a large-scale and systemic approach Maaike van Selm and Ingrid Mulder's paper is **"On transforming transition design: from promise to practice"** analyses and translates concepts from "Transition Design" and then proposes an integration of Transition Design with the Systemic Design Toolkit (Namahn, 2016; Vandenbroeck *et al.* 2016)). The authors aim to support the development of practice, based on the claim that few actual cases labelled Transition Design are described in academic literature. Distinguishing between what they see as three different phases – design research, design interventions and design practice for transition, they discuss opportunities for further development to address current practical challenges and limitations, pointing to potential resources and methods from fields such as strategic design. In doing so, they find the last phase to be the least developed, and especially methods for monitoring and steering to be missing. Their suggestion that there may be relevant lessons to learn from lean start-up methodology for example opens up for discussions on how to balance the urgent need to act with the need to observe and reflect.

In contrast to the systems-level perspective of the previous papers, Niki Wallace describes the first two years of her PhD exploring design against consumption in "**The Personal, political, professional: a practice in transition".** This work starts from the premise that "in order to contribute to transitions towards sustainability, both practitioners and design itself must also transition." Wallace describes (and illustrates) her own personal awakening as a process of transition. In this auto-ethnographic study Wallace details changes in her practice and perspective and introduces some of the key theoretical concepts that inform her personal, political, professional transitions. Writing about the role of the double bind in design for sustainable transitions, for example, Wallace contributes a passage worth quoting at length:

> double-bind theory stems from social psychology; it describes how schizophrenic symptoms can result from no-win situations, where complex and contradictory messages prevent action (Bateson *et al*., 1956). Designers can experience a double-bind when they view sustainability as simultaneously necessary and impossible in the context of their design brief. The resulting action paralysis can lead to design's equivalent of business-as-usual—an aesthetically pleasing range of unsustainable design outcomes. In contrast, a designer who transforms their relationships to ecology and the problems that threaten it becomes empowered to politicise their approach.

In bringing attention to the notion of the double bind in a transition design context, Wallace offers an expansion of the transition designer's conceptual vocabulary, joining other 'soft systems' concepts such as wicked problems (Rittel & Webber 1973), visual representations of systemic relationships (Boehnert 2018a, 2018b), and 'knots' (Lockton 2018) which can help designers better represent power structures, conflicts, and tensions inherent in the systems in which design operates. Working back and forth from theory to personal reflections, as pointed out by one of the anonymous reviewers, Wallace's "research stands out for its honesty and sincerity... an excellent example of incorporation of theory and practice containing both scientific rigor and artistic creativity." Although striving for a zero-waste lifestyle is not on its own an innovative or novel practice, it nonetheless relates to an important and topical transition context that can be studied at the level of the individual in sufficient depth. Wallace's account of her personal journey, thanks to its rigour and theorisation, opens up a series of rich discussion threads for designers to look into the mirror and reflect on the politics of their practice both at individual and professional-collective dimensions.

Finally, the paper **"The influence of design thinking tools on NGO accountability"** by Ledia Andrawes, Adela J McMurray and Gerda Gemser considers two case studies of the use of Design Thinking as an approach for increasing the prominence of beneficiary-centred accountability within NGOs working with humanitarian aid. With the goal of stimulating and increasing accountability, two real world projects (the first focussing on maternal, newborn and child health in Ghana, the second on humanitarian action in Lebanon) demonstrate the value of empathy felt individually by aid decision makers, as opposed to external accounts from the donor's perspective. This is powerfully reflected in a quote in the paper from an aid worker involved in the research: "I felt frustrated for them, I could see what was happening to them and it just pissed me off. It touched me, I had empathy for people who are in many ways unlike me, and in many ways just like me – it definitely increased the accountability I felt towards them." Using personas and journey maps as tools to enable those on the donor side of aid projects to understand the experience of those on the recipient side, this project brings design thinking methods to development practice and development studies with design thinking.

These papers have all contributed to emergent field of Transition Design in ways that emphasis the political dimension of change-making by design. In our view, transition design is inherently political. As an expanded conception of design, it necessarily draws on cross-disciplinary debates from ecological, feminist, post-humanist and decolonial theory to inform sociotechnical systems-oriented design practice at all scales. Where transition design advocates a design-led social transition to more sustainable futures (Irwin 2015) it has sought to do so by developing inclusive theory to enable ethical and justice-oriented design as a means to address the reproduction of social injustices by design. Moving away from traditional user-centred design to more participatory paradigms, transition design situates the user in the context of larger socio-political (Irwin *et al.* 2015; Gaziulusoy 2018; Gaziulusoy & Erdoğan Öztekin 2018) and ecological systems (Boehnert 2018c). With this perspective, transition design integrates system innovations and transitions theories, social practice theory and sustainability science (Irwin *et al.* 2015). It builds on the approaches of Design for Sustainability, Service Design and Design for Social Innovation (Irwin 2015) to enable new visions for sustainable futures (Irwin *et al.* 2015; Lockton & Candy 2018). It engages with the disciplines that describe human relationships in society and the environment such as anthropology, sociology, politics, environmental sciences, science and technology studies, etc. in ways that help designers incorporate the interests of diverse groups of people (Escobar 2018) to make more inclusive, just and sustainable worlds by design.

In conclusion, we note a distinction in design debates between those who see our current situation as a set of severe intersecting crises or even 'emergencies' (following most recently the Extinction Rebellion and a growing number of cities, councils and universities responding to the movement's call to declare 'climate emergencies' at various scales: institutional, local, regional and state level) – and those whose call to action (if there is a call to action at all) is formulated within the limitations of current politico-economic systems. Where addressing eco-social problems requires challenging currently existing values, socio-economic structures and systems, depoliticised design discourses undermine the potential for systemic design responses to the most challenging contemporary problems. This conflict between the urgency to act and the desire to continue to only slowly change design is evident spaces such as heated debates on the PhD Design List and the public statement published by the Decolonising Design Group (Ansari *et al.* 2016). Those intent on disrupting and transforming design practices responsible for reproducing unsustainable design (and the ideas that buttress these practices) continue to face political and structural obstacles as design and design research all too often remains tightly focused on insular and instrumental outcomes.

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The Disconnect Between Design Practice and Political Interests: The Need for a Long-Term Political Engagement as Design Practice

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Long-term, sustainable transitions cannot occur without working at the political level to address the serious, global political challenges we are facing today. However, the capacity of design as a rigorous component and complement of the political world is yet to be seen. In this paper we discuss surveys we conducted, showing that there is a clear discrepancy between how designers engage in the political process as citizens and as professionals. We also discuss a subsequent workshop which allowed survey participants to explore these questions of roles and agency in greater depth and offered insights into barriers and opportunities. We found the workshop to be an effective method of helping designers identify leverage points and courses to intervene within both the designer's sphere of influence and sphere of concern. In so doing, we might begin to draw more designers into the critical work of designing for a transition towards more inclusive and equitable socio-political futures.

Keywords: political participation, civic engagement, Transition Design, policy design

Introduction

Langdon Winner's oft-cited paper, "Do Artifacts Have Politics?" (Winner, 1980) is frequently used to argue that design is an inherently political act, and that our role as designers is an intrinsically political one. Yet, the presence of designers in the sphere of political and civic engagement is notably thin. Indeed, our research has shown that designers tend to view their role as active citizens as being entirely distinct from their role as designers. Though designers do engage in the political process, they struggle to reconcile that sense of political agency with their design work, and tend not to leverage their design expertise to facilitate political understanding and rapprochement through activism. The capacity of design as a rigorous component and complement of the political world is yet to be seen. Considering the designer's expertise in changing perceptions, facilitating conversations, and "imagining... new ways to live" ("Imaginaries Lab" n.d.), we view the arena of political participation as untapped potential for designers to facilitate and be involved in a transition towards more inclusive and equitable socio-political systems. Our research explores the absence of concrete political work in the realm of design and derives methods for how the design community might begin to bridge that gap.

Perhaps now more than ever, it has become imperative for designers to find ways to design interventions that foster healthy, resilient, participative and strong political constructs. One need not scroll far into a news feed to recognize that political systems all over the world are declining into increasingly volatile, precarious

structures that are nearing a tipping point towards destruction. We have already seen once-stable countries in Africa and the Middle East devolve into chaos and violence (Boghani, 2015). Now, strong Western democratic powers such as the United States and United Kingdom are also faced with rising nationalist and populist movements that threaten the very foundations of those democracies, such as Donald Trump's "America First" campaign slogan and the Brexit movement in the UK (Abbott et al., 2018).

The slow corrosion of democracy has created a sense of polarization and uncertainty on both sides. In the United States, these divisions have been kindled by a series of sociopolitical measures by the Trump administration that have consequently triggered a new wave of activism and civic awakening. An estimated 113 million voters participated during the November 2018 U.S. midterm elections, a record number in its history (Vesoulis, 2018). In addition to massive voter turnout, demonstrations have been pervasive since the recent change of government: news-making events were the Women's March in 2017 and 2018 upholding women's rights as human rights; the March for Our Lives in 2018, a demonstration in favor of gun regulation; and the March for Science 2017 in response to the skepticism from the Trump administration regarding climate change; amongst many others (Dockray, 2018). The aforementioned demonstrations all took place in the course of the past two years, some of them ranking as some of the largest protests in American history (Dockray, 2018). What is most notable from 2017 to the present is that people are rising to the challenges of our time. Regardless of the cause, it seems political participation is rampant in an age where apathy has been perceived to be the norm (Dalton, 2008).

State of Affairs

In spite of such critical shifts in politics, designers still seem to be reluctant to fully take on these challenges as part of their work. An increasing interest in political discourse gives the impression that a new field of "design for policy" is emerging/rising. We see this in universities, as service and strategic design courses are now present in the curricula of many design programs, and in the development of new programs such as Design for Government at Aalto University in Finland by Ramia Mazé (Mazé, 2017). Academic research done by Lucy Kimbell at University of the Arts London (Kimbell, 2015), Nicolás Rebolledo at the Royal College of Arts (Laboratorio de Gobierno. (n.d.)), Lara Penin at Parsons (Penin, 2018) and Christopher Le Dantec at Georgia Tech (LeDantec, 2016), amongst others, offers a new vision of how design and designers could contribute to the realm of politics and public innovation.

Beyond academia, we see the development of public sector initiatives driven by design (such as the Public Policy Lab in New York, the Lab OPM—part of the U.S. Office of Personnel Management—and the Lab@DC, both based in Washington, DC; the San Francisco Office of Civic Innovation; and the Los Angeles Innovation Team in California; amongst many others in the United States alone) ("Mapped," n.d.). Nevertheless, the explicit commitment of young designers has still been relegated to the technical and remains the interest of a minority in the design guild.

Perhaps the lack of political engagement in design work comes from the misinterpretation of two distinct terms: politics and government. In a conversation with Bryan Boyer, founder of the Helsinki Design Lab and board member of the Public Policy Lab, he referred to politics as "a vision"—the spearheading idea that stirs political decision-making in particular timeframes and negotiates a multiplicity of values and agendas.[1] Government refers to the machinery, the form in which that vision is implemented through the work of thousands of public servants and policy-makers. The need for a transition towards more sustainable futures will come hand in hand with political transitions, and these will require designers to be active political actants. By this we mean leaders of these new visions as well as practical operative implementers. We thus aim to explore the political side of the equation—how design and designers can be involved in the creation of those "visions" that nourish the governing apparatus. How might design become a pivotal instrument in the political rather than just an operative tool?

Envisioning Alternative Futures

The seriousness and expensiveness of the political climate today can be overwhelming and paralyzing for many. The sociocultural impact of politics can be considered what essayist Elaine Scarry calls "world-destroying" (Scarry, 1985, p. 29). "World-destroying" is the narrowing of a vision and of the possibilities of

[1] Boyer, B. (2018). Personal interview with the authors.

imagination and future portrayal by the infliction of daily pain which demands present and total concentration. How can we envision the future when the present is in pain, aching, and requires our full attention and concentration?

As innovative makers, envisioning alternate futures is precisely where designers excel. Designers' expertise lies in materializing imaginaries—bridging what we know, how the present is and what it "ought to be" (Simon, 1981, p. 5)—in order to enable new futures and possibilities. This worldmaking ability is not limited to the creative, but extends to socioeconomic and cultural phenomena as well (Bodker, 1999; Docherty, 2017). Design is the conceptual and physical connector providing tools for what Scarry would refer to as "making-up"—the ability to creatively imagine alternatives to present realities—and "making-real"—materializing those alternatives (Scarry, 1985, p. 280).

Politics is also an envisioning discipline in which the need to actively create future imaginaries is essential. The contribution of design to the political sphere, then, is rather straightforward: designers have the means and possibility of creating new, abstract, speculative and hypothetical possibilities (Candy & Dunagan, 2016) and the pathways by which those possibilities could then be materialized. Moreover, because of design's malleability and permeation into everyday life, designers are uniquely positioned to have political agency and influence as well. In that sense, designers' personal vision of their work coupled with their political scope enables them to advance or deter particular agendas.

Implications for Transition Design

For this reason, politics is a critical component and powerful tool for Transition Design. Transition Design is an emerging and growing field of research that "is based upon longer-term visioning and recognition of the need for solutions rooted in new, more sustainable socioeconomic and political paradigms" (Irwin, 2015, p. 230). Transition movements argue that traditional approaches to problem solving are insufficient for our increasingly complex world of entangled, wicked problems (Irwin, 2019, p. 150), and thus new strategies will be necessary in order to transition through the precarious now to a sustainable future (Irwin, 2019, p. 149). The aforementioned global political climate—with the rise of fascism, threats to the environment, and greater marginalization of vulnerable populations—has set the stage for an even more unstable and volatile global backdrop, making the need for a transition that much more urgent but also more arduous.

Many transition movements argue that change must begin at the local level, with groups of like-minded individuals banding together to forge experimental communities rooted in transition principles such as sustainability, local cosmopolitanism, and collaboration ("What is Transition?," n.d.). Though these grassroots movements do have impact, without macro-level, large-scale policy change and the support of the political entities in which they exist, transition communities' influence remains relatively localized. A more expansive and inclusive transition towards a truly sustainable future would require policy change and buy-in from government at all scales—from local to federal. Hence, we argue that long-term, sustainable transitions cannot occur without working at the political level to address the serious, global political challenges we are facing today.

Though an oftentimes slow and arduous process, policy change is arguably the most effective means of infrastructuring change. In "Steps toward an Ecology of Infrastructure," Susan Leigh Star and Karen Ruhleder outline the "dimensions" of infrastructure, explaining that infrastructure "has reach beyond a single event or one-site practice,...links with conventions of practice," establishes standards, and is "built on an installed base," which, in the case of policy, is the system of government itself (Star & Ruhleder, 1996, p. 113). Infrastructuring, then, is the process by which isolated changes become widespread, long-lasting societal shifts.

The Multi-Level Perspective (MLP) is a theory of change that can be used to explain the process by which infrastructuring takes root. As explained by Frank W. Geels, the MLP "views transitions as non-linear processes that results from the interplay of developments at three analytical levels: niches (the locus for radical innovations), socio-technical regimes (the locus of established practices and associated rules that stabilize existing systems), and an exogenous socio-technical landscape" (Geels, 2011, p. 26). The niche is where novel ideas with the potential to shift systems first emerge (Geels, 2011, p. 27); the regime is made up of practices, beliefs, laws, and policies (Geels, 2011, pp. 26–27); and the landscape is the level of more rigid "material and spatial arrangements of cities, factories, highways, and electricity infrastructures" (Geels, 2002, p. 1260). As explained by Hargreaves, Longhurst and Seyfang, "a 'transition' is said to have occurred when there is a major

change in the way particular societal functions (e.g. energy, water, food etc.) are fulfilled or, in other words, a shift of 'regime'" (Seyfang, Longhurst, & Hargreaves, 2012, p. 5).

Transition policy will need to grant and foster flexibility between the niche and the regime, the micro and the macro without losing view of a larger political arc of detachment from the current neoliberal trend. This will be imperative to socially shift rooted political paradigms at the regime level that have precipitated the breakdown of political systems we see today. A convergent radical move is needed from niche, grassroots movements in synchronicity with top-down institutional hacking. A current ongoing example of this is New York congressional representative Alexandria Ocasio-Cortez, who began her political career as a local Bronx and Queens activist and has risen to be one of the most visible personas in Congress, with proposals such as the New Green Deal and a raise on marginal tax rates as high as 70% (Choi, 2019). With both of these bottom up and top down, significant yet opposing changes happening concurrently, there is a sense of urgency and an imperative to act to shift the balance towards values of equality, justice, and inclusivity that are the foundations of democracy. By promoting civic engagement and policy change, designers can have a direct impact at the niche and regime level and ride the momentum of these wide-spread movements to effect the long-lasting, systemic change that Transition Design seeks to achieve.

Research

Surveys

In order to understand how they can begin to create these shifts, we first needed to take a few steps back and gauge how designers currently think about political participation in relation to design. With the United States midterm elections approaching at the time of this writing and political consciousness at its height, we felt it was an ideal time to research and inquire about designers' stance: do they, either individually or through their work, participate in the political process? What are their motivations to be, or not be, involved?

We felt a general survey was the best means of obtaining a baseline understanding of how designers in a range of industries think about politics. We thus sent out two sets of surveys on October 29, 2018 and November 1st, 2018, and responses were collected up until November 5, 2018, the day before the United States midterm elections. Seeking to gain responses from a range of designers at different points in their careers, one survey was sent to all design faculty, staff, and students at Carnegie Mellon University (CMU) in the city of Pittsburgh, United States, and another, similar call to respond was shared with professional designers via the authors' personal social media accounts, triggering organic replication. Details on survey questions and responses can be found in Appendix 1.

We received 29 responses to date from faculty and students and 43 responses from professionals. Although responses to the survey for professionals came in from all over the world, this research focuses on designers in the United States, regardless of their country of citizenship. Of the 43 responses, 26 were either American citizens or non-citizens living in the United States. Questions focused on demographics (citizenship, age, political affiliation), knowledge about and interest in political and social issues, and the different ways in which respondents participate in the political process. Sixty percent of participants identified as female and 33% as male across both surveys (7% either declined to identify or identified as other). Demographics on race or ethnicity were not collected, as we were specifically interested in discovering how the participants' political agency (be that by means of their party, citizenship, or residency) influenced their approach to politics.

The vast majority of respondents from both surveys indicated that they identify most with the Democratic party, with a handful identifying with the Libertarian, Independent, Republican, or Working Families parties. When asked their level of interest in social and political issues, the majority indicated they were extremely or very interested. Notably, the level of interest did not match the expressed level of knowledge. When asked to rate their level of knowledge about the local political process and avenues for political participation, the majority of the CMU respondents indicated a 3 out of 5 on a Likert scale, with 5 indicating they were well-versed. (A little more than half the respondents who said they have little or no knowledge were either international students or non-American faculty members). Professionals were a bit more confident, with the majority rating their level of knowledge about avenues for political participation at a 4 out of 5.

In spite of the high level of interest in political issues, fairly high level of knowledge, and strong commitment to participating in the political process, very few respondents were interested in or are currently working in the public sector. Although Carnegie Mellon design students and faculty are a select population and may appear to

represent a particular predisposition, we found that their responses were echoed by professionals from all over the world. When asked, "in which industry do you hope to work when you graduate?" only three students checked the public sector as an option. 53.5% of students were interested in working for design consultancies or tech firms when they graduate, and 21% said that entrepreneurship or self-employment was an option. Similarly, of the 26 professional participants living in the United States, only four are working in the public sector, whereas 53.8 percent of respondents work either in tech or a design consultancy. Professionals were asked to what extent their work intertwines with their political views, and only two individuals responded that their politics greatly influence their work. Fifty percent stated that their work and political views are completely or mostly separate.

Workshop

Clearly, there is a discrepancy between how people engage in the political process as citizens and as professionals. Though the majority of participants indicated that politics plays an important role in their life, only a few number were inspired to carry that passion into their work. In order to understand why this was, and to incorporate a qualitative component to the quantitative surveys we had done, we designed a workshop that allowed us to explore questions of roles and agency in greater depth. The exercises aimed to understand which roles designers are most likely to enact in the context of political participation and at which points of intervention designers feel the greatest sense of agency and influence.

The workshop was held on campus at CMU. All survey respondents residing within Pittsburgh were invited to attend, including students, faculty, and working professionals. There were seven people in attendance, five of whom were current students. Participants were not actively recruited; self-motivation and interest in the topic is what sparked their participation.

First, participants were given a set of cards with different roles related to political participation written on them, such as "change perceptions," "educate and inform," or "be an activist." They were then asked to do a card sort to rank and number the roles in order from most to least important, with the option of adding their own roles or discarding whichever felt irrelevant. Next, they were given an adaptation of a mess map (Horn & Weber, 2007), in which they were asked to list potential points of intervention, ranging from where they felt they have the most influence and agency (innermost circle) to the least influence (outermost circle). We then asked participants to place the numbers of the various roles onto the map, visually connecting the roles to the points of intervention. For example, if they felt they could most easily change perceptions at the university level, they would place that role at that point of intervention on the map (Figure 1b). See Appendix 2 for step-by-step visuals of this process.

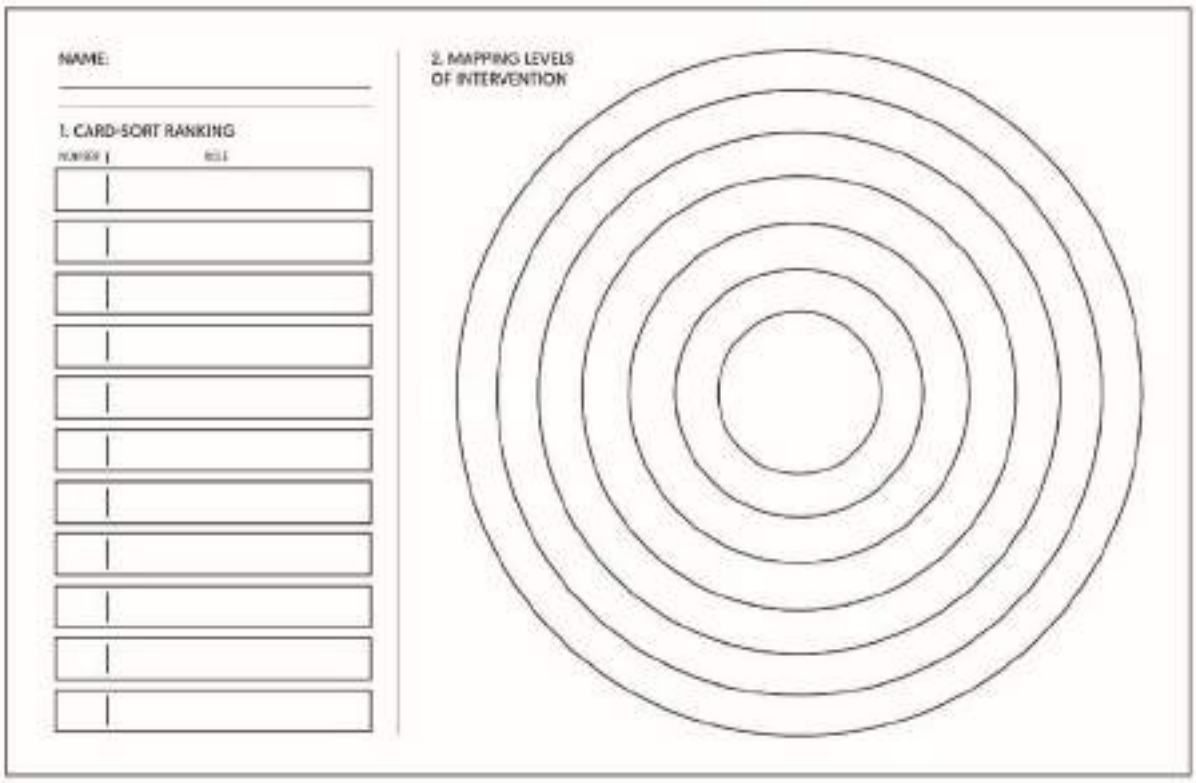

Figure 1a. Map design for the workshop for participants to place their roles within self-determined concentric areas of intervention

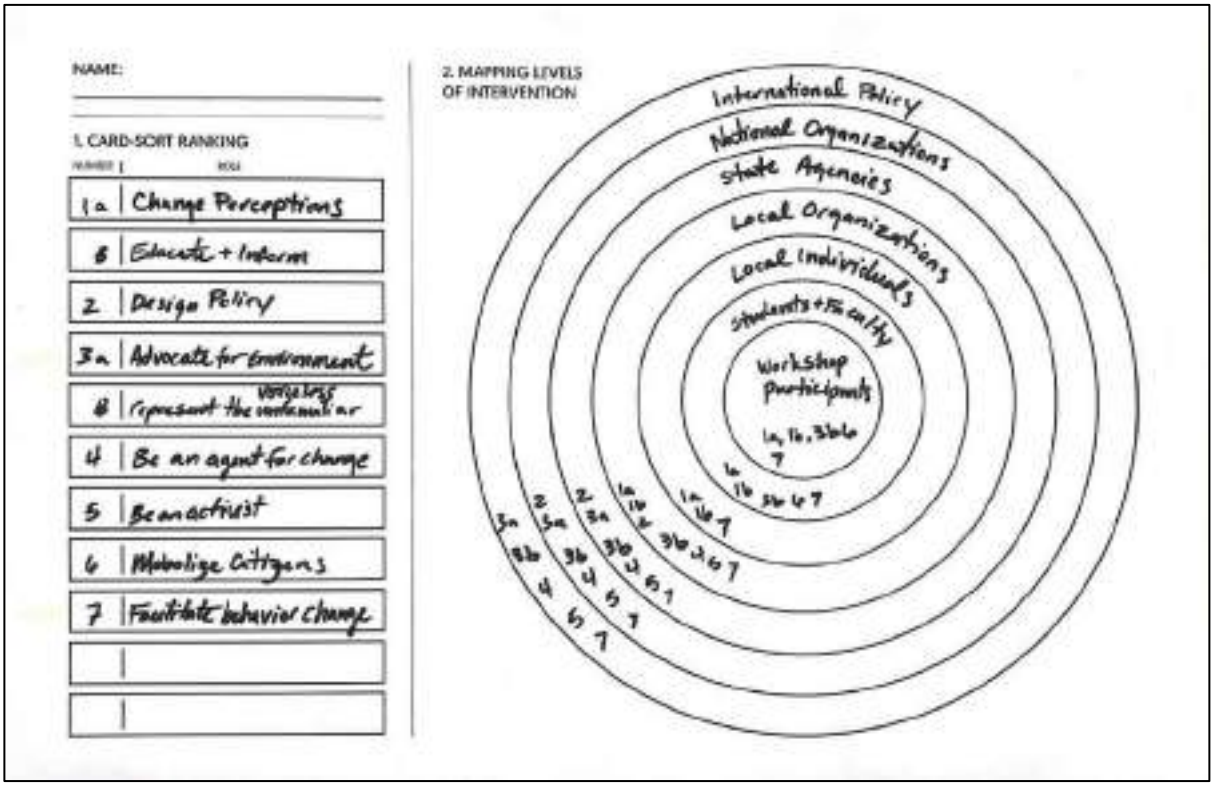

Figure 1b. Workshop sheet completed by a participant. Roles are ranked on the left side of the sheet, while concentric points of intervention are indicated on the right side. The numbers indicate which roles were most appropriate at which intervention point. See also Appendix 2.

Finally, participants were asked to choose a particular social or political issue that was important to them, and then design an intervention for that issue utilizing a particular role at a single intervention point. If, for example, someone indicated that gun control was important to them, and they stated that the role of "changing perceptions" was most appropriate at the university level, they would devise an intervention that can change perceptions of gun control around the university.

At the end of the workshop, we offered feedback forms for participants to remark on what they most valued from the workshop and what they would change. The feedback suggested that we needed to revise our question prompts, but also confirmed that the workshop provoked participants to recognize means of intervening that they may not have considered otherwise.

In order to reach a larger audience that could participate remotely, we converted the revised in-person workshop experience to a series of digital questions and exercises using SurveyMonkey as a tool. (See Appendix 2 for screenshots of the digital workshop). For the digital version, all survey respondents residing in the United States who were not able to attend the in-person workshop at CMU were invited to participate. To date, we have received seven responses to the digital workshop, for a total of 14 workshop participants (whether in person or remote).

Due to technical limitations, there were some challenges in translating the mapping exercise to the online survey. Nevertheless, this did not detract from the quality of responses received or insights gained for that portion of the exercise. However, relative to the digital version of the workshop, we found that participants devised more robust and detailed interventions when doing the exercise in analogue format. In person, participants were allotted 15-20 minutes to design an intervention; we conjecture that an online activity may not afford dedicating that same amount of time to the exercise.

Response

Method

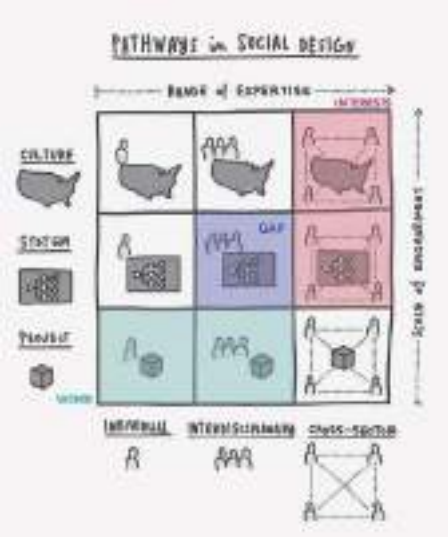

Figure 2. Adaptation of Social Design Pathways matrix developed at the 2013 Winterhouse Symposium. Source: socialdesignpathways.com

When synthesizing the responses to the surveys and workshops, we used the Social Design Pathways matrix ("About," n.d.) as a practical tool to situate the participants' area of work in contrast to their area of interest. Their work, mostly project based and most often either individual or interdisciplinary, can be situated in the lower left corner of the matrix. However, their political interests overfly systems-level cross-sectoral change in the top right of the matrix.

Based on feedback and the results of the workshop, we have found the workshop to be an effective method of helping designers begin to identify courses to intervene to begin to broach the top-right of the matrix. By having participants design an intervention for an issue of personal interest, in a role where they have some sense of agency, and in a domain where they feel they have some degree of influence, they are able to identify a point of intervention at a greater scale of engagement that is meaningful to them and has minimum barriers to entry. Moreover, they are able to leverage the skills for which they have been trained to further a cause that is of personal significance to them. Through this method, we are able to demonstrate to designers that, using their unique set of skills, they have a much greater degree of power to influence politics than they may have imagined. In so doing, we hope to inspire designers to find some ground where their work and politics may coalesce to create positive, sustainable change in our political systems.

Some may resist designers entering the realm of politics, arguing that this shift may take designers beyond the scope of their present expertise. However, we contend that designers already possess many of the skills needed to design for systems-level political change. As a point of illustration, we outline below five competencies of designers that can be leveraged across the spectrum of engagement and expertise of Social Design Pathways. For example, storytelling and communication skills used to advocate for a new app interface or to communicate to clients can just as easily apply in the political arena to advocate for policy change and communicate to representatives. We believe that building on the mastery they already have will enable designers to develop the confidence to advance their work from niche, project-level interventions to landscape-level political change.

1. Storytelling and Communication

Designers, especially those trained in visual and interaction design, are adept at storytelling and communication. As politicians are well aware, this is a powerful tool that, at its most basic level, can be used to **educate and inform** the public about issues of concern. Through that education, one begins to **change perceptions** by challenging assumptions, dismantling false narratives, and bringing awareness to issues that may be ignored or even covered up. In so doing, we can **advocate for the underrepresented**, the marginalized, and the conveniently forgotten communities that oftentimes lack but are in most need of a political voice. By doing all of the above, we can **mobilize the public** to become more civically engaged to ensure their voices are heard.

2. Facilitation

Designers of every capacity work in interdisciplinary contexts, and therefore must be able to negotiate between the oftentimes conflicting needs and demands of various individuals and teams to achieve a single, unified goal. Designers can very easily translate this skill to the realm of politics, where oftentimes divisive and polarizing views hinder progress forward. By establishing **platforms for conversation** among individuals, designers can help conflicting groups arrive at some common understanding which may then pave the way for collaboration on issues that are of shared concern. By facilitating important discussions and offering safe spaces for people to voice their concerns, designers can help **break down barriers** among groups in conflict. This is particularly needed today with the ever-expanding political divide.

3. Design legibility

Policy is an invisible infrastructure that few people understand but by which all are affected. Design plays a significant role then in changing how policy is communicated and understood by the public that it impacts. The lack of understanding of a policy often results in the public rebelling against it, even when the proposed change is in their better interest (Bosch, 2016). Design can be effective in changing people's perceptions of governments and policies by **increasing "legibility,"** that is, increasing transparency but also making policies more understandable to the general public. Increasing legibility goes one step further than transparency by making policies *understandable* so as to invite greater engagement and agency, which in turn prevents governmental abuse and ensures that policies are made in accordance with the public will.

4. Creation

What unifies designers of all backgrounds is their propensity to create something from nothing. Designers have the tools and the skill set to identify gaps in systems and create interventions that fill those gaps. Web

and interaction designers, for example, can **create digital platforms** for activists, politicians, and creatives to network, connect, and share information, which fosters an environment of dialogue, collaboration, and mutual understanding. Thus, in creating interventions, designers are **agents for change**, acting as the catalyst that materializes the type of world that people envision yet are unable to create. This is a powerful and unique skill that enables designers to have profound impact in how our political systems function.

5. Innovation

At the highest level, designers are visionaries whose ability to envision **novel ways of seeing and doing** can help society break free of destructive and toxic cycles of behavior. Designers are especially proficient at reading a complex situation and identifying several different approaches to intervening in that situation. As such, they are particularly needed in the realm of **policy-making**. Though we do not propose that designers must necessarily themselves design policy, their unique ability to find innovative solutions to complex problems would be a breath of fresh air in what is often viewed as a stuffy and stagnant political atmosphere.[2]

Areas of further exploration

Our research shows that there is a clear gap between how designers understand their civic role as individuals and as designers, and that our workshop is a promising tool that can be used to bridge that gap. The long-term impact of the workshop as a method remains to be seen. Further research would include following up with participants to understand if their motivation for political participation has been changed, exacerbated or deterred by the midterm election results and by going through the workshop.

Diversity

It would also be fruitful to engage with a more politically diverse pool of participants. As we have remarked before, most participants identified with the Democratic party; thus in order to broaden the understanding of political participation, having conservative designers partake in the series of exercises would offer insight into particular political ideologies within the design discipline, how and why designers relate to particular political discourses, or why they choose to practice design in a certain way.

As noted above, our research focused only on designers living and working in the United States. Interviewing and carrying out similar exercises with designers in other parts of the world is an area of research that we hope to explore further in order to determine whether designers in other countries are more or less active in politics, what their motivations or barriers are to doing such work, and in what ways their politics manifest themselves in their work. In so doing, we may gain additional insight into different approaches to inspire designers in the United States to become more politically engaged.

Pedagogy

Though the workshop may be an effective means of changing designers' mindsets in the short-term, we still feel that a long-term, cultural and pedagogical shift in design is needed in order to bridge the gap between where designers currently work and where their political interests lie. In a sense, a method that provides designers with the scaffolding and the confidence needed to traverse the shift between project-level interventions to systemic, political change is needed. What is still lacking is a culture in design pedagogy and industry that supports the work of designers in the realm of politics, and gateways for designers to establish fruitful careers in this arena.

In that sense, the workshop tool could be refined as an educational exercise to encourage design students to reflect upon their input—both visible and invisible, and personal as well as political—in their design work. Students in particular would benefit from it as a form of career-path decision-making or as a form of identifying inflection points of political intervention early on in their careers, such that they become comfortable with the notion of using design to influence political change.

[2] See the example of Restaurant Day in Finland (Weijo, 2018). Although Restaurant Day may not have changed policy itself, its widespread reach and establishment as a regular festival created its own de facto policy in the country.

This can be reinforced in the classroom by encouraging a strong, confident generation of emerging designers to work intensely on wicked problems (Buchanan, 1992; Rittel & Webber, 1973) from a holistic approach. Encouraging eye-bird view approaches that are later on complemented by technical skills depending on the particular design proposal they would want to pursue. Without these, designers will continue to be able to produce and operate others' visions, but not have the potential to rally others on theirs. Preparing students early on to recognize their political agency is an essential component to creating the cultural shift in design that is needed. Educational spaces therefore become social leverage points (Meadows, n.d.) where scalable systemic approaches to complex problems are taken from early on, engaging and making students comfortable with future challenges.

Future Transition Designers will need to make radical career choices and commit to their transitional practice in an ideological way. Speaking about her particular place in government, Chisnell admits: "[...] I *never* thought I would end up here doing design and research in the federal government. I'm a career opportunist, meaning that I've always just done the next thing that looked interesting, rather than having a long-range plan" (Amatullo, Boyer, Danzico, & Shea, 2016, p. 128). This nomadic or "career opportunistic" approach to design practice is oftentimes the norm, yet makes large spatio-temporal arcs of change especially challenging. An internal reflective shift within the discipline will be crucial for designers to become the long-term standard-bearers we need.

Design Research

This research, however, just begins to broach the lacuna of research into how design intertwines with politics. Other researchers might delve deeper into how design can combat neoliberalist disillusionment with the political process, using design as a form of civil disobedience and resistance, or participation in the form of co-imagining alternative futures with the publics. We invite designers to take up these and other potent areas of research to better understand how design can play a more significant role in stabilizing our rapidly changing political structures.

Conclusion

Much like our environment, our systems of government and politics are the foundations upon which nearly all other aspects of our lives rely. Without a healthy, resilient, and robust political system that ensures the safety and wellbeing for all people, transitions to more sustainable and more equitable futures lie on precarious footing. Leveraging the expertise and competencies they already have, designers can play an important role in correcting course and working towards political systems that truly represent the voice of the people. Our research has shown that helping designers identify intervention points within both their sphere of influence and sphere of concern can help overcome initial barriers and inspire them to act on social and political issues of personal significance. Given the significance and urgency of this work, an active pedagogical push to prepare and equip designers to design for political change is called for. With more designers beginning to take on this important work, we may begin to see a transition not just within the field of design, but within the world as well.

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Appendix 1: SURVEY

Conducted via Google Forms
Practitioners: 43 respondents
Carnegie Mellon School of Design: 29 respondents

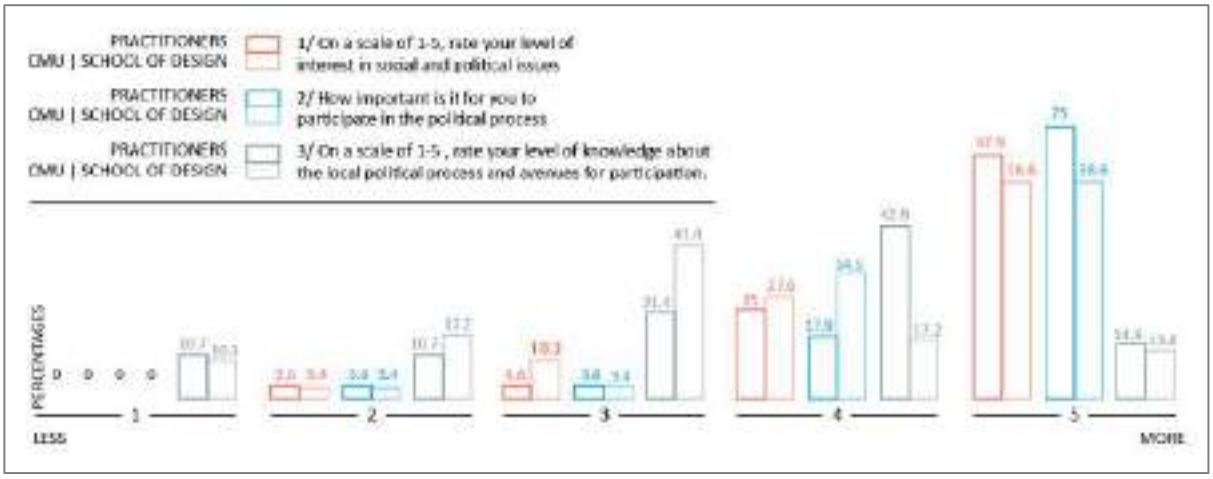

Figure 1: Responses from practitioners and students. Comparison of the importance given by participants to social and political issues, to their participation in the political process, and their knowledge on the local process and avenues of participation.

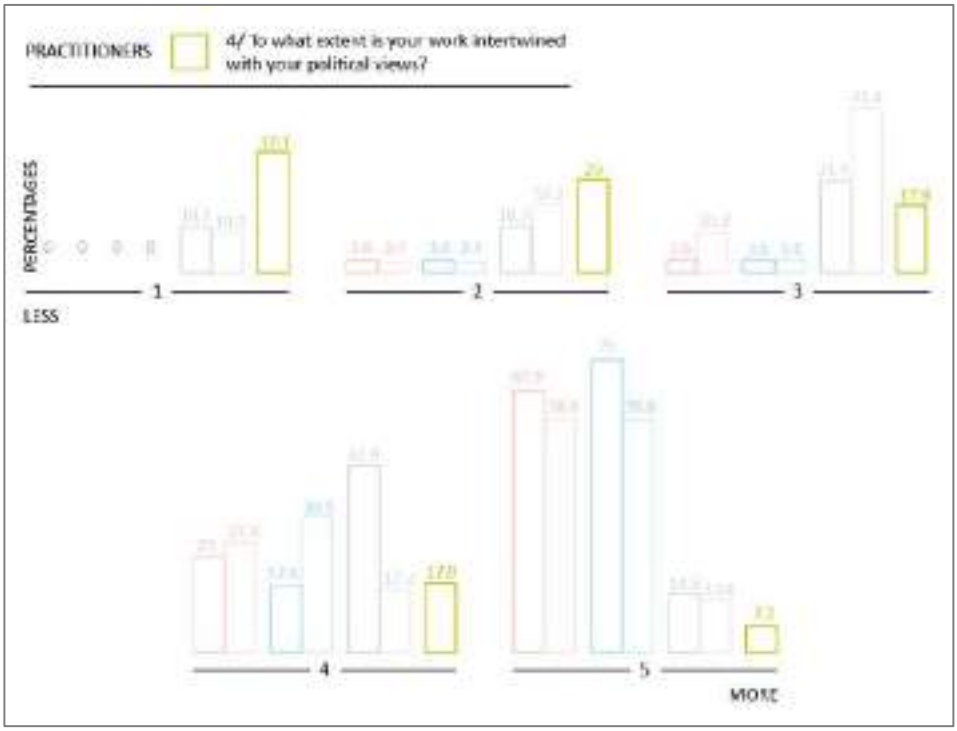

Figure 2: Comparison between responses to questions 1,2 and 3, and the extent to which participants viewed their work intertwined with their political views.

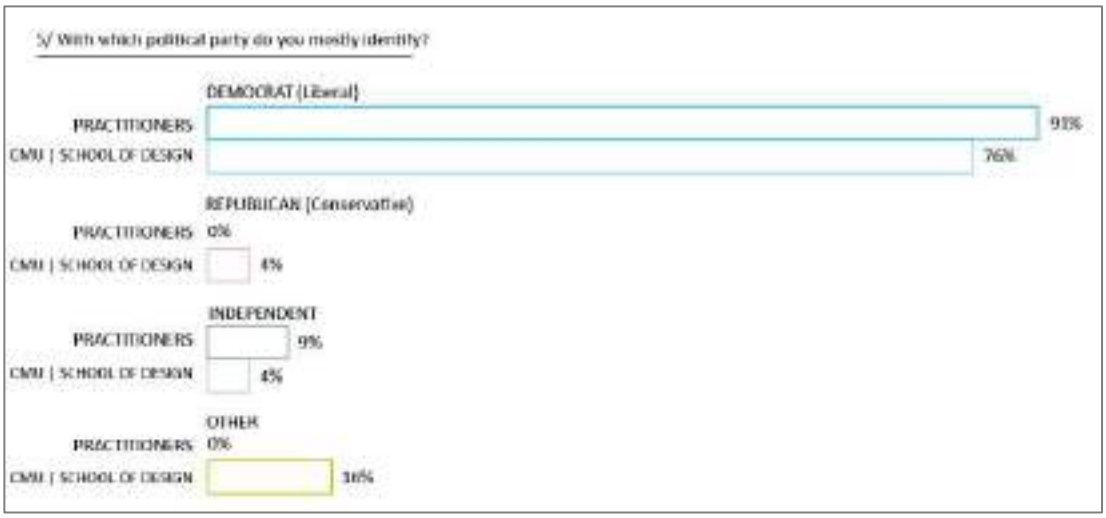

Figure 3: Political Party participants identified with.

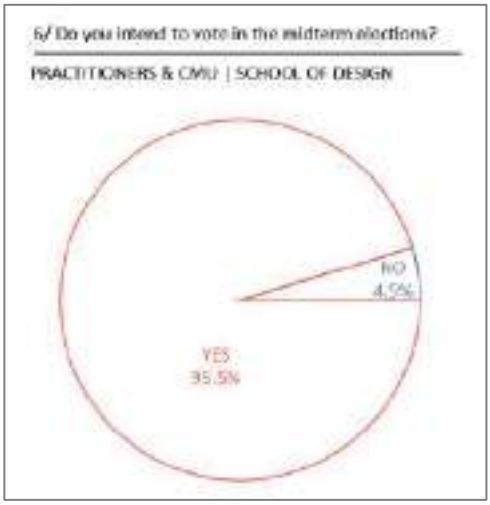

Figure 4: Intention of participants to vote on the midterm election.

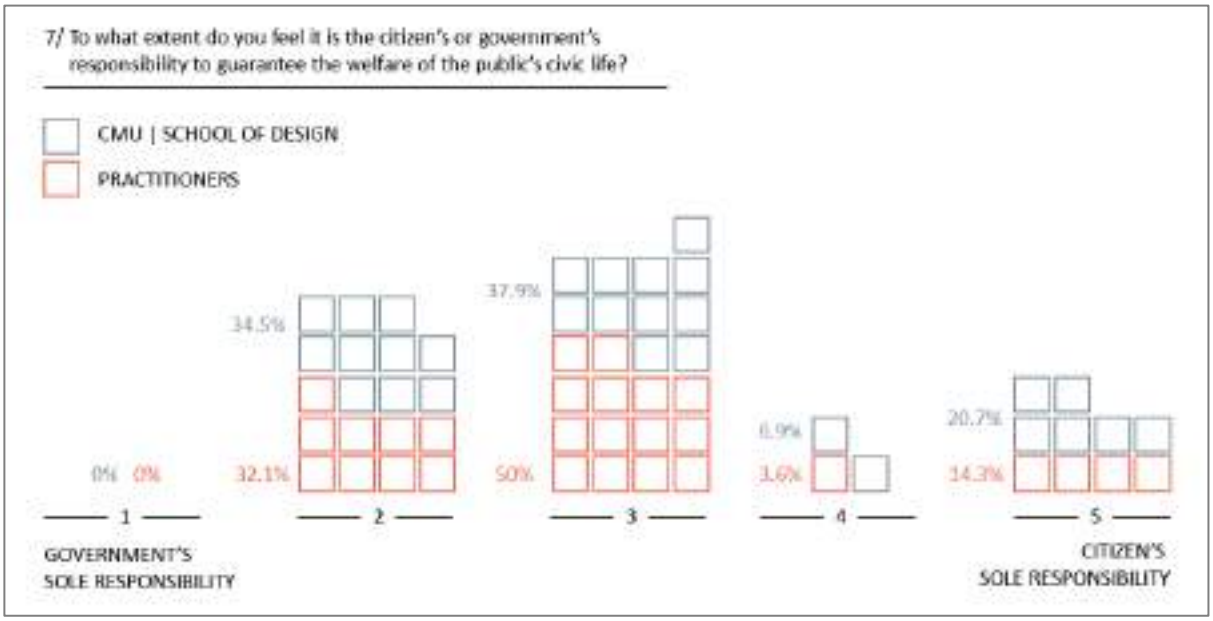

Figure 5: Participants intake on government versus citizen responsibility on the welfare of civic life.

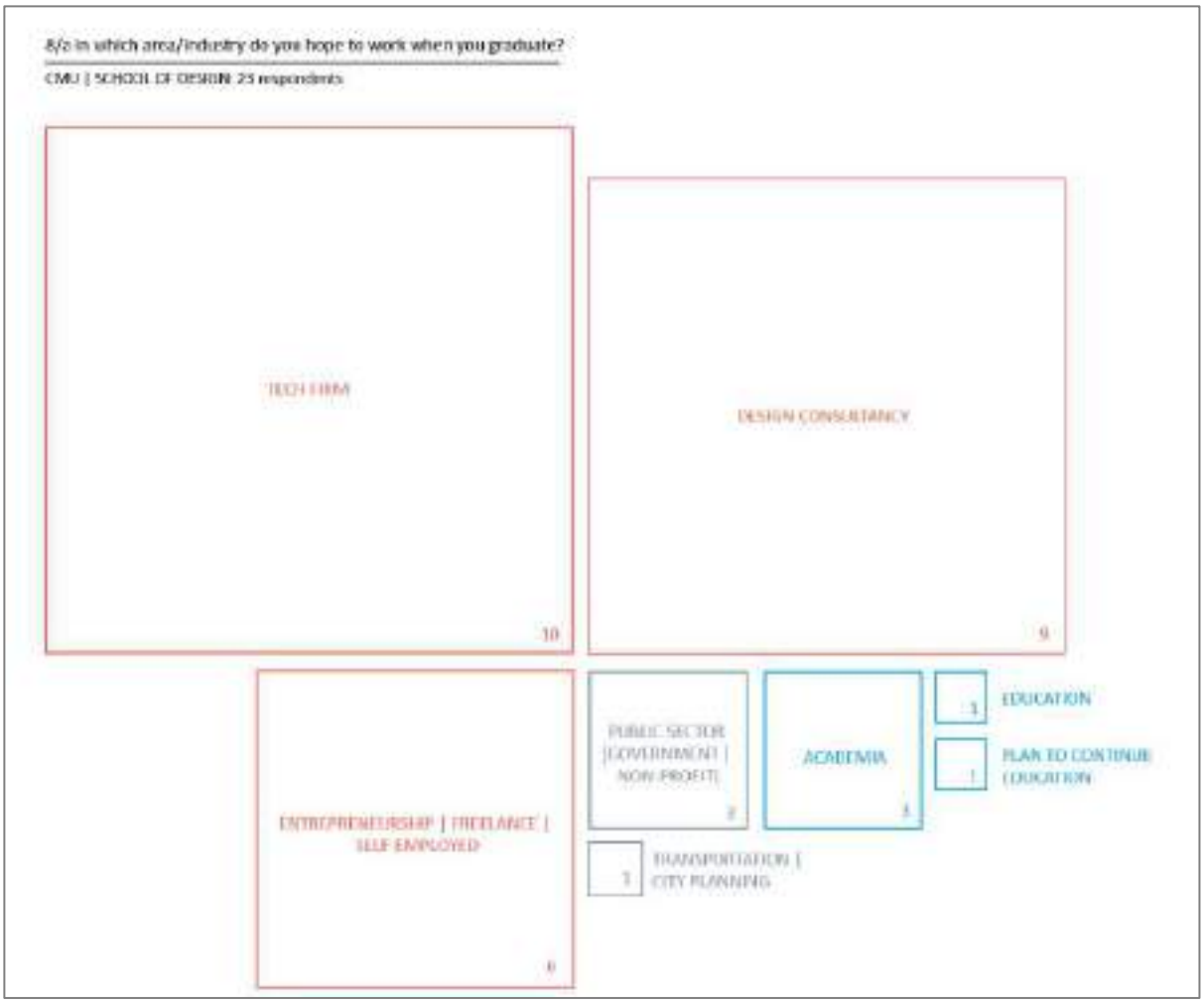

Figure 6: Industry in which students responding to the survey wish to develop a career after graduation.

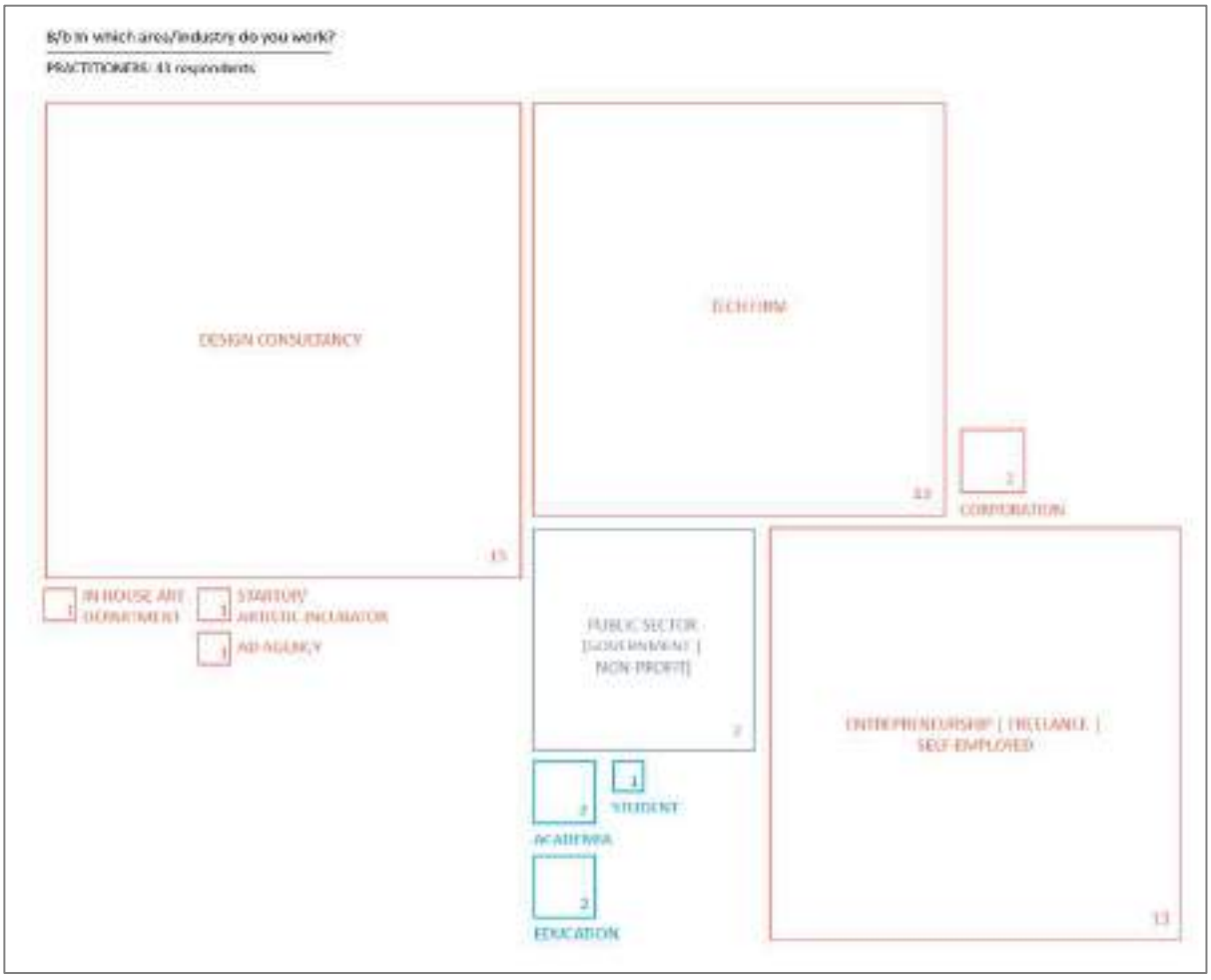

Figure 7: Industry in which practitioners responding to the survey work.

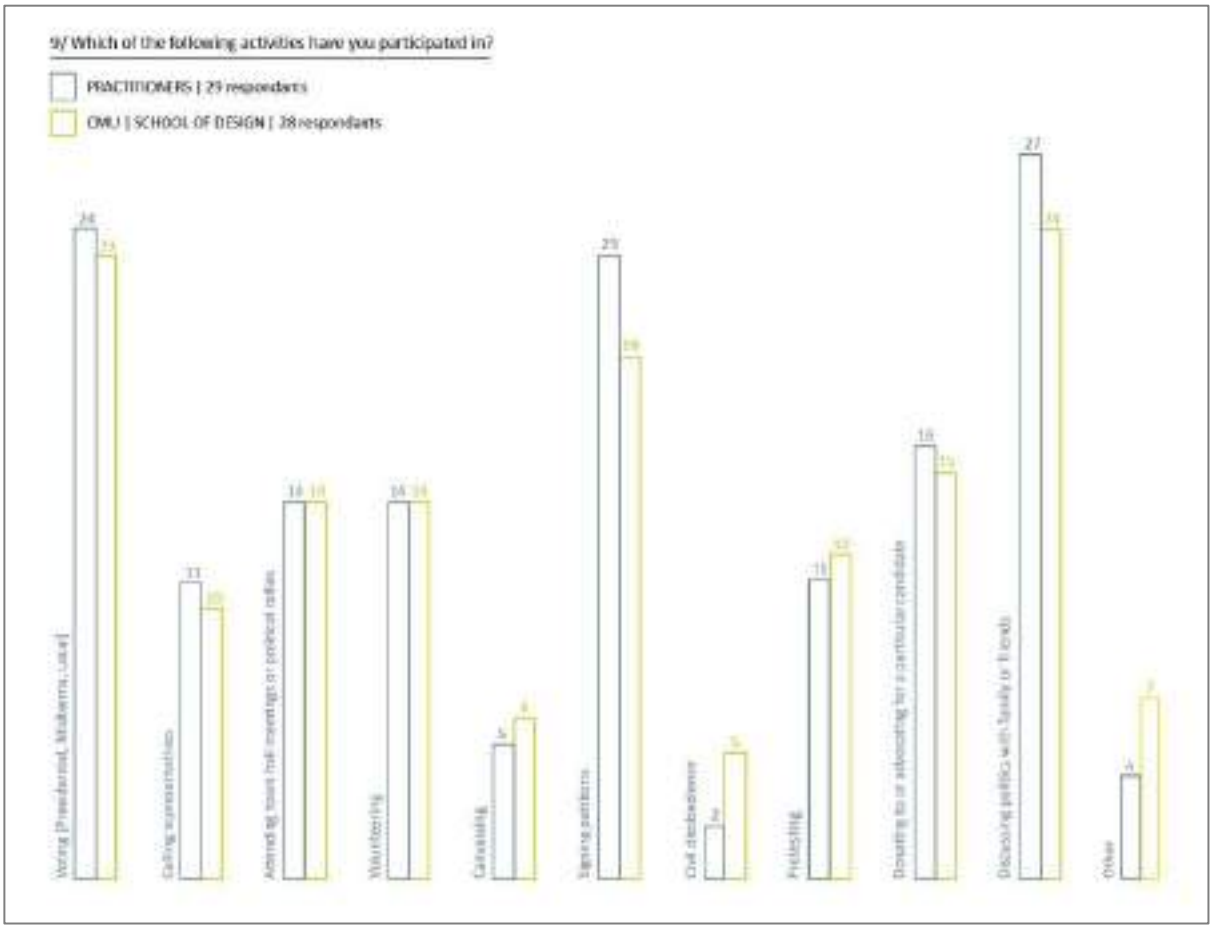

Figure 8: Political activities in which responders have participated.

Appendix 2: WORKSHOP

Conducted in the School of Design at Carnegie Mellon University and via Survey Monkey
Paper based workshop: 8 participants
Digital exercise: 7 participants

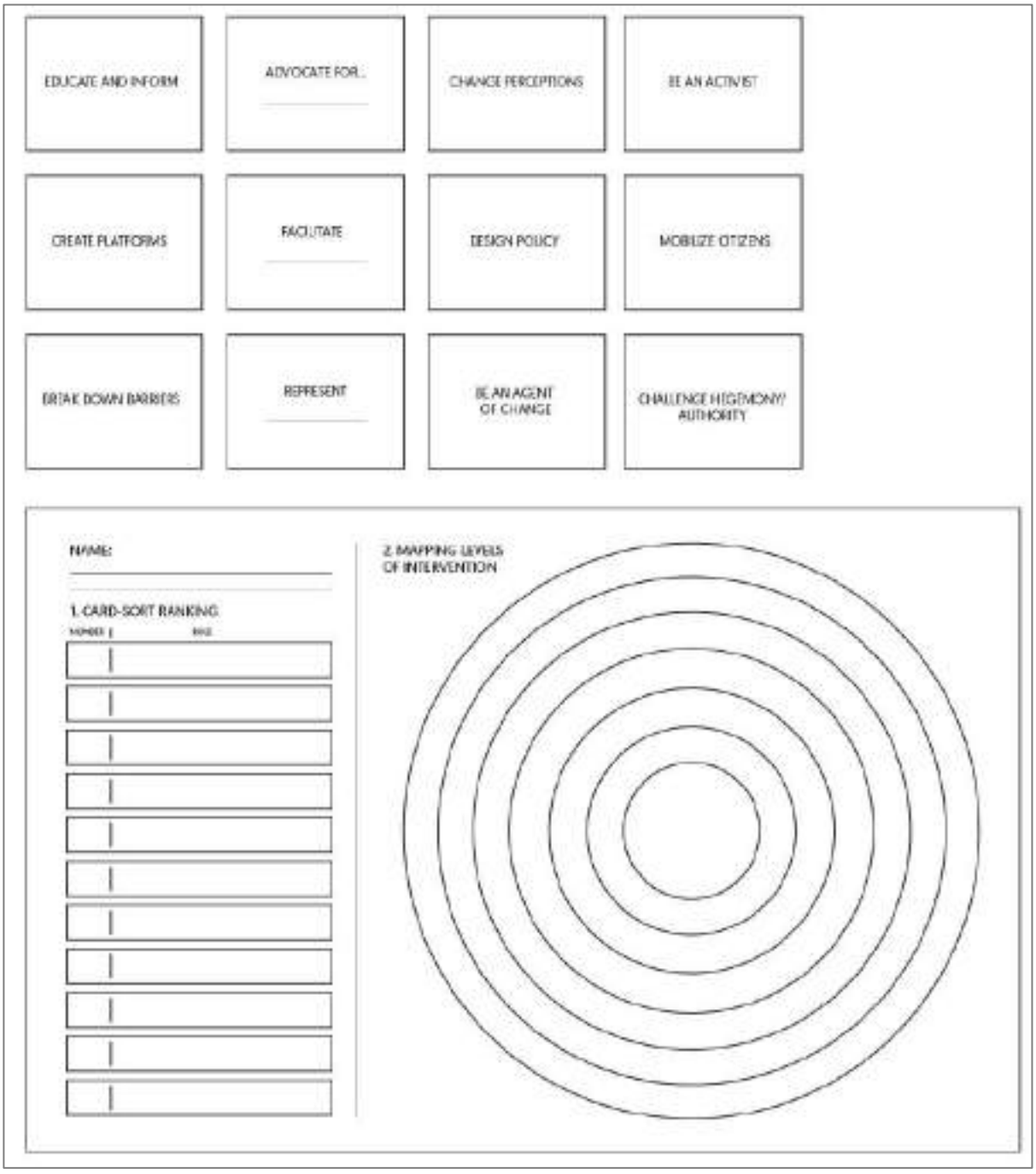

Figure 1a: Paper-based workshop material, cards and map, used during the workshop.

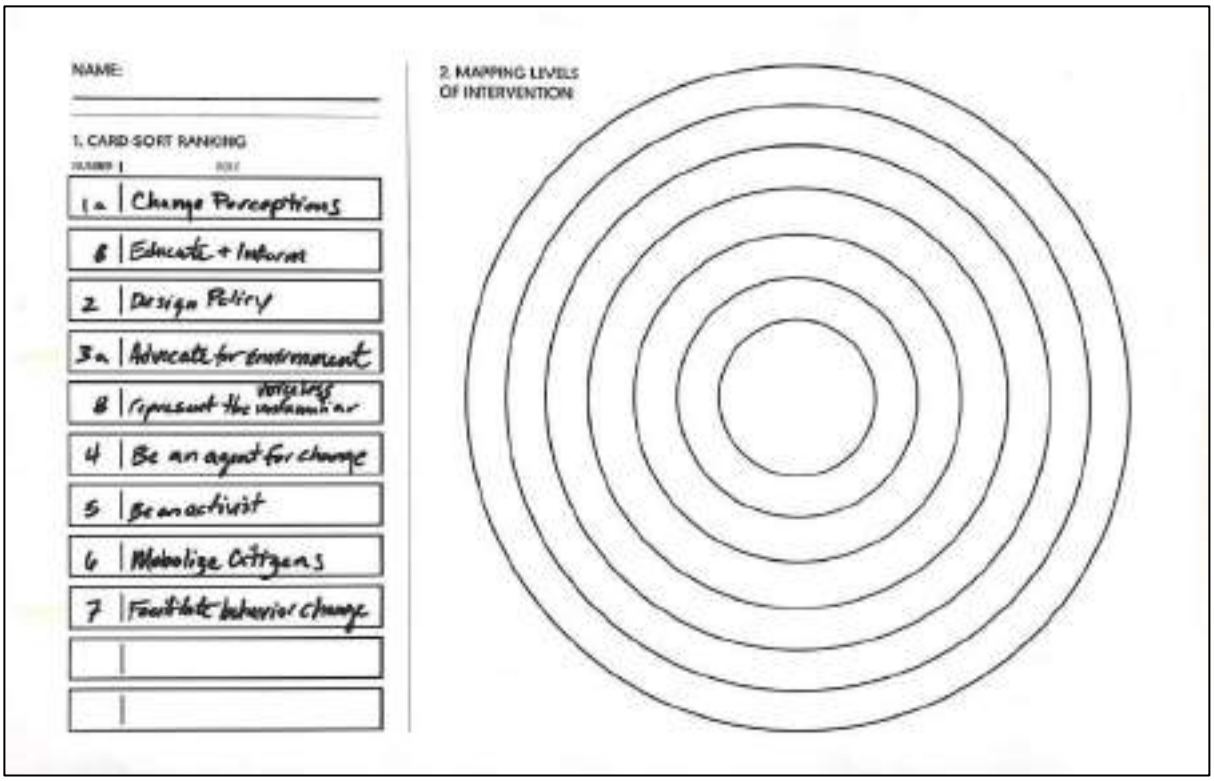

Figure 1b: First step of completing the workshop worksheet, with roles related to political participation ranked and numbered on the left.

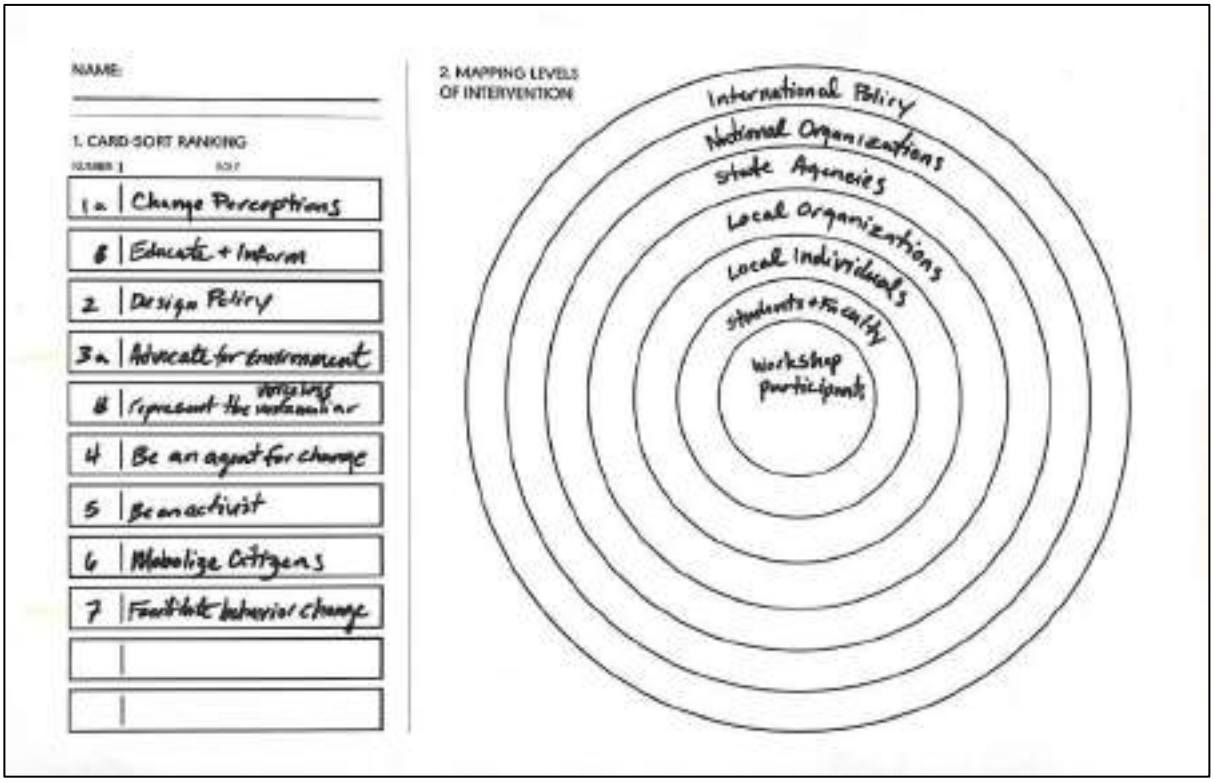

Figure 1c: Step 2 of the workshop sheet, with participants listing points of intervention, ranging from where they felt they have the most influence and agency (innermost circle) to the least influence (outermost circle).

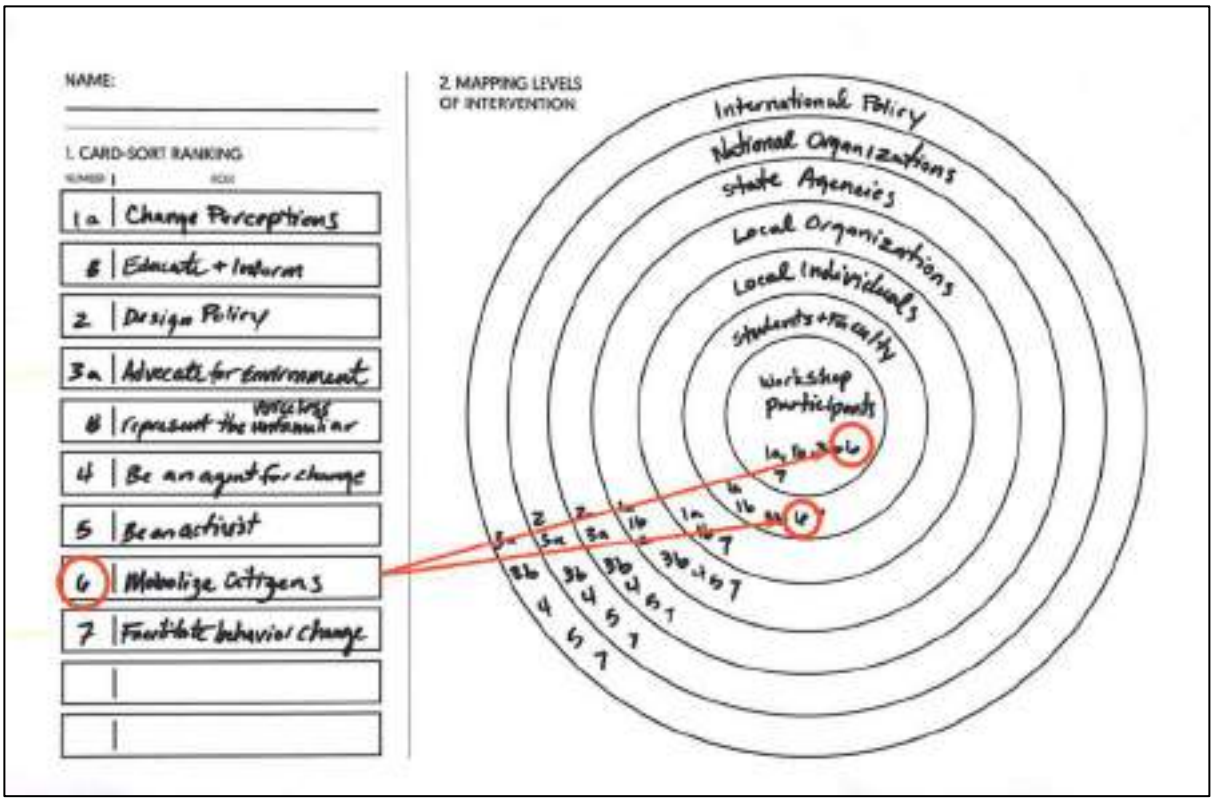

Figure 1d: Fully completed workshop sheet, where participants were asked to place the numbers of the various roles at intervention points on the map where they felt that role was most appropriate, visually connecting the roles to the points of intervention. (Red lines added here for illustration purposes).

As a final exercise, participants were asked to choose a particular social or political issue that was important to them, and then design an intervention for that issue utilizing a particular role at a single intervention point on the worksheet. If, for example, this individual indicated that gun control was important to them, they might choose to devise an intervention that can mobilize citizens around the university to lobby for gun control.

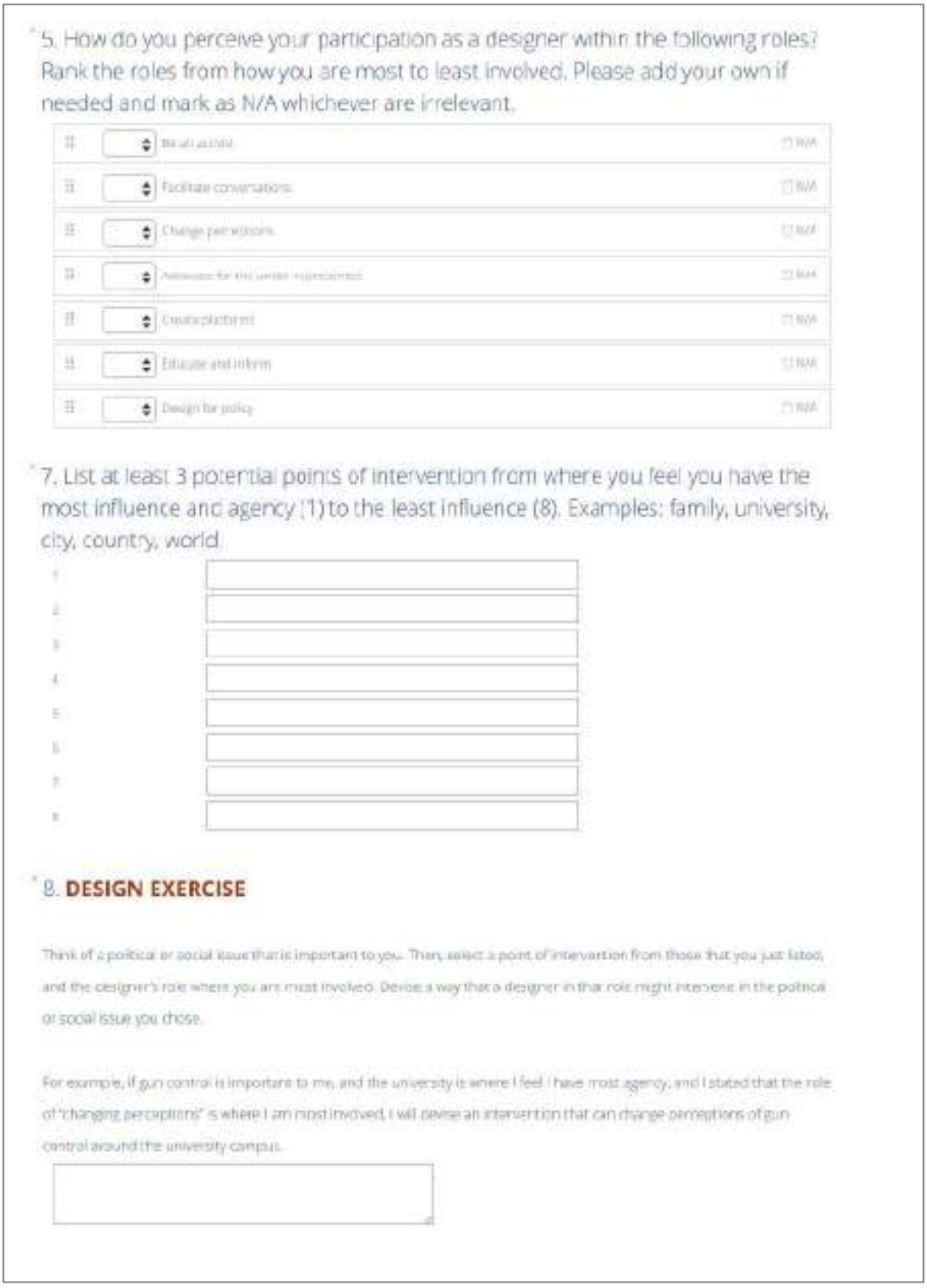

Figure 2: Digital adaptation of the workshop sent out via Survey Monkey.

Results

Roles

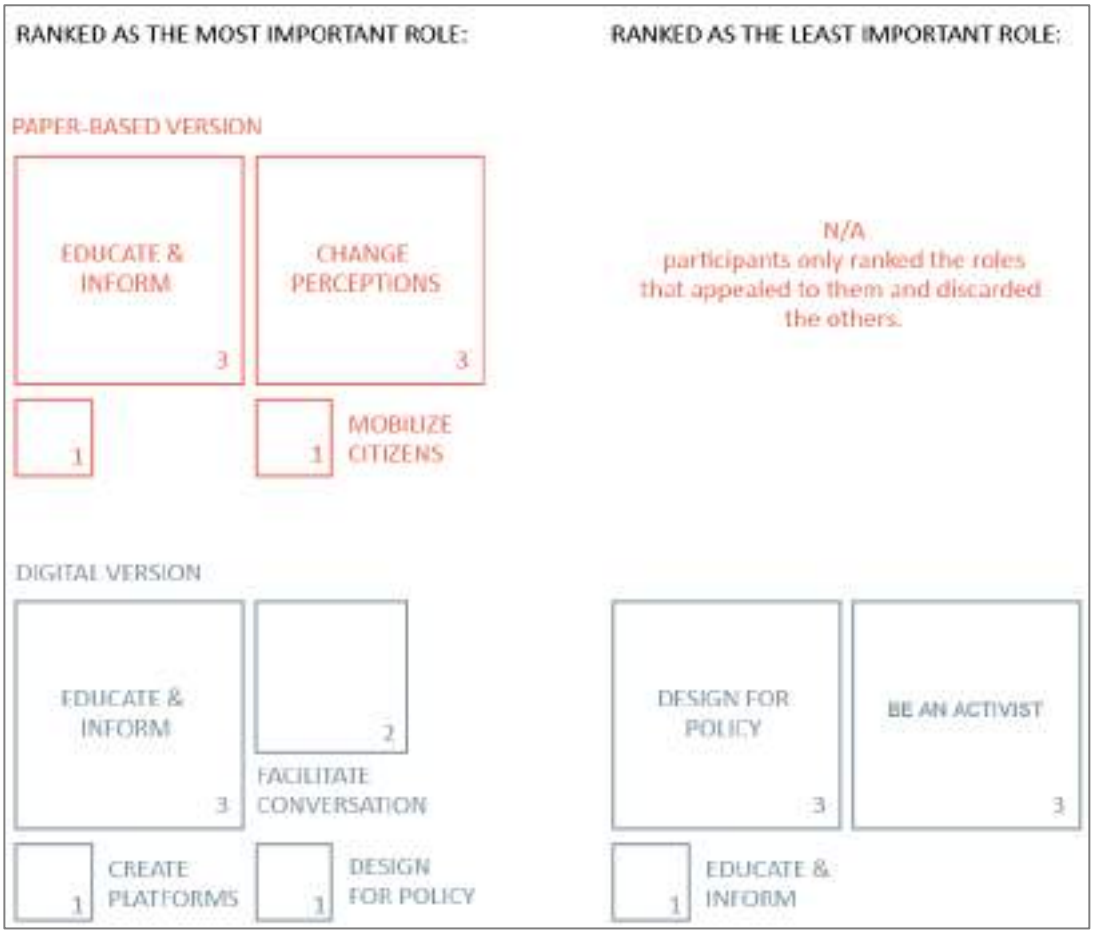

Figure 3: Roles given out during the workshop and in its digital adaptation. Participants were able to propose new roles according to appropriateness.

Figure 4: Roles ranked as the most/least important by participants.

Intervention points

Figure 5: Most recurrent points of intervention with the most/least amount of influence/agency.

Overlapping roles and intervention points

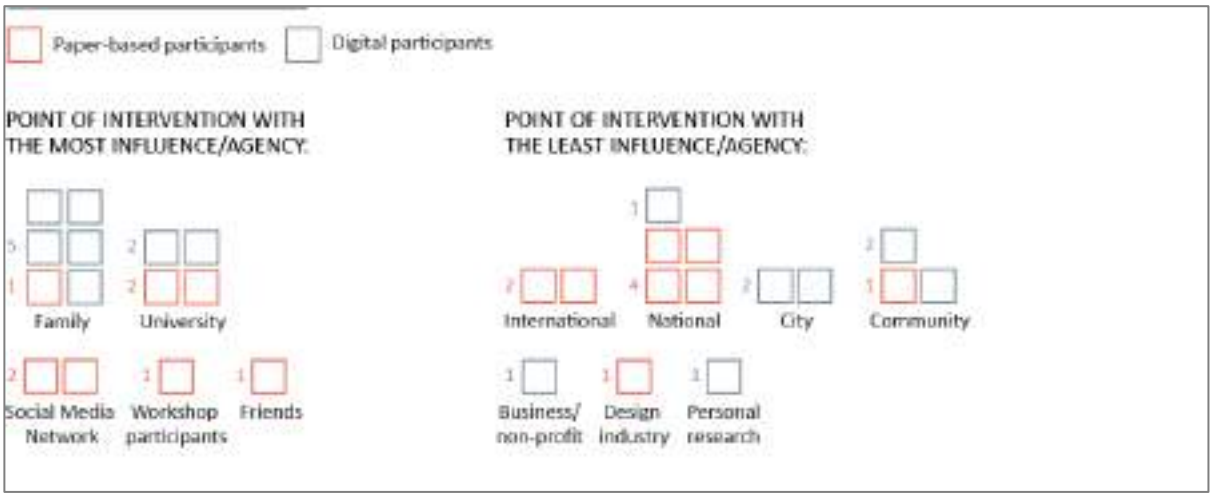

Figure 6: Participants were asked to choose a wicked problem of their preference. To tackle it, they needed to locate overlapping roles and intervention points determined in part 1 and 2 of the workshop (Figures 1 and 2). Finally, they had to propose a design-led form to intervene in those overlapping nodes in regards to their wicked problem.

In Pursuit of Design-led Transitions

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This paper contributes to the growing maturity of transition design. A Dutch transition design project with the Dutch Government and food sector is presented and reveals the challenges of designing at a system level. Reflection on the project reveals two insights that were not factored within the project but in retrospect require the attention of transition designers; (1) the timing of the transition relative to the surrounding environment and; (2) the velocity or speed at which a transition can be fully enacted. The paper shifts to investigating change theories to identify possible directions to address these challenges. Theoretical implications are concluded from this investigation. This paper deals with politics, power, democracy, leadership, and enablers and inhibitors of change.

Keywords: power, policy, leadership, ecosystem, pluralism

Introduction

It is a time of unrest described in various strong rhetorical forms as a *time of many problems* (Margolin, 2015), an *increasingly complex world* (Buchanan, 2015), a time of *rapid changes* (Bucolo, 2015), and *transience* (McGrath, 2013). The successful processing of this subject matter has elevated design (and designers) to areas of organisational reform, system[1] design, policy reform and technology related transformations (Muratovski, 2015). The witnessed rise in the statue of the design discipline is eloquently described by Richard Buchanan as the *design movement* (2015). In short, it has been a busy period for designers.

One particular growth area in the design movement is the increasing popularity of design-led innovation. Design-led innovation provides organisations with the means to negotiate uncertainties and innovate to create and capture value. Design becomes a source of new thinking and action and informs the strategic direction of an organisation. Yet focus is shifting again. Design is now being explored beyond the scale of individual organisations. Questions such as 'how might design assist national economies to thrive during uncertainty', and; 'how will international carbon emission be lowered while maintaining social and economic stability' are now open to designers (Irwin, 2018). Such an increase in scope has led to methodological developments within the discipline. *Transition design* is one such emerging methodological development (Irwin, Kossof & Tonkinwise, 2015). In particular, guidance on how to apply transition design given the inherent scaling challenges and political implications associated with working at a system-level remain an area for further attention.

The aim of this paper is to contribute toward the methodological emergence of transition design. The paper reveals how the urgency for transition design can be arrived at from an alternative path to social innovation -

[1] The terms system and ecosystem will be used interchangeably from herein

via design-led innovation. Design-led innovation is acknowledged as a means to drive organisational transformations.[2] Transitions do require the collective transformation of public and private organisations together (Geels, 2002) which acts as an interaction point for design-led innovation. This logic is explored through a review of literature before the paper shifts to describing a Dutch case of transition design in effort to explore the current state of the methodology. Literature on policy making (e.g., Bason, 2013), technology forecasting (e.g., Adner & Kapoor, 2017), innovation (e.g. Christensen, 1997), management (e.g., McGrath, 2013) and ecological economics (e.g., de Jesus & Mendonça, 2018) is consulted in order to draw upon multidisciplinary perspectives that reflect the complexity of transitions literature. Based on these insights, theoretical implications for designing transitions are presented.

The Design Movement

Central to design, is the notion of design being capable of addressing wicked problems (Buchanan, 1992; Rittel & Webber, 1973). Designerly strategies (such as problem-framing) are particularly, if not uniquely suited to dealing with ill-defined or wicked problems (Cross, 2007; Forlizzi, Stolterman, & Zimmerman, 2009; Gaver, 2012; Stolterman, 2008). Buchanan presents the four orders theory of design in which wicked problem-solving are encountered (1992; 2015), see Figure 1. Buchanan's *four orders* deconstructs the nature of design problems, relating activities required to prescribed solutions. As Buchanan states of the four orders, "the *evolution* of the design professions from graphic and industrial design to interaction design and, then, to the design of systems, environments and organisations is the hallmark of the current design movement" (2015, p. 11). Since the turn of the century, a series of new approaches to design have evolved from human-centred foundations. From transformation design to service design, design-led innovation and strategic design (see e.g., Calabretta, Gemser & Karpen, 2016; Jones, 2017; Bucolo et al. 2012). This diversification away from a heritage of industrial design is an indication of the discipline's increasing maturity, a journey supported by the positive reception of the designers within newfound contexts of organisational reform (Elsbach & Stigliani, 2018) and policy arenas (Yee & White, 2016).

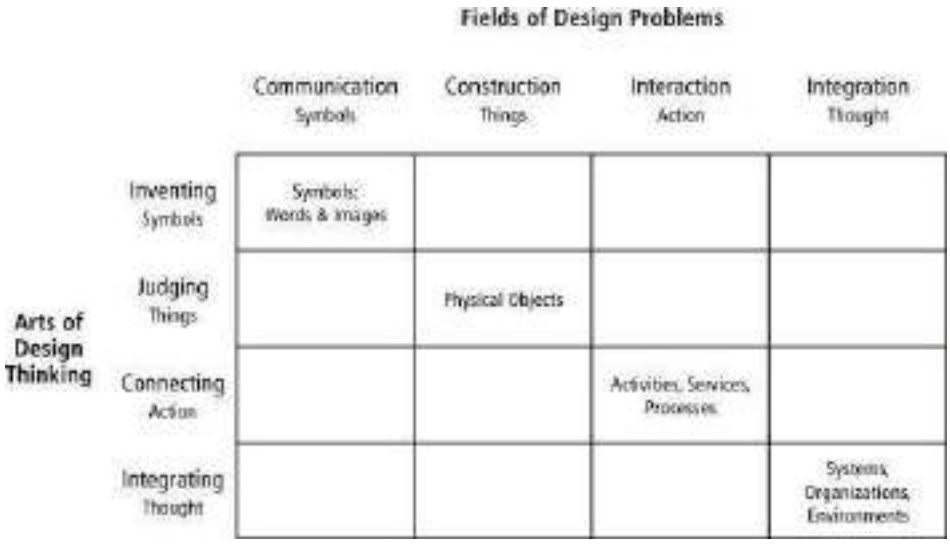

Figure 1: Four Orders of Design - Buchanan, 2015

Design-led Innovation to Design-led Transitions

Design-led innovation as a concerted approach was realised in response to growing pressure on the Australian manufacturing sector from nearby high-productivity and low-wage competitors based in Asia. A design-led approach to innovation encapsulates the methods, skills and culture of design throughout the entire process of creating and capturing value within an organisation. The approach conceptualised by Bucolo, Matthews and Wrigley (2012) assists an organisation to diversify by gathering and acting upon novel insights from customers

[2] I choose to make a distinction here for clarity. *Transformation*s are changes at an organisational-level, and *transitions* are changes at the system-level.

and stakeholders. Novel insights become a basis for differentiating innovation and a vital source of top line growth for firms experiencing the pressures of market competition. Cases reveal that design-led innovation can positively contributes to, and can even drive organisational transformations (Doherty, Wrigley, Matthews & Bucolo, 2015; Townson, Matthews & Wrigley, 2016; Krabye, Wrigley, Matthews, & Bucolo, 2013).

While design-led innovation began with a motive to support the Australian manufacturing sector, interest quickly grew from the broader business community. Of note is the mobility sector (Garret, Straker & Wrigley, 2017; Price & Wrigley, 2016). General findings from these initial years of research are contained in the work of Wrigley (2016) and Price, Wrigley and Straker (2015). Design-led innovation has also transferred successfully to the European context, involving partnerships with an automotive company (Bryant & Wrigley, 2014) and software developer (Bastiaansen, Price, Govers & Machielsen, 2018). Parallel efforts to bring design-led innovation into the public sector have also been positive (Bason, 2013; Camacho, 2016).

Focus has turned progressively from the scale of individual organisation and impact of design, toward a macro perspective of the potential impact of design across networks of organisations. This shift entails scaling design-led innovation, and more broadly design as a source of improved competitiveness for single organisations, to the resilience of a network of organisations – an entire sector, industry or indeed a national economy. Fraser (2012) raises the potential of design to be a source of an economic prosperity, describing an *innovation economy* where enterprises compete with and through design. Similarly, Bucolo (2015) extends the design ladder (Figure 2) to describe *design as national competitive strategy* (step 6) whereby a government designs and implements macro-economic strategies that promote national resilience. The Australian paradigm prevails in the work Peppou, Thurgood and Bucolo (2017). Yet there are also parallel international efforts to elevate design to source of system-level impact. Of note are methodology developments that address:

- The socio-technical → thing-centred design (Giaccardi, Speed, Cila and Caldwell, 2016), DesignX (Norman & Stappers, 2015);
- The socio-cultural → infrastructuring design (Hillgren, Seravalli & Emilson, 2011), and;
- The socio-economic → Design-led innovation (Bucolo, Matthews & Wrigley, 2012), design driven innovation (Verganti, 2009).

Another emergent methodology is transition design. Transitions are more prominent within fields such as policy development and technology forecasting. Journals such as *Futures, World Development, Research Policy* and *Technological Forecasting and Ecological Economics* contain work that is topical to the transitions of developing nations and adoption of new technology innovation systems. Transitions represent the collective shift of multiple levels of a system (Geels, 2002). Geels describes three levels that must be aligned for a transition to take place. These levels are

1. The 'niche' level where innovation occurs;
2. The 'regime' level where policy frameworks operate, and;
3. The 'landscape' level where megatrends and collective motivations reside.

As Geels, (2011, np) writes:

> *Although each transition is unique, the general dynamic pattern is characterised by transitions resulting from the interaction between processes at different levels: (a) niche-innovations build up internal momentum, (b) changes at the landscape level create pressure on the regime, and (c) destabilisation of the regime creates windows of opportunity for niche-innovations.*

As an example, the sustainable energy transition requires innovation to develop renewable energy products and services that are attractive to citizens (niche). The organisations that are responsible for that innovation must also undergo a transformation. New policy frameworks (regime) that promote renewable energy sources are required too so that the existing finite energy system is phased out. Finally a collective movement toward acceptance of the need to act on climate change (landscape) creates a sense of urgency (Kivimaa & Kern, 2016). A window of opportunity is opened and a transition can take place. When these layers realign and stabilise to a new state, a transition is said to have been enacted. For this reason, transitions require overcoming 'lock-ins' or entrenched ways of operating, thinking and being at each level (Lachman, 2013). Hence, transitions also require a build-up of forces for change that move dynamically between citizens, industries and political division (Frantzeskaki & de Haan, 2009). This build-up takes time and inherently involves tension (Jorgensen, 2012). Overtime the existing system is creatively destroyed and replaced with a new system and accompanying paradigm (Kivimaa & Kern, 2016).

The strength of transition theory is in the comprehensive way retrospective cases are described. However, Lachman (2013) also describes this as a 'catch 22', as literature offers limited practical guidance for designing and enacting transitions. Further transition literature points generally to the collaborative effort and engagement between niche and regime actors. However, actual description of practices required to facilitate this interaction are vague (Kemp & Rotmans, 2009). Martens and Rotman (2005) do point toward anticipatory approaches that are reflexive, test assumptions and drive innovation. An opportunity for design is apparent.

From a design perspective, transitions theory shifts rhetoric from commercial principles such as viability and competitiveness associated with *design x innovation* (Dong, 2015) to a holistic perspective – an 'interconnectedness' of social, economic, political and natural systems to address present and future wicked problems (Irwin et al. 2015). Wicked problems such as climate change, loss of biodiversity, and increasing wealth disparity require the design and implementation of new products, services and systems. Such change in rhetoric elevates design to new urgency. Irwin et al (2015) view transition design as a natural extension of existing design approaches, view visualised in Figure 3.

As Irwin (2018) describes, designing transitions involves three repeating phases; (1) reframing present and future; (2) designing interventions, and; (3) waiting and observing. The methodology places emphasis on envisioning long-term futures that are desirable for a holistic range of stakeholders, then backcasting toward feasible realisation steps. The present context is also reframed, for example how Leitao (2018) reframes the narrative of western modernity to explore new notions of past and present . These new perspectives inform envisioning that is intended to break away from conventional 'lock ins' described by Lachman (2013) that reinforce the present ecosystem. Interventions are then built and enacted at various system-levels that are informed by Geels' multi-layered perspective (MLP) (2002). These interventions are intended to create pressure for change between and across levels of a system. Waiting and observing as evaluative activities then determine the status of the interventions before a series of reframing occurs again.

Figure 2: Design Ladder Extended – Bucolo 2015. Reaching national transitions

Figure 3: Emerging Discipline of Transition Design – Irwin et al. 2015

RtD: Dutch Transition Design Case

Presenting a practical example of transition design provides insight into the nuances and emergent state of the methodology. As part of a collaboration with the Dutch Government's *X-Lab*, Youngsil Lee (2018) lead a design team to create a *kitchen-code service* to promote healthy and sustainable daily cooking habits for Dutch citizens. The design team was multidisciplinary; including designers, ecologists, industrial engineers and policy makers. The project, *From things to systems, and back: a thing-centric approach to protein transition in the Netherlands* explored socio-cultural and socio-economic circumstances of food purchase, preparation and consumption. This construction by Lee involved the integration of *commons* theory (Ostrom, 2015) as mechanism to create tension between new daily individual actions and the food industry. This approach is consistent with Geels' multi-levelled perspective (2002).

Lee designed a service to encourage changes in how food is produced, regulated and consumed. The strength of the project lies not only in the outcome – a new service proposition - but in the conceptual construction of a spatiotemporal axis of the kitchen to which the problem of unhealthy and unsustainable societal eating habits reinforced by current agricultural and food processing is confronted. Lee establishes a vertical axis from individual consumer, to family, community and society and uses each level as an interlinked design context (Figure 4). The kitchen context is reframed as a decision making space and becomes the vertical axis. Kitchen tools that afford certain cooking techniques and practices are identified as amplifying effects for the diffusion of change at each horizontal rung of the axis. The home kitchen, the commercial kitchen, the restaurant kitchen, the farmer's kitchen all act as decision making spaces that determine supply and demand within the greater food system.

Lee and her team designed a service intervention that would support policy efforts to reduce meat-based protein consumption in the Netherlands. Overtime, the home cook would be encouraged to use green protein (as opposed to animal-based protein) sources in purchasing and cooking decisions. When buying new green food products, the *kitchen-code service* would assist individuals and groups to learn new recipes based on what cooking utensils were available in their own kitchen context. Should the entire Dutch population cease to purchase and consume meat overnight, a supply-chain induced disaster would occur with waste accumulating toward crisis point. Under the kitchen code service, policies would need to be devised that would support farmers to shift their production over time to ensure they were producing food relative to demand and substituting meat based farming with green alternatives.

The case of protein transition within the Dutch context is an example of the emerging state of transition design. The project reveals that the task of building conceptual and theoretical integrity within the methodology must take place in situ while experimenting via *research through design*. An observation throughout the project was that the ecosystem was 'not ready' to embrace such thinking about the reduction of meat-based protein sources. More insight about the state of the ecosystem was required to determine when the transition could be enacted. The production of meat-based protein, especially in the dairy industry, in the Netherlands is considered part of the socio-cultural identity of the country. The Dutch are proud of their cheese, milk and dairy products which are exported globally. In this sense, the project felt political resistance. While the kitchen-code service has not been implemented, the principles underpinning the protein transition and kitchen code are now informing policy making.

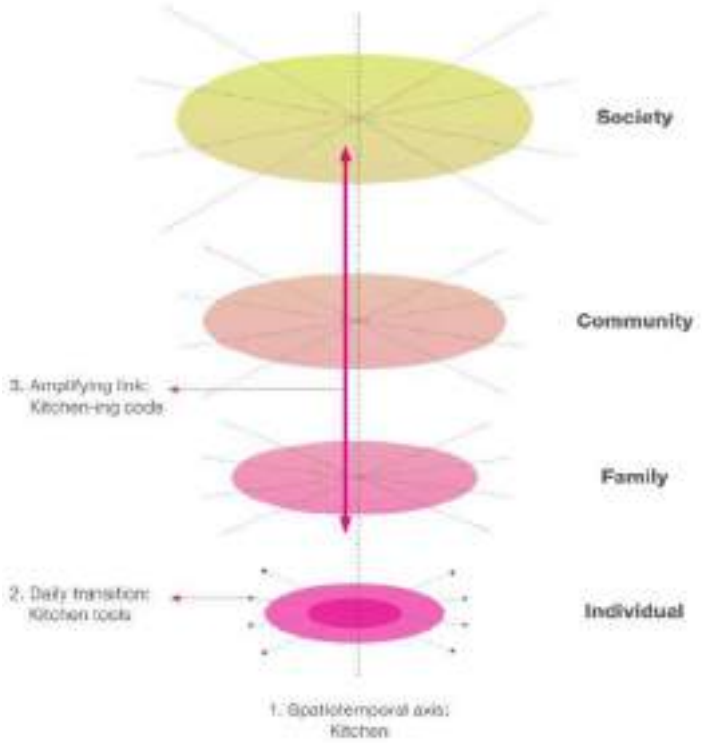

Figure 4: System diagram of the Kitchen Concept developed by Lee (2018) and inspired by Geels (2002).

A second key insight gained by the researchers was a sense that how quickly a protein transition could be fully enacted across an ecosystem. The scale of changes within the agricultural industry in particular would take many years to stabilise. The protein transition designed by Lee and colleagues provided an idealistic vision of steps required to move toward a new food-system. Necessary transformative actions and the political upheaval within each participating organisation was not factored into the design of this greater transition. In retrospect these two factors of timing and speed were critical. In the next passage of this paper, I look to theories associated with change and growth to learn more about how timing and speed are addressed in transitions literature.

Looking to Change Theories for Guidance

Transitions requires daily changes at the scale of the individual. In daily life there are many transitions already underway. Transitions can manifest in adoption of new products and services; for example from combustion to electric vehicles or from non-recyclable plastics to organic alternatives such as alginate based materials. These two transitions can be considered part of the general sustainable transition. This transition involves an unwinding from an industrialised carbon-intensive economy toward notions of renewable energy, reuse, repair, repurpose and recycle (de Jesus & Mendonça, 2018). The challenge of this transition is not to change one individual, but to scale change viably across the entire value chain associated with production to consumption of goods and services.

Innovation can be an enabler here, as Schot and Kanger (2016, pg 76) note; 'As Innovation enabled the development of an industrial, carbon-intensive economy, it is plausible that ("transformative") innovation may now be the vehicle for triggering a new, "green" transition'. However, the same approach to innovation prioritising efficiency and productivity that hailed in the industrial era cannot be repeated. With the power of retrospect and with the presence of an information economy, it is clear that an approach that integrates ecological and social factors into an economic and technical 'transition' must be championed. Here transition design as source of innovation that integrates socio-cultural, ecological, economic and technology developments is of significant relevance.

It is important to note, that I view technology as a scaffold for new types of actions that collectively build pressure for change. This viewpoint is consistent with technology innovation system theory (TIS) that forms one direction within transition literature (Hekkert, Suurs, Negro, Kuhlman, Smits, 2007). TIS involves viewing the co-evolution of technical systems with social and economic institutions. This viewpoint has synergies to the

theoretical underpinnings of design-led innovation. Notably how design as an alternative approach to innovation can stimulate cultural and organisational transformations that benefit society. TIS theory is closely related to strategic niche management (SNM) which offers another nuanced direction within transitions literature (Kemp, Schot & Hoogma, 1998).

The S-Curve

The seminal work of Christensen (1992; 1997) provides valuable starting point to explore innovation and system-level change. The s-curve is a theoretical model that fundamentally describes the phenomena of growth in relation to time (Christensen, 1991; 1997). The s-curve, named for its approximate shape of an 'S', has been applied to study population growth (with the advent of the *pearl function*), adoption of products and services, and the efficiency of technologies during operation (see Figure 5). Growth begins slowly. When the tipping point or critical mass is achieved, growth accelerates and can even be exponential. Eventually growth plateaus due to maturity or stabilisation of the phenomena. Martens and Rotmans (2005) contextualise the s-curve within transition studies, following a similar route to stabilisation. Martens and Rotmans place greater emphasis on describing the acceleration phase where growth occurs and visible structural changes take place between interactions of various levels; socio-cultural, ecological, economic and intuitional.

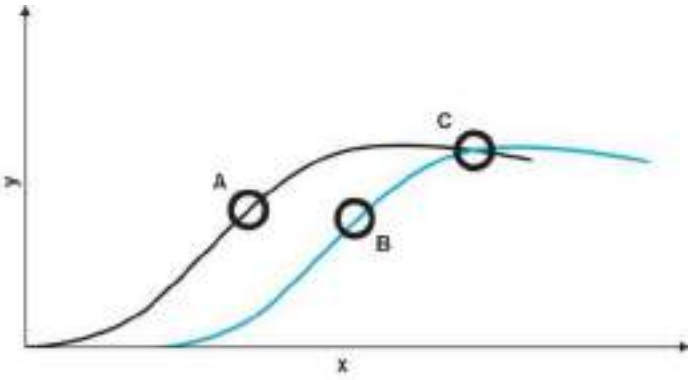

Figure 5: S-curve model; A) growth of product 1 sales; B) growth of product 2 sales and C) inflection point where growth curves intersect.

Depending on the nature of a growth trajectory (Dosi, 1982) and competitive forces at play (Porter, 2008), a technology or firm represented by an s-curve will be displaced by another firm or technology of superior performance. The existing firm or technology is unable to match the performance and capabilities of the newcomer. The newcomer enjoys market success until its own position is disrupted by a new alternate product or service of superior performance. A series of *creative destructions* take place. When observed from distance, this process is akin to general progress.

The notion of *disruptive technologies* pioneered in the work of Christensen (1997) has deeply influenced the direction and shape of management and technology disciplines. For example the positive economic influence of competitive forces (particularly the threat of the entrant) has been identified as a stimulant for investment in research and design (R&D). R&D investment has historically been a key metric underpinning prosperous economies (Foster, 1986). Design is already known to assist organisations to flourish under the associated innovation challenges of the competitive arena. This position is acknowledged in practice and academic alike (Rae, 2016; Sheppard, Kouyoumjian, Sarrazin, & Dore, 2018).

The Dynamics of an S-Curve Jump

When the vertical parameter (y axis) is extended and two or more s-curves are represented, discontinuities can be identified. The transition from one growth curve to another is termed by Asthana (1995) as the *s-curve jump* (see Figure 6). The notion of 'jump' describes a moment of increased activity associated with springing into a new mode. Usually this jump requires significant capital outlay and redistribution of resources to change from one operating system to another. Asthana (1995, p.15) describes, "Properly used, an s-curve analysis helps reduce the risk of premature dismissal of technology." This carries implications for transition design such as when to phase out or replace existing infrastructure, systems and policies associated with the industrial era

or predecessor ecosystem. While the term jump carries the denotation of fast speed, often transitions may take many years to enact.

Conditions surrounding the s-curve are inherently uncertain and unstable. In these conditions it is common to find a diffuse range of future visions – note plurality. These visions may also be of varying salience, with some visions of the future already informing decision making. Change becomes difficult as tension builds and disagreements persist. It is common to find power-structures that both enable and inhibit change based on individual agenda. Such conditions are ripe for leadership (Asthana, 1995).

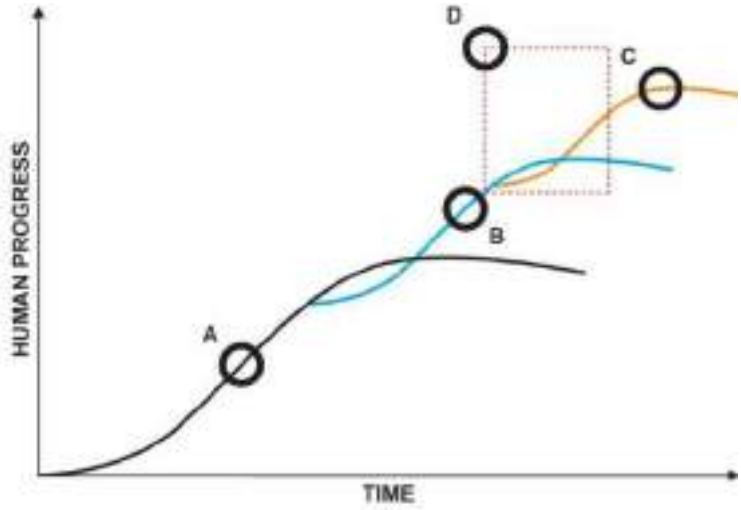

Figure 6: Consecutive s-curve models describing human progress informed by the thought leadership of Harari, (2015); A) growth of the agrarian age; B) growth of the industrial age; C) predicted growth of high-tech age, and; D) scope of current transition period. Note bene: scale is representative only but as Harari notes, each age has approximately halved the time period of the previous age.

Timing of Transition

Identifying the timing of a transition implies a reliable reference point. Here, the theoretical relevance of the s-curve (Christensen, 1991; 1997) returns. Within this article relative the notion of being early, late and a laggard within an adoption or s-curve emerge as a way to describe the *timing* of transition. However the notion of an s-curve 'jump' (or transition to new system) also complicates this perspective as the discontinuities occur across the vertical axis as well as the horizontal axis. The work of Asthana assists in understanding the dynamics of the s-curve jump. The jump from industrialisation to high-tech era (citing Harari, 2015) is perhaps the broadest example to contextualise this theory. The dynamics of this jump are further illustrated in Figure 7. The figure caption describes how each transition involves loss as the s-curve jump takes place.

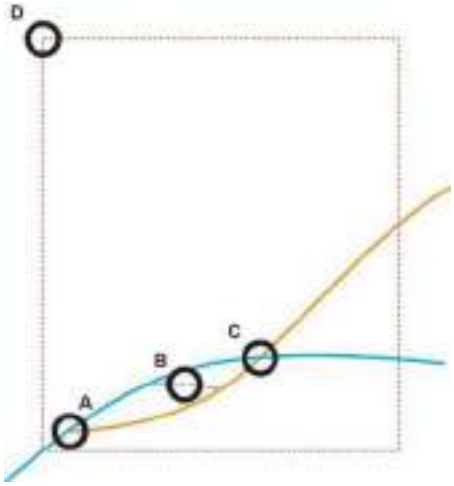

Figure 7: Dynamics of the s-curve jump; A) early mover must make do with an early loss to the performance of the system yet becomes well positioned (intellectually and with necessary infrastructure) for gains when the system begins to perform; B) mid mover must invest considerably in order to transition to the lower trajectory of the new system but can learn from the actions of the early adopter ; C) late mover endures the slowing performance of the older system, and must invest considerably to bridge the gap to now highly performing and mature system, and; D) scope of transition (see Figure 6 for reference point).

Recent work by Adner and Kapoor (2017) builds upon Asthana, using s-curve theory as a way to predict how and when new technologies should replace predecessors. The paper *Right tech, wrong time*, identifies four possible scenarios where technology innovation system transitions occur. These four scenarios are illustrated in Figure 8. Referring to Figure 8, Adner and Kapoor (2018, pg.60) write;

> *Traditional substitution of a new technology for an old one is shown with two S curves. (The solid lines). A more holistic view adds two dynamics. First if the new technology depends on the emergence of a new ecosystem, it becomes dominant more slowly (tightly dashed line intersecting at A and C (sic)). Second, the old technology's competitiveness is extended if it can benefit from performance improvements in its surrounding ecosystems (loosely dotted line intersecting at B and D (sic)).*

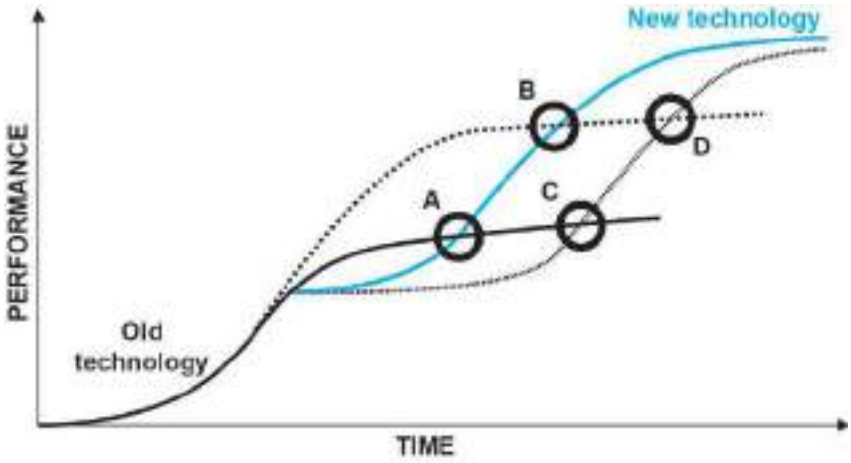

Figure 8: Right tech, wrong time – Adner and Kapoor (2017)

Figure 8 contains two s-curves representing the substitution of an old technology by a new technology. The tightly dashed line (intersecting A and C) represents a delayed arrival of a new technology. The loosely dotted line (intersection B and D) represents the extension of an old technology. Four circled points are annotated as A, B, C and D. These points represent:

- *Point A - Creative destruction.* Described as the classic and fastest substitution of technologies, a new technology is supported by a new and ready ecosystem. The old ecosystem cannot be significantly improved. It is the ideal moment to substitute technologies.
- *Points B - Robust coexistence.* Old technologies have sustained relevance, through improvements to the existing ecosystem. Old and new technologies temporarily coexist. For example the coexistence of combustion and hybrid vehicles, yet the general shift toward an electric vehicle supportive ecosystem is taking place.
- *Point C – Illusion of resilience.* The substitution of an old technology by a new technology occurs with little performance gains as the old ecosystem seems outdated. Yet, the new ecosystem seems to be 'not ready'. It is important to take active steps toward transitioning to a new technology ecosystem.
- *Point D – Robust resilience.* New technologies encounter strong resistance to adoption. The existing ecosystem has great potential to be improved, while the new technology ecosystem requires significant updates before becoming viable. A gradual substitution takes place. Adner and Kapoor provide the example of the barcode to RFID chip. Barcode technology is still relevant, and indeed has been resurgent with QR code scanning allowing the consumer to benefit from simple services and products.

Adner and Kapoor develop a working theory that scales from single technology to implications for the broader technology ecosystem. This logic provides decision makers with a set of clues to analyse a technology in relation to the broader ecosystem. The notion of 'ecosystem' encapsulates technology, consumers, businesses and policies that allow new technologies to be commercialised and part of daily life. Consider how solar technology has been developed, subsidised and adopted, leading to new behaviours and actions that are crucial to a wider energy transition.

Another example of how Adner and Kapoor's work could be harnessed is as follows. A transition designer may identify similar to Iansiti and Lakhani (2017), that Blockchain requires an extensive new ecosystem – most notably total reconfiguration of prevailing financial systems and governance structures to allow peer-to-peer transactions and distributed databases. This process of change may take twenty to thirty years to fully realise. From a societal perspective, the designer might identify that significant deinstitutionalisation is required to shift responsibility and trust to each individual citizen. From this analysis the designer can take reasonable course of action; perhaps plan for gradual improvement of the current ecosystem toward one more supportive of Blockchain's utility – a strategy akin to *robust resilience*.

In sum, the work of Adner and Kapoor offers a strategic approach to consider how and when an old technology can be substituted by a new technologies by analysing the state of the broader technology ecosystem. That ecosystem involves the political, structural, economic and societal elements at play. While technology-focused, an appropriation of this approach can support the efforts of transition designers to realise sustainable futures by analysing the conditions of the prevailing social, cultural, political, economic ecosystem.

Velocity of Transition

One factor implied within the work of Adner and Kapoor, is the velocity to which a transition can be enacted when the timing is 'right'. For lack of suitable terminology here, I will refer to this as the *velocity of transition*. Table 1 contains six transitions drawn from literature used to explore the constructs of timing and velocity. Enablers and inhibitors of change are noted. As previously identified, the timing of a transition may be early, late or somewhere in between. The velocity of a transition can occur gradually or abruptly. I note here that gradual transitions can take more than 10 years. While abrupt transitions occur rapidly below this 10 year time scale. This 10 year demarcation requires much further inquiry to define but for now is a practical reference point. In the next paragraphs I will explore more examples that are summarised in Table 1.

Not all transitions occur quickly. In fact many decades may be required to transition from one operating system to another. These transitions are *gradual*; for example over the last 40 years, the 'Energiewende', or German energy transition from finite to renewable sources has been taking place. This gradual transition has occurred to unwind reliance on the infrastructure associated with the existing energy system. The slow dismantling, reconfiguration or replacement of finite energy infrastructure mitigates social disruption to employment and gross domestic product (GDP). Strong leadership (and even bipartisan unity) was initially required to develop policy that could remain protected overtime, thus allowing implementation beyond electoral cycles.

Similarly, a gradual transition in the Australian energy sector has been occurring for contrasting reasons. During the global financial crisis, Australia was one of the few developed nations to experience growth. Such stability came from the export of minerals (coal, iron ore) to nearby developing trade partners such as China and India. As China's import of Australian coal has slowed in light of its own energy transition, an increase of export to Japan has risen in lieu of closure of the nation's nuclear energy plants following the 2011 earthquake and tsunami. The inhibitors to change associated with the cost of new infrastructure hold such heavy political weight that exploring clean energy alternatives was suppressed for many years. In short, sustained success brought through mineralogy instilled the thinking, 'why change when something is successful'. The country now finds itself on a clean energy precipice. Partnership between the South Australian State Government and Tesla to implement a solar-battery strategy to stablise an unreliable electric grid will be closely followed by many.

An example of an abrupt change is the Chinese Energy Transition. With fast leadership mechanisms enabled by a socialist republic model; President Xi Jingping was able to quickly pass reform and begin capital outlay toward replacing finite energy resources and infrastructure with renewable alternatives. Interestingly, even with the authoritative governmental model of the People's Republic of China, it was vocal protest of citizens living in mega-cities such as Beijing and Shanghai facing serious air quality challenges that encouraged a transition. China still remains one of the largest polluting nations per capita. However, its investment shows how seriously the transition is being pursued. In 2017, China invested more than half of the global renewable energy capita; nearly $280 Billion US dollars (Energiewende Team, 2018). Interestingly, the idea that China's authoritarian model of governance being effective during a system-level transition prompts critique of dialogue-based processes for reform associated with democracy. Such an example does warrant consideration into how to establish a shared vision through democratic processes like that of preceding unity leading to the German energy transition. As Hendriks notes, unfortunately sometimes politics just goes on and on (2009).

Similar abrupt system-level transition occurred in Sweden on 3 September 1967, when driving switched from left side to right side of the road. *Dagen H* (Day H) involved a temporary ban of vehicles driving on roads while intersections were reconfigured. In this case, the existing infrastructure of the road remained a stable factor – allowing a fast transition to take place. This transition was fully enacted within months. Further, an abrupt transition occurred when penicillin was discovered by Dr. Alexander Fleming in 1928. It was not until 1940 that mass production of the drug was achieved. Even today, pharmaceutical development takes many years to achieve[3] given tight regulations around clinical trials and human testing. Once produced *en masse*, penicillin rapidly changed medical practices creating the capability to treat bacterial infections that were otherwise fatal. One of the great inhibitors to the transition to *modern* medicine was the ability to mass produce and distribute penicillin. Once the ecosystem was ready for distribution (timing), the change became widespread and fast (velocity).

Table 1: Timing and Velocity of Transitions

Transition	***Timing of transition***	***Velocity of transition***	***Enablers***	***Inhibitors***
Australian Solar/Wind Energy Drive as a breakaway from previous reliance on coal-fired infrastructure (present);	Late	Gradual	Abundance of natural resources; cost benefits to the consumers with solar in particular; temporary government subsidies; lowering costs of solar panel technology	Entrenchment of finite energy providers lobbying power within the political landscape; immediate trade opportunities for coal/gas in nearby developing nations (for example: India)
Irish Taxi Liberalisation (2000) 20 years after the deregulation and liberalisation trends of the 1970-1980s	Late	Abrupt	Deregulation stemming from new legislation; lower prices passed onto the consumer; population growth; move of inhabitants to urban centres	Labour union protest; backlash from existing industry

[3] Even today with notable technological developments, it still takes about 10-12 years on average to develop and realise new drugs (US Food and Drug Administration FDA).

Singapore Economic Reform (1965) becoming a strong and independent economic hub	Late	Gradual	Strong charismatic leadership and a powerful vision for independence; government incentive for new ventures; geo-political location on intersection of major trade routes	Existing economic instability as an outcome of WWII; lack of capital reserve
Chinese Renewable Energy Policy (2017 – announces 360 billion dollar investment)	Late	Abrupt	Strong (authoritarian) leadership and vast capital reserve; citizen activism regarding the country's air quality; lowering price of solar panel technology	Significant infrastructure dismantling requiring massive job losses and short term instability
German Energy Transition (Energiewende, 1980 to present)	Early	Gradual	Strong leadership and vision; taking responsibility for long term stability	Unravelling of extensive and successful finite energy resources; criticised publically as a 'financial burden'
Integration of penicillin into worldwide medical practices (Between 1928-1929 and 1940)	Early	Abrupt	The ability to survive simple infections (massive performance gains); suitability of penicillin within existing models of care (injection or tablet form)	Disproportionate supply of the drug to massive demand (scaling issues); religious pushback associated with playing 'god'; capital within the US economy post WWII to stimulate mass production

Theoretical Implications

It is necessary to pause now and identify what theoretical implications can be drawn from growth theories that can aid the maturity of transition design. The implications below hold value to transition designers and designers seeking to work across ecosystems. Some implications are:

- A transition can be modelled as an s-curve 'jump';
- A destabilisation or crisis within an ecosystem during the preceding moments before an s-curve jump is an opportune time for design leadership;
- Theoretically, a transition requires loss. Loss occurs either through performance or capital outlay associated with change. The social element of loss is often overlooked in transitions literature;
- A transition begins with the first decisive action toward change, usually policy or legislative reform, but may also be mobilisation of a population toward change;
- Market mechanisms such as deregulation/regulation can drive very fast changes in supply chain reconfiguration and consumer preference;
- Early yet gradual transitions require strong (and united) leadership that extend beyond electoral cycles;
- Some transitions occur rapidly and successfully because a technology, such as penicillin, provides such a radical performance improvement that it sparks the creation of new ecosystem around it;
- Late transitions often come with the challenge of unwinding entrenched lobbying power between for-profit organisations and government parties who are 'locked in' to the old system, e.g. see the Australian energy transition;
- The illusion of resilience of an old technology within an ecosystem only prolongs the responsibility of change to future generations;
- A transition design approach must factor concepts of timing and velocity in order produce robust design interventions.

Regarding the last implication, 'how to' factor timing and velocity of change within a design process remains an area for further research.

Conclusion

As innovation enabled the development of an industrial, carbon-intensive economy; it is plausible too that innovation may now be the vehicle for triggering a new, sustainable transition. With the power of retrospect,

it is clear that an approach that integrates ecological and social factors into an economic and technical 'transition' must be championed. Here transition design (as source of innovation) is of significant relevance. While some scholars and practitioners have reached this realisation through the evolution of social innovation, my research has led me to a similar point through expansion of the logic associated with design-led innovation – a human-centred yet economic path.

In this paper I have reflected on a transition design project with the Dutch Government. This project revealed two challenges that were not factored within the design approach; (1) the *timing* of the transition relative to the surrounding environment and; (2) the *velocity* at which a transition could be fully enacted. I inquired into change and growth theories in order to understand how to manage the complexities of leading transitions by design. Theoretical implications act as platform for explorative and reflective practice that continues fostering the maturity of transition design as an emerging methodology.

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Research Perspectives IN THE ERA OF Transformations

On transforming transition design: from promise to practice

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We are living in transitional times. Much has been under debate on the need to change and to cope with societal transitions, less emphasis, however, is devoted on how to do so. Therefore, one of the primary questions in Transition Design is *how to design for sustainable transitions*? The current work aims to evaluate 'transition design studies' by analysing and evaluating the current available practice of transition design in order to contribute to the field in two ways: first, by maturing through evaluation, and second, by identifying points of further research. Our findings show that three phases can be distinguished within transition design processes: *Design research* to understand past, present, and to envision the future; *Designing interventions* to create the right thing, at the right place, at the right time, and *Design practice for transition* that accumulate the design interventions in order to drive societal transitions.

Keywords: Design methods, persistent problems, sustainability transitions, systemic change, transition design

Introduction

Current transitional times are often referred to as the *Anthropocene*: an epoch caused by human activity, as opposed to a natural process. Crutzen and Stoermer (2000) explain that "*Human activities are exerting increasing impacts on the environment on all scales, in many ways outcompeting natural processes"*. Even though, the concept of the Anthropocene has been well-motivated, many people have difficulties in accepting both the concept and the consequences. The corresponding objection towards the Anthropocene is causing social tension, trivialising this topic to a rather normative debate skewed by beliefs and values, rather than a scientific debate about evidence and explanation (Steffen, Grinevald, Crutzen, & Mcneill, 2011). Despite the trivialising of the topic and the endless debates, we *do* find ourselves in the middle of a global transition - with an outcome unsure, depending on how environmental, economic, and social *persistent problems* are resolved (Raskin, Banuri, Gallopín, Gutman, Hammond, Kates, & Swart, 2002). Persistent problems (Dirven, Rotmans & Verkaik, 2002) are the superlatives of wicked problems (Rittel & Webber, 1973). Differently put, persistent problems are the result of the flaws within our current economic and societal system, and can only be combated by fundamental change and the restructuring of our societal systems (Rotmans & Loorbach, 2008). The nature of persistent problems is extremely complex, due to their roots in different societal domains and the diversity of stakeholders (Rotmans & Loorbach, 2008).

Although the word *problem* is often associated with the word *solution*, for persistent problems this is not the case, due to their complexity. Persistent problems need to be broken down into digestible nodes, which can be addressed through the creation of smaller solutions, or interventions (Rittel & Webber, 1973; Rotmans &

Loorbach, 2008). The accumulation of those smaller solutions and interventions could lead to the transition of a persistent problem. Therefore, instead of solving persistent problems, we refer to *transitioning* persistent problems. A deep understanding of the system, the relations, and the components of the problem is required to do so. Transitions are understood as long-term, complex, and non-linear processes of systemic change (Mulder & Loorbach, 2018). In the current work, we refer to a more detailed explanation of transitions introduced by Rotmans and colleagues:

> *A transition is the result of developments in different domains. In other words, a transition can be described as a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems. A transition can be seen as a spiral that reinforces itself; there is multiple causality and co-evolution caused by independent developments. (Rotmans, Kemp, & van Asselt, 2001, p. 16)*

Due to the relevance and the urgency of persistent problems, the concept of transition has been widely discussed and broadly studied. Over the years, 'transition studies' has become an academic field (Escobar, 2015). In order to facilitate a new way of formulating and implementing policy for sustainable development in the short, mid and long-term, Rotmans and his colleagues have introduced the term 'transition management' to study transformative change processes in socio-technical systems (Rotmans et al., 2001; Geels, 2002; Kemp et al., 2007; Loorbach, 2010), resulting in a variety of frameworks and theories describing transformation and change. Geels (2002) developed a socio-technical landscape that depicts how transitions move through different abstraction levels of our society. Loorbach (2010) created the so-called transition management framework and cycle to make a distinction between different types of transition management, and what their functions are, and to bring this theory into practice. Werbeloff, Brown, and Loorbach (2016) studied what patterns transitions follow in order to understand how they manifest and move with, the aim to identify relevant and strategic agency opportunities. Through those theories and research, we seemed to have gained a lot of knowledge and insight in how transitions work: how they happen, in what ways they take shape, and how they are structured. Nonetheless, we have not found a way to structure, steer, or accelerate ongoing transitions. In other words,

> *We need to be clear that so far, transition management has been mainly implemented and conceptualised as a "shadow track" in which new visions, ideas, and agendas can be developed in a more innovative way than within the context of regular policy processes" […] "it leaves open for further research the fascinating question of how the basic ideas and principles underlying transition management could be translated into specific operational models that would be more in tune with other phases in policy- and decision-making processes. (Loorbach, 2010, p. 178)*

The severity of persistent problems and the urgency to address them, cannot be overstated. Although, this has been a topic of talk and research for years, fundamental change of the system has not occurred. There is little action to actively shape, control or guide this change. During the Climate Conference 2018, Greta Thunberg, a 15 years old girl from Sweden, nicely pointed out the problem to the UN: *"Until you start focusing on what needs to be done rather than what is politically possible, there is no hope. We cannot solve a crisis without treating it as a crisis"*. She correctly understood we have to move towards *action:* the growing severeness of persistent problems is accompanied by a growing *urgency to act*. This is where transition design comes to the play. Complementary to the transition management field, it aims to move *from understanding towards action*. Pointed out by Hughes and Steffen (2013), Jensen (2017) as well as Porritt (2013) there is a need for a new, design-led approach to address the complex, wicked problems confronting societies in the 21st century and to seed and catalyse societal transitions toward more sustainable and desirable long-term futures (from Irwin, 2018). The next section elaborates upon the role of design in transition studies.

Transition design

The design discipline has successfully evolved itself into a profession that addresses business and social issues with the use of design principles. Now, the design discipline is researching and experimenting how it can evolve itself into a discipline that is able to address complex persistent problems and to transform society, under the flag *transition design*. Transition design aspires to become an integrated discipline with a variety of knowledge and skills, that acts as an agent to facilitate, accelerate, and steer transitions. It is unique in its design-led approach and the ambition to integrate frameworks, processes, tools, and methods from a variety

of fields. This discipline emerged from the Carnegie Mellon University around 2011: Irwin and her colleagues explain the philosophy of transition design as following:

> *Transition Design advocates the reconception of entire lifestyles, with the aim of making them more place-based, convivial and participatory and harmonizing them with the natural environment. Transition Design focuses on the need for 'cosmopolitan localism', (Manzini 2009; Sachs 1999) a lifestyle that is place-based and regional, yet global in its awareness and exchange of information and technology. Everyday life is viewed as a potentially powerful, transformative space (Lefebvre 1984; Gardiner 2000) where transition designers explore ways in which basic human needs are satisfied locally, within economies that exist to meet those needs (Max-Neef 1992; Illich 1987; Kamenetsky 1992). This is in contrast to the dominant economic paradigm that is predicated upon unbridled growth and an imperative to maximize profit (Korten 1999. 2010; Mander 2012; Douthwaite 1996). (Irwin, Kossoff, Tonkinwise & Scupelli, 2015)*

Further elaborating upon this philosophy, Boehnert, Lockton and Mulder (2018) sharpen the role of *design* in transition design in their editorial for the recently organised Designing for Transitions track held at the Design Research Society conference in June 2018:

> *Whether considered in terms of everyday social practices, at a community scale or at the level of global challenges, a framing around designing for transitions brings together considerations of temporality, futures, different types of literacies, participation, social innovation, human needs, and interconnectedness;* ***designing for transitions involves designing how transitions are conceived, enacted, governed and managed****. (Boehnert, Lockton, & Mulder, 2018, p. 892)*

Clearly, the role, the value, and potential of transition are well-defined and explained, as the design discipline is paying more and more attention to transition design. The topic is addressed in academic literature and conferences. Nonetheless, and more importantly, just a very limited of number of academic case studies can be found that carried out and validated methods and tools, and thereby the potential of transition design. As the purpose of transition design is to *thrive action*, the (academic) focus of this discipline should shift towards development and validation of methods, tools and the potential of transition design through experimentation. Note that this does not rule out the variety and value of projects carried out on local, national or business level in the theme of *transition:* it is rather a critical note that in order to further develop the academic field of transition design, scholars should focus on analysing and evaluating those cases. Development of the academic field might also increase the value of non-academic projects, as it allows to move from random experimentation and trial-error process, towards a structured process and best practices.

In order to move from theory to practice, the current work aims to evaluate the transition design *practice* by analysing and evaluating the current available practice of transition design. The goal is to evaluate *how* and *where* the field can mature, to specify in more depth *what* should be developed, and to propose from *which* disciplines and practices, transition design can draw inspiration from that can contribute to achieving its ambitions.Method

First of all, it is important to note that *transition design* is a relatively new discipline, and the term *transition design* is not a specific term particularly used for the transition design field. The other way around, *transition projects* are not always carried out under the flag of transition design. This makes a researching this field tricky and fuzzy (Werbeloff et al., 2016). This study aims to *evaluate established practices of the transition design field* based on academic case studies that use transition design methods, tools, and frameworks as we aim to *map* and *evaluate* this specific discipline. Consequently, an online search strategy using the term "transition design", has been carried out. However, the search term "transition design" did not result into much results for the reasons explained above. Therefore, additionally the terms "design for sustainability", "design for systemic change", and "design for social innovation" are researched in order to find *case studies that do use transition design methods, tools, and/or frameworks.* Those terms are chosen based on a framework, created by Gaziulusoy in 2015, that visualises linkages, overlaps, and complementarities between different Design for Sustainability approaches. In this framework, Design for Systems Innovations and Transitions, evolves from and overlaps with systemic design, social innovation, and design for sustainability.

The search has been applied twice; once, broadly through google scholar, and once, limited to three leading design journals, i.e., Design Issues, Design Studies, and Design Philosophy Papers. Alongside this literatures search, the emerging design field has been studied by reviewing the themes addressed in recent call for papers

announced on the websites of well-known international design conferences, i.e., European Academy of Design 2017 (EAD12), Design Research Society 2018 (DRS2018), and Relating Systems Thinking and Design 2018 (RSD7). Publications meeting the following inclusion criteria are analysed: academic work that carries out a case-study with real users in order to test proposed frameworks, processes, and tools *developed for transition design*. This analysis has been done by structuring the frameworks, processes, and tools in a table (see Table 3). More precisely, each step or phase of a particular method found, the goal(s) of the step, how this step is carried out and the comments on those steps have been extracted. In this way, an overview of the available methods and their relation towards the step and goal has been created.

Results

The current section presents the results of our review, and is structured as follows. First, results following our search strategy are reported, presenting findings from the literature research and design conference calls, respectively. Next, the found frameworks, processes, and tools meeting the inclusion criteria are described.

Results: literature

Table 1 shows the results of the online literature research found via google scholar, and in the three design journals, Design Issues, Design Studies, and Design Philosophy Papers. A total of almost 13 million papers have been found (n= 12,908,889); 288,889 publications were found in the three journals, and 12,620,000 via google scholar. However, from this abundant number of hits, just a small amount of those papers is related to the transition design field, which has been concluded based on the title, and scanning the abstract from those papers. Through this online research, no publications meeting all inclusion criteria have been found.

Table 1 Results of literature review through google scholar and design journals

Searching engine	Terms	Results
Google scholar	“transition design”	n=5,970,000
	“design for sustainability”	n=3,200,000
	“design for systemic change”	n=3,450,000
		Total result google scholar n=12,620,000
Design Issues	“transition design”	n=11
	“design for sustainability”	n=112
	“design for systemic change”	n=45
total results		n=168
Design Studies	“transition design”	n=268
	“design for sustainability”	n=264
	“design for systemic change”	n=66
total results		n=598
Design Philosophy Papers	“transition design”	n=72
	“design for sustainability”	n=196,838
	“design for systemic change”	n=91,223
total results		n=288,133
		Total result journals n=288,889
		Total result journals & google scholar 12.908.889

Interestingly, the results show that the field of Transition Design is emerging, as relevant papers start being published from 2015 onwards. The work by Ceschin and Gaziulusoy (2016) explicitly indicate that the first, and only three, PhD's on the topic have been completed recently; Ceschin in 2012, Gaziulusoy in 2010, and Joore in 2010. The results also show the field is gaining attention within the design discipline: "Transition Design" (Kossoff, Irwin, & Willis, 2015) and "Transition Design Provocation" (Irwin, Kossoff, & Tonkinwise, 2015) are the second and fourth most read articles from Design Philosophy Papers. Furthermore, Ceschin and Gaziulusoy (2016) pointed out that transition design is also getting attention in the design education, as a group of scholars (Irwin, Tonkinwise, & Kossoff, 2015) has developed a curriculum on what they call transition design for the first time.

Results: design conferences

Our search in call for papers of recent design conferences confirmed the increase in attention for the transition design field: the European Academy of Design 2017 (EAD12), Design Research Society 2018 (DRS2018), as well Relating Systems Thinking and Design 2018 (RSD7) included transition design related tracks in their conference program. Table 2 provides an overview of the tracks and proceedings that are based on the field transition design.

Table 2 Results of design conferences search

Design conference and title	EAD12, 2017 "design for next"	DRS2018, 2018 "catalyst"	RSD7, 2018 "Challenging complexity by systemic design towards sustainability"
Transition design relevant tracks	- Design for next economy - Design for next environment - Design for next society - Design for next thinking	- Designing for transitions	- Models and processes for systemic design
Hands-on design practices included in conference proceedings		The Emerging Transition Design Approach	Systemic design toolkit

Results show explicit mentioning of the topic "transition design" in the DRS2018 track "designing for transitions". In EAD12 and RSD7, the topics "design" and "s*ustainable transitions and futures"* were combined in tracks, but *transition design* was not explicitly mentioned. Through this research, two interesting results are found. From the proceedings of DRS2018, an elaboration and pilot of the emerging transition design approach by Irwin and colleagues (2015) has been found. The proceedings of RSD7 refer to the Systemic Design toolkit (2018) developed by Namahn (Belgium human-centred design agency) and shiftN (futures and systems thinking studio from Brussels). Both propose a framework, method and tools specifically aimed at *designing transitions.* However, only for Irwin's framework a publication that meets the inclusion criteria has been found. This publication has been selected for a further, and more in-depth analysis on design methods, which is elaborated in the next section. As the further analysis consists of only one case-study, The Systemic Design Toolkit is used in the discussion complementary to Irwin's framework, for a synthesis and evaluation of the transition design practice. These two results are in the remainder referred to as Irwin's framework and the Systemic Design toolkit.

Results - analysis of the Transition Design Framework and Approach

Since 2014, the Transition Design Framework and Phased Approach developed by Irwin and colleagues, has been integrated into programs and curricula at the Carnegie Mellon University's School of Design. A first case study entitled "*The Emerging Transition Design Approach"* that applies this framework and approach has been presented at DRS2018. In this paper, Irwin (2018) evaluates the use of the framework and approach based on

one case-study. Table 3 shows a further analysis of this transition design framework and approach with a particular focus on the design methods used.

Table 3 Transition design framework & approach analysis (these references can be found in Irwin (2018))*

Step	*Goals*	*How*	*Comments*
1. Reframing present and future	1.1 Mapping the problem in the present *(creating the big picture)*	Stakeholder groups collaboration *(co-creation sessions)* Visual map *(visualization)* Identifying relations in map *(structuring the problem)*	Participants believes to be 'true' where challenged Process fostered empathy between stakeholder groups From 'confrontational' to 'co-creation' through discovery and playfulness
	1.2 Mapping stakeholders concerns and relations *(form individual perspective towards collective perspective)*	**No design methods** From other fields Needs-Fears Mapping (Wageningen University 2017)* Conflict Analysis Tools (Mason and Ruchard, 2005)* Multi-Stakeholder Processes (Hemmati, 2002)*	**Lack a component of action** Made people aware of their own cultural norms, beliefs and assumptions Prepared participants for future visioning by shifting their mindset
	1.3 Future visioning *(Envisioning and prototyping possible and preferable futures)*	Snapshots from 2050 *(narrative)* Create a worldview: first in small groups, later with whole group *(method 1:4:all)* Backcasting to create transition pathway *(backcasting and roadmapping)*	Showed there is much more room for solutioning when we think outside our paradigm, and this also unites different stakeholders **Backcasting to make things concrete is highly challenging and there are not enough tools and not a structured process to do so**
2. Designing interventions	2.1 Looking up and down systems levels in space, backward and forward in time *(discovering intervention points)*	What specifics of everyday life and individual practices contribute to the problem? *(user insight)* What current, large scale events, situations or trends contribute to the problem? *(trend analysis)*	Nothing indicated on how to do this
	2.2 Situate interventions aimed at transitioning the system toward the preferred future *(intervention design)*	Acupuncturists needles metaphor: situate the interventions at points they start to move things *(formulate design goal, design of intervention)* Amplifying projects (Manzini, 2015)*: look for what is already working at the grassroots level in order to support and amplify these efforts *(connect projects to vision)*	A table with design disciplines that are useful for intervention design is provided
	2.3 Multiple interventions at multiple levels of scale over multiple time horizons	**No design methods used**	The reaction of the system cannot be predicted The more complex the system, the more unpredictable the response
3. Waiting and observing	3.1 Observation and reflection in order to understand how the system has responded to the perturbation	**No design methods used**	-
	3.2 Shift in mindset and posture (and paradigm) from 'fast thinking and designing solutions' to 'long-term thinking'	**No design methods used**	**-**

Results show that step 1 and step 2 have a good foundation of design methods and processes. Regarding step 3, the goal has been defined, however, there are no design methods indicated or used in the case-study. For step 1.2, mapping stakeholders' concerns and relations, there are no design methods. Here, methods from other fields are borrowed. Although it is mentioned that these borrowed methods lack a component of action; this did not stop or withhold the process. In step 1.3, it is addressed that backcasting with a big group of stakeholders is highly challenging. However, this phase lacks the tools, methods and processes to support the intentions of the phase, and this is where the project starts to drift. For step 2, the goal and an indication of methods that can be used to reach this goal are defined - but as there is no plan of action made in step 1, it is difficult to situate the interventions in step 2.

Discussion

Results of our search strategy on transition design practices indicate a growing interest in this emerging discipline. Although the increased interest in the design discipline appeared promising, our findings show little evidence to fulfil the promise: only one publication that meets the inclusion criteria, has been found. In other words, only one academic publication has been found that carries out a case-study with real users in order to test proposed frameworks, processes, and tools *developed for transition design*. This might be due to the fact that we deliberately used the phrase "transition design" and "transitions", which rules out studies from other fields, that using different terminology but might bring relevant contributions to the methodological practices in the transition design field. However, as argued, the current work aims to specifically map practices that have been developed under the flag of transition design. For further research, it would be interesting to include those studies and to evaluate how other disciplines can contribute to the development of the transition design practice.

Furthermore, the framework and approach by Irwin (2018) has been based on principles and consequently, remains rather abstract: until today, only one case study of application has been published. There is no indication found regarding the impact and performance of transition design practice. In the remainder of this section, we elaborate upon how Irwin's framework and the Systemic Design toolkit can address the limitations of transition design field referring to limitations earlier identified by Ceschin and Gaziulusoy (2016). Although the Systemic Design toolkit did not meet the inclusion criteria, we choose to use it as an example for the synthesis of the transition design practice. The limitations identified by Ceschin and are Gaziulusoy (2016) are: on the one hand a too big picture approach, and on the other hand a lack of actionable components. Consequently, ways to address the discrepancy between macro- and micro-innovation are discussed. Based on a synthesis of the transition design framework and approach (Irwin, 2018), and the Systemic Design toolkit, three transition design phases are proposed: *Design Research*, *Designing Interventions* and *Design Practice for Transition*. According to this synthesis, each phase can be linked to one of three limitations earlier mentioned (Ceschin & Gaziulusoy, 2016). The found methods for each phase, referred in the transition design framework and approach (Irwin, 2018) are listed. Based on this overview, each phase is evaluated and suggestions for further research are done. The results of this synthesis can be found in Table 4.

Table 4 Synthesis of the transition design framework and approach (Irwin, 2018) and the Systemic Design Toolkit (2018)

Transition Design Phase	**Design Research**	**Designing Interventions**	**Design Practice for Transition**
Indicated limitations transition design by Ceschin & Gaziulusoy (2016)	*Too big picture*	*Linking macro- and micro innovation*	*Endorsement*
Steps and methods in Framework	1. Reframing present and future - co-creation sessions - visualization - relation-mapping - use of narratives - 1:4: all - backcasting and roadmapping	2. Designing Interventions - locate the spots for design interventions in the system - create multiple interventions at multiple levels over multiple time horizons	3. Waiting and observing
Steps and methods in Toolkit	1. Framing the system - rich context template	5. Exploring possibility space - intervention strategy canvas	
	2. Listening to the system - actants template	6. Designing the Intervention strategy - connectors template - paradox cards	
	3. Understanding the system - system map template	7. Fostering the transition - roadmap for transitions template	
	4. Defining the desired future - value proposition template		
Total	*Framing present: sufficient tools and methods*	*Designing interventions: sufficient methods and tools from other design fields*	*Monitoring and steering: no methods*

Design Research: how to escape time and land in space?

This phase is about researching, structuring and understanding the past, present and future context, and the stakeholders, of the problem. This research phase should lead to new insights that are used to create a vision on how to address this problem. Therefore, we refer this particular phase of a transition design process as Design Research. Both Irwin's framework (2018) and the Systemic Design Toolkit (2018) partly address the apparent limitation, too big picture, for this phase. Both the framework and the toolkit seem to be equipped to create an understanding of the past and current situation and to frame the problem, using design methods; as can be found in Table 4: step 1 in the transition framework, using stakeholder co-creation sessions, visual maps and connecting and structuring in this map. Step 1 to 4 in the Systemic Design Toolkit: using the rich context map, actants, system map, and value proposition. However, both the framework and the toolkit are not equipped with design methods to help users think outside their own paradigm in order to create a novel future vision. There is agreement that the novelty and quality of a shared vision guide and determine the success of innovation processes in business (Pearce and Ensley, 2004). Considering transition design as a large scale, multiple stakeholder, radical innovation trajectory, the novelty and quality of the future vision is crucial. Further research on methods, tools and processes to create future visions are welcome to mature the transition design discipline. Lessons from strategic design and radical innovation can be a first step for further research.

Another limitation found in the *Design Research* phase, is the lack of design methods for the management and leveraging of stakeholders and their interests. Irwin (2018) borrowed methods from other fields (see Table 3, step 1, goal 1.2), and motivate that those methods are useful to gain insight, but they lack a component of action. To understand the involved stakeholders and the discrepancy between their interests, the Systemic Design Toolkit created the 'listening to system' method. It considers the perspectives of the stakeholders on the issue, and it provides a visual tool to show the points of discrepancy between the stakeholders within the situation. Unfortunately, this canvas is made to compare the perspectives of only two stakeholders. Persistent problems have a great variety of stakeholders (Rotmans & Loorbach, 2008), and therefore this canvas is not extensive enough for addressing those problems. A first step to address this limitation might be expand the tool 'listening to system' in such a way it allows for use with multiple stakeholders. Another step could be researching the used methods by Irwin and collages, to see if they can be transformed towards design methods.

Designing Interventions: the right thing, at the right place, at the right time?

The current phase is about moving from vision towards action by creating the right intervention, at the right place, at the right time. In our work, we, therefore, refer to this phase as Designing Interventions. Both the framework and the toolkit propose a method to find the right place and time for the intervention; as can be found in Table 4: step 2 in the framework: locate the spots for design interventions in the system, create multiple interventions at multiple levels over multiple time horizons. Step 7 in the toolkit, roadmap for transitions. To create the right thing, the framework provides a table with other design disciplines that can be used to create interventions; the toolkit developed step 5 (the intervention strategy canvas), and step 6, (the 'connectors' and the 'paradox cards') to design interventions. An interesting observation is that the framework starts this phase by looking into the whole system and the planning of design interventions; the toolkit starts by creating solutions and then continues to planning. Unfortunately, the framework provides little structure or tools to find the right time and the right place, and at the same time, to create the right intervention; or in other words, how to link macro and micro innovation. To link innovations, the toolkit created the roadmap for transitions. This helps to place the interventions in time. However, this canvas is not extensive enough to find the right place, as it does not consider the complexity and different levels of the transition context - or in other words, it is not extensive enough to link macro and micro innovation. For further research into how to link macro and micro innovation, it might be interesting to start with combining the 'locating' of the framework and the 'roadmapping' of the toolkit. It might also be interesting to look into product portfolio management and product development from a strategic design perspective, as they consider careful planning the timing of launching new products, and how the products relate to each other.

For the designing of interventions, step 5 (The 'intervention canvas') of the toolkit provides a good bedrock as it clearly structures the boundaries of the system, and step 6 (the connectors and the paradox cards) are useful probes to further develop and define the interventions. Thereby, it provides sufficient guidance on how to create the right thing. The framework suggests a table with design disciplines that are experienced with the

design of interventions, which should give sufficient guidance in designing interventions, as those design disciplines are matured and capable of creating good designs. A first initiative to further develop this step, might be to create a separate toolkit for the design of transition interventions, including methods from other disciplines.

Design Practice for Transition: from parts to sum

Transitions are understood as long-term, complex, and non-linear processes of systemic change (Mulder & Loorbach, 2018). In other words, by accumulation of small happenings and changes, or planned interventions, a non-linear transition of systemic change is effectuated. If we facilitate and steer this non-linear process, by making the parts, thus the several design interventions into a whole, and so enable an accumulation, design can contribute to the transition. In keeping with the promise of transition design, this can be achieved with the use of design methods. Therefore, we coined this third phase as Design Practice for Transition. As can be seen in Table 4, nor the framework, nor the toolkit propose a structure, method, or tool, to do so. The framework suggests the phase "waiting and observing" without any further elaboration. Clearly, this phase lacks components of action, which is in keeping with the limitations Ceschin and Gaziulusoy (2016) indicated. However, the difference between design interventions and transition design is the ability to tie interventions together towards one goal. Therefore, further research on how to make a sum of the parts is needed. On top of this, it is important to develop ways to measure the effect of design interventions to get insight on their effect, so we steer the non-linear process in the right direction.

For further research on this matter, it seems to be interesting to learn from the lean startup philosophy and principles. "The Lean Startup method teaches you how to drive a startup: how to steer, when to turn, and when to persevere - and grow a business with maximum acceleration" (Ries, 2011). Considering this "learning to drive a start-up" as a non-linear process, which constantly fundamentally changes direction, transition design can be seen as "learning to drive an extremely complex, invisible vehicle", and can learn from a good start-up drive-lesson.

Conclusions

The current study presented the results of a review study that particularly searched for publications, studies, and other material demonstrating practices of transition design. Based on the search results, an analysis and evaluation of transition design has been presented. This research is limited to the particular field of transition design practice, and rules out the variety and possible contributions from other fields and/or projects that are not written up in an academic literature format. For further research, it is recommended to study a broader spectrum of the academic field, as well as the non-academic field exemplifying a "transition approach". Nonetheless, the current research resulted in a proposal of a new transition design process consisting of three phases, and provides suggestions on how those phases can be further developed. The first phase, design research, is about researching and framing past, present, and future with the end goal of a deep understanding of the situation and a shared, novel future vision. This phase is equipped with various methods to understand past and present, but thin on methods to envision the future. Further research into how for example strategic design and business develop future visions seems to be promising. Phase two, designing interventions, is about creating the right thing, at the right place, at the right time. For this phase, there are available methods and steps that guide how to do so; however, those methods and steps do not provide sufficient support to link macro- and micro-innovation. For the design of interventions, a great variety of knowledge from other matured design disciplines can be used; but it would be interesting to further research if a *design interventions for transitions toolkit* can be developed. The last phase, Design Practice for Transition, is both the most important phase as the less developed phase of transition design. For further development and maturing of the transition design field, it is of great importance to further research and develop methods for this phase. Learnings from for example the agile philosophy, aiming to guide innovation based on a build-measure-learn approach, might be an interesting starting point for this phase.

In conclusion, there is great relevance and need for transition design in transition studies, as it aims to move from understanding towards *action*. Unfortunately, until date both fields demonstrate little knowledge about the effect and implementation of those new disciplines in practice, and consistently end with a – unfulfilled – promise. To further develop the academic field, the emphasis should lie on testing and developing the frameworks, tools, and methods for transition design as well as measuring and monitoring the effect of this

approach in the real world. Through its implementation, transition design can come to life and move from an inert promise to a discipline that drives action and enables transitioning forward to a sustainable future.

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Personal, political, professional: a practice in transition

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It is widely agreed that in order to contribute to transitions towards sustainability, both practitioners and design itself must also transition. This paper presents findings from the first two years of transition in my Australian-based design practice. The paper explores what this transition has required of me personally, politically, and professionally, and draws on cases from my PhD. The PhD and paper are both part of an analytic auto-ethnography of my practice's transition from 'making greener things' towards design for transitions. The projects discussed use ethnography, action research and reflective practices in their temporal approaches. This paper explores how slower methods such as transition design and autonomous design can extend the political reach of a design practice and discusses sacrifice and the financial stabilisation that comes from enveloping old practices within the new. The analysis presented here also reflects on my experiences practicing design for transitions and on data collected through participant engagement.

Keywords: transition design, practice transitions, transformation, designer politics, power

Introduction

Humanity has exceeded multiple planetary boundaries (IPCC, 2018) and it is increasingly evident that significant changes are on the horizon. Whether these changes are by choice or by force depends upon immediate and collective actions being taken to mitigate climate change. Design is uniquely positioned to contribute to managed processes of societal change, and to make change desirable (Boehnert, 2018; Fry, 2009). In order to do so, design itself must change—from a practice entangled with the economic pursuits of business, to one that is focussed on transitions toward more just and sustainable ways of being in the world. As part of this endeavour designers will need to craft rich narratives for sustainable futures (Lockton & Candy, 2018) and these visions will reimagine everyday life. This permits designers to consider how their daily labour could be redirected as transition design; but in this reimagining of everyday life, consideration must also be given to what work/labour for non-designers looks like in transitions towards sustainable futures (White, 2015). Visions of a sustainable everyday will require a granularity that allows rich interpretations of how these possible futures might function, particularly if they are to offer viable alternatives to the dominant neo-liberal narrative in the West. This paper explores the practice of transition design and reflects on the first two years of a research-led, practice-based transition.

A design practice in transition is many things at once, often making it ill-defined and impeding the clarity of its brand narrative. These in-between times can be challenging due to the ever-present tension from blending the old practice and the new. The sometimes-paradoxical mix can result in a practice that feels at odds with itself; doing commercial work can feel 'wrong' but conversely it helps fund the transition work that feels 'right'. This paper discusses these tensions, the navigation of pain points, and the personal, political and professional

commitments I have made as a practitioner while transitioning my design practice from a commercially-focussed sustainable design practice of 'making greener things', towards a practice that designs for transitions.

The reflections presented are underpinned by theories of change, power, social practices, consumption, and complexity, as well as data collected as part of a larger PhD research project. It should be acknowledged that this paper and my broader transition have been influenced by supervisory guidance provided through my PhD. The projects referenced in this paper are part of this PhD and my Australian-based design practice. Due to the temporal nature of transition design most of these projects are ongoing, and likely to continue for years to come. The 'unfinishedness' in transition design case studies poses a relative challenge in their presentation, so perhaps (at least for this paper, if not for transitions as a whole) the discussion of case studies is better thought of in a continuing sense, as case studying.

Personal transformation and the commitment to a practice-based transition

Transition design literature argues for an altered mindset and posture in designers, shifting the designer from a competitive space into a cooperative one (Irwin et al., 2015). This appears to be a crucial step for practicing transition design, which is highly collaborative in its approach. Drawing heavily on participatory processes such as co-design, ethnography and facilitated stakeholder engagement, transition designers also benefit from personal virtues such as deep listening, patience, generosity, flexibility, empathy and resilience (Irwin, 2015, p. 23). In Escobar's descriptions of autonomous design, these collaborative processes are described as existential or 'life's work' (Escobar, 2018 p. 184-185). They are performed by designers embedded within communities who facilitate space for the co-definition of problems and the co-design of solutions that meet communal visions for the future (Escobar, 2018 p. 184-185; d'Anjou, 2015). Both autonomous design and transition design are reliant on collaborative processes for their success, and require an understanding of power dynamics (Boehnert, 2018; Escobar, 2018; Lukes, 2005) and of the power relations present in group dynamics (Dahle, 2018; Gee, 2011) in order to practice with sufficiency (Avelino, 2016; Dahle, 2018; Willis, 2015). Reflection on literature discussing power and behaviour dynamics brought with it a greater sense of my own power and privilege, and the role this is playing in re-forming my identity as an empowered designer is significant. My PhD research exploring consumption and waste catalysed further change and empowerment. Adopting a zero waste lifestyle formed part of a personal ethico-political stand against consumerism (see figure 1)—a change that became more meaningful after its extension into my practice. In making the commitment to transition my practice and refocus its outcomes in line with this, the immediate question of 'how?' came to the fore. Decelerating consumption is not a principal concern for the design industry or its symbiotic partner-in-crime, business, so how can a designer perform the work needed for a post-capitalist society if practicing design is currently made financially viable through its active participation in a consumer society? What sacrifices must precede the rewards that could follow?

Figure 4: (Top) Daily litter collection as part of the political action against waste. (Bottom) The landfill waste produced during the first two years of my zero waste transition

There is a complicated tension that arises from a disconnect between personal empowerment and professional actions. Sub-conscious responses to this tension could present as cognitive dissonance, leading to denial and a subsequent action paralysis (Boehnert, 2018 p. 135-142). Deeper cognisance of this tension can put designers in a double-bind. Double-bind theory stems from social psychology; it describes how schizophrenic symptoms can result from no-win situations, where complex and contradictory messages prevent action (Bateson et al., 1956). Designers can experience a double-bind when they view sustainability as simultaneously necessary and impossible in the context of their design brief. The resulting action paralysis can lead to design's equivalent of business-as-usual—an aesthetically pleasing range of unsustainable design outcomes. In contrast, a designer who transforms their relationships to ecology and the problems that threaten it becomes empowered to politicise their approach. Deeper

engagement with problems and contexts through transformative and epistemic learning can create a kind of stickiness to theories presented in the literature which can forge pathways to action (Sterling, 2011). This shift from knowing into doing activates the ethico-political designer. This awakening can illuminate the sustainable potential in a brief, in turn loosening the double-bind causing action paralysis. It would appear that the rich experiences that formulated my transformation have sparked a mindset and posture shift which in turn facilitated the emergence of transition within my design practice. An ethico-political commitment fostered a praxis that catalysed a powerful practice-based transition—from designing 'greener things' towards designing against consumption through transition design.

Design against consumption: the intersection of personal and practice transitions

It is widely understood that the problems of consumption and waste are connected, but less frequently recognised that both are accelerated and reinforced by design (Jackson, 2006; Thorpe 2012). Like so many of the sustainability problems we face, the problems of consumption and waste are also structural in nature, and the design industry's technical approaches—including designing 'greener things'—tend to reinforce rather than resolve these problems. Approaches such as cradle-to-cradle design (Braungart & McDonough, 2010) present valuable changes to the use and circulation of materials as part of a circular economy, but simultaneously fail to address design's acceleration of consumption (Boetzkes, 2016). Cradle-to-cradle aims to make 'good' things but its myopic consideration of design as an accelerant of consumption results in a default position of "making consumerism 'better'" (Thorpe, 2010 p. 15). Case in point: compostable single use plastics. This intervention 'improves' the materials of single use items but reinforces the culture of convenience and disposability underlying this waste stream. Furthermore, compostable plastics reinforce other wicked problems such as monoculture farming, decreased soil health, biodiversity loss and declining pollinator numbers. This well-intended solution demonstrates how complex sustainability problems are, how critical designers must be in our approach to technofixes, and how deeper relational thinking is required from designers working in this space.

Mapping processes in transition design (see examples in figures 2 and 3) are part of the framework's 'new ways of designing' (Irwin et al., 2015) which practice critical thinking and systems thinking. Pattern sensing during the analysis of complex data practices relational thinking (Dahle, 2018).

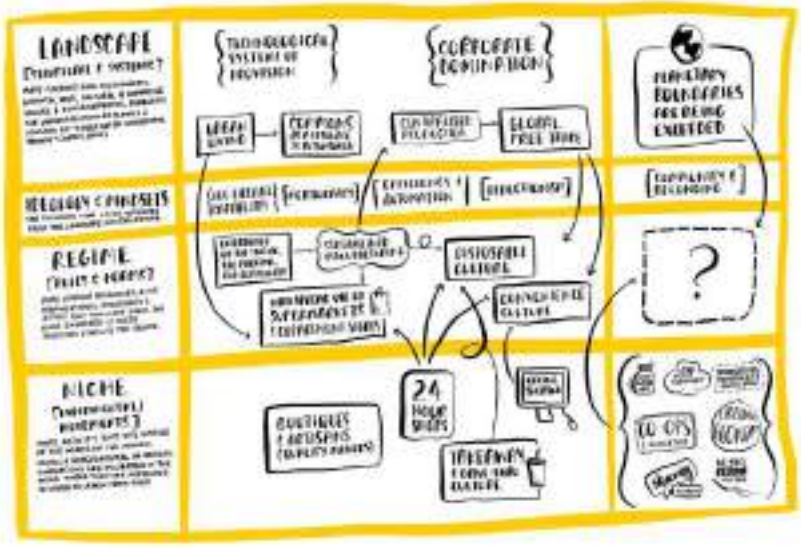

Figure 6: Making ideologies and mindsets visible in the MLP: mapping social

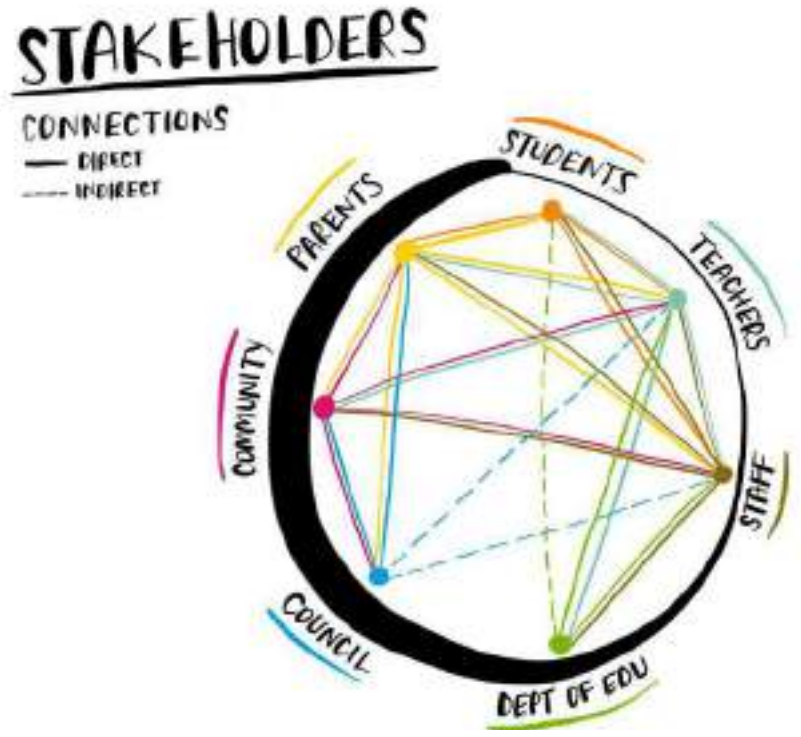

Figure 5: Mapping stakeholder group connections, from the Rethink Rubbish project as part of my PhD

These mapping processes and thinking techniques provide valuable insights into the approaches that might be needed in order to design against consumption, and when combined with theories of change such as socio-technical regime theory (Geels, 2002; Geels & Schot, 2010), designers can analyse historical shifts in social norms and gain insights for possible future transitions. Figure two (above) analyses consumption's history as a social practice by adapting Geel's (2002, 2011) multi-level perspective (MLP). It presents a narrative for the impact of the economic paradigm embedded in neo-liberal capitalism and reveals how a combination of changes made to production, manufacture and sale at the landscape (slow-moving) and niche (fast-moving) levels of a society can influence the everyday social practices that make up the norms of consumption, use and disposal at the regime level (stable-centre). Combining insights from mapping the MLP with Meadows' leverage points for system intervention (Meadows, 1999) provides a deeper understanding how and where structural change might be possible. This informs visions and backcasting, where ideation of design interventions starts in a future position and works back to the present (Lockton & Candy, 2018; Irwin et al., 2015). Mapping has been used in my practice for ideation (mind maps) research and prototyping (system/journey/experience mapping) but transition design's approach to mapping and analysis spanning wicked problems/interconnections, stakeholders, and their visions, is a 'new way of designing' within my practice (Irwin et al., 2015). These mapping processes have enriched the collaborative approaches being undertaken, illuminating previously unheard perspectives and creating a richer and more dynamic understanding of the problems to be solved. Using collaborative mapping and ethnographic data collection techniques in considerations of the consumption and waste problem has revealed cultural differences in people's relations between consumption and waste. Project analysis for *Rethink Rubbish* reveals culturally visible virtues of respect and responsibility appear to cultivate low waste behaviours more easily, and point to underlying values of care and compassion. Use of design interventions to awaken these values and encourage these virtues has been a key consideration in this project.

Designing against consumption is perhaps most challenging because post-capitalist narratives are absent from the bulk of Western society, yet it is evident that a compelling narrative for sustainable futures is required to enact transitions (Eisenstein, 2013; Irwin et al., 2015; Monbiot, 2016;). Looking to indigenous cultures and the Global South provides valuable insights into the power of community-based narratives (Escobar, 2018); these cooperative narratives are vastly different to the competitive narratives so prevalent in the West that accelerate consumption by encouraging a growth mentality. Notably, a very different relationship to consumption and waste is also prevalent where communal narratives are more dominant (Escobar, 2018); most likely arising from deeper ecological connections providing satisfaction separately from consumption that tend to be more prevalent in indigenous and communal cultures. There is much that can be learned from the Global South and indigenous perspectives when crafting new narratives during visioning exercises, particularly when developing the more granular details of a possible sustainable future. Figure 4 presents an early draft of a possible future narrative for *Flourishing Fleurieu*, a transition design project emerging in South Australia's Fleurieu Peninsula that explores this farming region's struggle with food security.

Figure 7: An early draft of a narrative being developed as part of the Flourising Fleurieu project that is exploring a transition from food desert to participatory food hub

The 'everydayness' of the problems being approached in transitions

Situating sustainability problems in the everyday also provides a granularity to our understanding of wicked problems (Kossoff, 2011; Kossoff et al., 2015). The aforementioned example of single use plastics points to this 'everydayness' in

the consumption and waste problems. Mapping these complex problems provides richer understandings of the complicated interwoven network of practices that hold consumer culture in place. There is a significant aspect to consumption that is socially constructed (Baudrillard, 1998; Jackson, 2006; Thorpe, 2012) but the 'everydayness' of contemporary consumption also operates outside of this construct. Baudrillard's (1998) suggestion that consumption is narcissistically driven by the desire to signify success or be perceived in a particular way is challenged by contemporary settings, where needs are satisfied through daily practices coupled with consumption (Manzini, 2006; Manzini & Walker 2008). This 'everydayness' defies Baudrillard's arguments of socially constructed signification, hierarchy, or status—aspects that are far more prevalent in conspicuous consumption than in the consumption of everyday items such as a bar of soap or a sandwich.

Consumption is often analysed as an economic or social function, and it has been argued that design acts like a glue that binds the economics and sociology of consumption together (Wallace, 2018). Analysing consumption with design's binding ability in mind provides some clarity on the impact of daily practices and reveals new possibilities for design interventions. Mapping the problem of consumption through daily practices reveals its all-encompassing nature; acts of consumption surround how we eat, how we bathe, how we communicate, how we transport ourselves and so on. There is an everydayness to the problem, and the coupling of practices with goods and services presents an opportunity to redesign consumption by detaching it from everyday practices. This is also recognised in Kossoff's 'Domains of the Everyday', where he identifies everyday practices as the locus for more sustainable modes of living (Kossoff, 2011). Changing the culture of our everyday practices—for example shifting from a disposable culture to a reusable culture—could dramatically reduce the impact of everyday consumption.

My personal transition to a zero waste lifestyle provides a lived experience that informs how I design interventions to the problems of consumption and waste. But moreover, its political endeavour has become an ethical guide for decision making in my practice. It is evident that the ongoing transformation of my daily practices continues to inform and facilitate the larger transition taking place in my design practice in what Escobar (2018) might describe as an 'onto-ethico-epistemic' political endeavour; it is existential in nature and as such cannot be neatly compartmentalised into personal or professional boxes, despite the attempt in this paper to do so.

Political shifts: from designer-consumer to designer-transformed

Political activation is a necessary part of transitioning, and politics are interwoven throughout design for transitions, however in this paper I posit the political quite intentionally between the personal and the professional, as a metaphorical bridge that connects one to the other. Literature from Boehnert (2018), Escobar (2018), and Fry (2011) discusses the politics of design as being a crucial component of design for sustainable futures, and reflection on several design projects from my PhD reveals the role of politics in empowering the praxis of sustainable transitions. I would argue that designers lacking political drive could be more inclined to live one way (sustainably) and work another (unsustainably), whereas a politically active and empowered designer holds greater potential to drive change through their work as a result of their personal values and beliefs. Furthermore, an inability for designers to recognise their political power subsequently limits their agency, and perceptions of power relations in the client-designer relationship can impede action. Recognising that action takes many forms, initially political acts in practice may take a verbal form (conversational/critical questioning) before being realised through a designer's work. The

Figure 8: Excerpt from a practitioner interview conducted as part of my PhD research

introduction of challenging concepts such as post-capitalist design can be limited in commercial practice (Boehnert, 2018); managing detachment from the economic priorities of the design industry could be key in the political activation required for transitions in design practice.

In his critical essay, *Edugraphology*, Papanek (1999) argues that designers are trained as consumers and I have called these designers 'designer-consumers'. I would further argue that while a designer-consumer can make anything desirable, they lack the required knowledge to design against consumption (see Figure 5). An education steeped in consumerism precedes emergence into an industry that requires the acceleration of consumption. Industry experience then reinforces the designer-consumer mentality, and the feedback loop between industry and institutions reinforces the designer-consumer approach in education. Following this argument, if the designer-consumer designs for consumption, what kind of designer designs against it? Designing against consumption can create a double bind for designers with a consumer mindset, rather it is what I call the 'designer-transformer' who performs in this space. Education in post-capitalist design is still lacking (and barely exists outside of a PhD) however deep engagement with theories of consumption, power, change and social practices leads to an expanded understanding of the culpability and capability of design. I propose that commitments made to shift daily practices, ways of thinking and approaches to design are all political acts that play a necessary role in a practice's transition, and combined can prompt more intentional moves towards transition design projects that lead to the emergence of the designer-transformer.

Professional: the ongoing process of transitioning and learning

The *Rethink Rubbish* project emerged from my zero waste transition, and in collaboration with primary school teachers explores a scaling up of a small and personal zero waste approach into classroom settings. This project drew insights from an earlier (failed) attempt at a disruptive/transition design project, *Encore*, that aimed to create a circular and sharing economy through a subscription service for fashion accessories. Whilst it was a great project to participate in, on reflection I was just a greener shade of designer-consumer and had not transformed enough as a practitioner to sufficiently contribute. The project was also impeded by street closures impacting its brick and mortar location, and timing-related setbacks that affected participant recruitment. Greater agility in reading the project and the participants and adjusting the approach accordingly would have been beneficial, but ultimately, I believe the collaborative team tried to do too much too soon. We did

Figure 9: Experiential provocations and emergent projects, from the Rethink Rubbish project as part of my PhD

not allow ourselves flexibility when we needed it, and perhaps as a group we did not understand the role that time plays in projects of this nature. I cannot help but wonder what would have happened had we explored this project with greater temporal-flexibility in mind? This was a significant learning opportunity in designing behaviour change as a slow process rather than a fast one. As my transition continues, I recognise how critical temporality is in designing interventions for transitions as opposed to standalone projects for pre-determined design briefs. Transitions involve shifting gears and what works in the fast-paced world of commercial design does not always translate into the slower pace of transitions.

Rethink Rubbish began with the aim to transition a school to zero waste through a series of workshops that explored the problems of consumption and waste through a number of experiential provocations (see Figure 6). The insights from each workshop informed approaches for the next cycle of activity, and a flexible approach to the workshop facilitation permitted greater responsiveness to the needs of the group at hand. Creating co-learning opportunities between class groups provided a dynamic way of communicating the zero waste transition to younger students, who responded well to learning from their peers. This also appeared to validate the project in their minds; one student remarked how the change seemed more achievable once they saw proof of another class's success. With *Encore's* lessons front of mind, bolstering the workshops with a significant allocation of open time also created space for student consultation and emergent projects.

Rethink Rubbish explores big change achieved through small actions, and the endeavour to address student behaviours around consumption and waste was more successful in some classes than others. Some students believed their individual behaviours were the key, some teachers felt that their classroom's proximity to the garden made a difference, and the data collected on the use of the zero waste jars suggests that those classrooms with an activated teacher/student who championed change were the most successful at minimising their waste. For the duration of 2018 all classes used a zero waste jar to keep their landfill waste visible, but there is still more work to be done to culturally embed this change. The project timeline has recently been extended and new possibilities have emerged from this additional time. A revised vision for the project shifts the school's aim from 'zero waste transition' to 'state leader in sustainability', and new projects are emerging that explore how connections to the curriculum could foster the continued teaching of sustainable life skills.

One such project aims to shift students from consumers to contributors by building connections between the classroom, the garden and the canteen (see Figure 7). Each class will plan, plant and prepare a meal for their peers, they will serve it to them and will later be in receipt of a meal that is planned, planted, prepared and served to them by another class group. The project draws connections back to the curriculum through traditional lessons such as math, economics, biology and life sciences all of which are contextualised in the garden and kitchen, and in the process, students will also learn sustainable life skills around food production and preparation while practicing reciprocity, cooperation, planning and project management. Student participation in experiential sustainability learning nurtures values of respect and care that could lead to lifelong pro-environmental behaviours (Holmes et al., 2011; Stern et al., 1999).

Figure 10: Connecting sustainability life skills into the curriculum. Sketch from the Rethink Rubbish project as part of my PhD

Throughout the *Rethink Rubbish* project I have used my voice and design authorship for political ends, and in turn my practice has continued to transition. I would argue that the project is an emergent outcome of my transition to zero waste and conscious consumption, and feedback from teachers and students revealed their belief that my behaviours inspired their transition. Being embedded in the school community and engaging with students regularly permitted greater transparency in my own behaviours, which unbeknownst to me were being carefully observed by the students. One student commented that she knew I really meant what I said because I always wore the same pair of earrings, the same sneakers and carried the same bag. To her, this was testament that I had been honest in communicating my own consumption habits. The project's success hinging on my own transformation is subjective, but upon reflection on the feedback from participants, I could argue that my demonstration of a zero waste lifestyle provided additional leadership for the changes occurring in the school. I posit that these findings show how a political shift from designer-consumer to designer-transformed can influence outcomes. Furthermore, this project's close ties to theory and its highly collaborative approaches have been key to the workshops' success, and to the identification of emergent projects that can help achieve the school's future vision.

Locating transitions in practice

Transition design is still largely academic and practice is in its infancy, particularly in Australia. In the US one well documented approach is underway, *Transition Ojai;* a joint venture between Carnegie Mellon University and FlipLabs that aims to build a community's resilience to climate change (Hamilton, 2018; Irwin, 2018). Much like *Rethink Rubbish* and *Flourishing Fleurieu*, the *Transition Ojai* project has benefitted from incubation in academia and practice. Conversations with designers attempting to practice transition design reveal how it is emerging in their work, and how distinct the challenges can be for employees. Designer-employees wanting to redirect their daily labour towards transition design could start by verbalising the need for transitions and by asking critical questions of their employers and peers. Power dynamics can play a significant role in stifling authorship in workplaces, and one designer's demand for greater criticality in the work and workplace reveals her practice of transition design faces a class-struggle. Idea counterpower is evident in research she conducted that interrogates how the company's product might be reinforcing marginalisation of minority groups. A kind of economic counterpower is evidenced in another designer's negotiation of mandatory time for transition design as part of her design agency employment contract. Another practitioner interviewed as part of my PhD research is still navigating the 'how', and feels they need further knowledge/training before their practice can truly activate. These stories reveal a practice is slowly surfacing outside of academia, and signify practitioners' commitments to making space for transitions, a curatorial process I believe has been key in my practice.

Curating space

What takes place in a transitioning practice could be described as a process of curation. In an art gallery curation involves careful planning and consideration of the interactions between works that share space, and the process bears similarities here. Creating space for the work of transition design to inhabit leads to the old practice becoming enveloped by the new. In this sense, transition design is less an adjoining camp to existing practice and more like a circle that is drawn around a practice, with consideration to what exists inside. Within its boundary live a number of things, each requiring space and attention to flourish. As the curation in my practice focusses on transition design this aspect of the practice will thrive, and in the process the old practice will recede. As with systemic change, transition design does not 'negate the old, but [rather it] contains and supersedes it' (Eisenstein, 2013 p. 38), and this notion of enveloping the old better communicates the changes taking place.

Figure 11: Curating space for transition design by enveloping the old with the new: this draft modelling concept is being explored as part of my PhD research

Curating this space has involved a process of letting go: of some clients, some projects, some thinking, however in doing so there has been no disciplinary divorce as such.

Practicing transition design does not negate my practice of communication or interaction design, rather it utilises my knowledge of both. It envelopes them, and changes how I think about them; their power is harnessed as part of transition design which continues to redirect their focus. Communication design as a redirected practice can make sustainable futures desirable (Boehnert, 2018; Fry, 2009) and post-capitalist applications of interaction design could support transitions (Tonkinwise, 2014). Eventually these redirected practices of communication and interaction design will simply form part of my practice of transition design, superseding their original modes of practice. As this transition continues, it is anticipated that a reliance on stabilisation funding from commercial projects will decrease as funding for community-based transition design increases.

The funding balancing-act is currently being explored through *Flourishing Fleurieu,* where a number of local circular economy food and farming innovation projects form part of the vision for this community. The short-term aim is to open a food hub that is supported by region-specific social enterprises that can decrease the food hub's reliance on funding through grants. Curation has permitted space for this exploration to occur in the hopes that documenting this community-based work may also provide valuable insights into financing transitions.

During curation the focus of a practice is changed by intentionally seeking out projects with transition-potential. A set of determining factors help guide the decision-making process, and the more closely aligned to sustainable futures the better. In my practice I remain open to standalone design projects for financial stabilisation, however I am more cognisant of what these projects are and how they might contribute more broadly to transitions. For example, designing a series of handbooks about self-care and activating change for changemakers is a standalone communication design project for a cause-client that feels conceptually linked to the work I am doing in transitions. An interaction design project that aids in architectural specification of materials feels less linked to transitions, yet it has been redirected from a series of unsustainable printed manuals to an agile digital product to increase accuracy in published data, and its profits help fund community-based work within my practice. Furthermore, conversations about the transition-potential of this large organisation have started. Despite the latter project's commercial face, it is part of the transition, primarily because I have asked for it to be. Open communication with current and potential clients and collaborators facilitates larger conversations about transitions, and these form an important part of this curation process. Without such discussions the transition-potential in a project or an organisation remains speculatory.

Transition design is slow and patient work (Irwin, 2018) and there is an art to saying no in favour of the slow. The curation process is likely altered by a number of different factors from one practice to the next and a number of tensions arise from it, many of which appear to be financial and/or ethical. Striking a balance can be a challenge in itself and curating the transition in an established practice takes time, but open conversations permit qualification of the possibilities, from this comes a more informed process of curation.

Tensions in the existential practice of transition design

Navigating the pain points in a practice's transition can be challenging, and there are obvious tensions between the need for financial security and the desire for utopia. But there is no pardon for design on matters of sustainability, and these tensions must be managed in order to practice transition design. Practitioners who are driven by deadlines and budgets in commercial practice may struggle with the ambiguity of transition design, in which projects tend to be emergent and often have imperceptible end-points, so patience, resilience and determination are required to comfortably experience the temporality of design for transitions. What follows is a discussion of four pain points that have been navigated during the first two years of transition: the process of sacrifice, the structural and financial changes made to the practice to support the ongoing transition, the transitioning professional identity, and the critical boldness required in briefing.

Sacrifice by design—a commitment to change

To transition a practice is to design a necessary process of sacrifice, the first part of which is making a commitment to change. This process will differ from practice to practice, what remains constant is the eventual need to say no to 'defuturing' projects. Should suggestions of alternative approaches, redirections or strategies for change be deemed unachievable, earnest consideration of the divestment of labour must begin. Every practice in transition will likely experience the need to say no—sometimes to the kinds of projects that may have historically defined them—in order to create space for the kinds of projects that will define them in the future. It is in this metaphoric space that a designer becomes empowered and enabled. Projects do not

exist in this space, rather it is open and held, filled only with possibility. If this process of sacrifice is not designed it can feel unmanageable as it may involve letting go of clients, projects, or both, and with this can come a sense of loss or grief. If the process of sacrifice is designed by the practitioner making the sacrifices then it can be managed, chosen and performed in ways that create the necessary space for transition design. Feeling some sense of control over the process can help alleviate any sense of pain, loss or grief.

The pressure of 'slow' on regular cash flow

The economic argument is one of the loudest, and I must acknowledge several privileges that have reduced risk exposure in my practice. Throughout the duration of my PhD (corollary my practice's transition) I have been in receipt of a scholarship stipend that has provided a safety net of sorts. Slower transition design projects have been pursued securely, in-part from the knowledge that this stipend would cover some of my living expenses. This PhD research has also facilitated the pursuit of theoretical and practical knowledge needed to perform transitions, including increased eco-literacy and an understanding of economic possibilities within ecological contexts. Further to this, I have also run a sustainable design practice for more than a decade, and my clients are (for the most part) aware of my politics, which I believe has made some of my conversations about transition design easier. The misaligned few were sacrificed in order to create space.

Whilst these privileges have reduced my risk and exposure, there are still financial implications to transition design that I have had to consider. The longer delivery window requires a different approach to invoicing and payment cycles as monthly invoicing is not always applicable, and milestone invoicing can leave long lean periods between invoices. What has made this process financially manageable has been the ongoing development of standalone projects as outlined in earlier discussions on curating space. Continued work in the 'greener things' space has provided financial stabilisation, however this work is being done with a curatorial approach to ensure it is transition design that thrives in the practice ongoing. At times these stabilising steps can feel like a step backwards, but maintaining a focus on developing standalone projects that are connected to future visions or that have transition-potential makes this process less discouraging.

Working in transitions requires an openness to change within your own practice structures, particularly during transitionary periods, and developing flexible working arrangements has increased the agility of my practice as a business. This has included the combined use of co-working spaces and a home-based studio to reduce premise-related financial commitments and engaging in more flexible working relationships with sole-practitioners/consultants rather than having employees with fixed expenses. Nurturing long term collaborative relationships with other practitioners also opens up opportunities to expose them to transition design and provides the agility needed for team-kairos (Greek for the right thing at the right time). This is building a network of transition-savvy designers around me, facilitating strategic workflow management, and creating time for development of transition design projects while overseeing standalone projects.

The professional identity in flux

Transitioning a practice also leads to a transitioning professional identity, and the pressure to present the right kind of professional narrative can be all encompassing. The digital landscape of professional social media such as LinkedIn, Medium, Behance and other similar sites demand a biography that presents a clear narrative of our work. In these settings, professional standing is often tied to completion—a body of work rather than work in progress, having transitioned rather than being in transition. Resilience and humility are required in order to be transparently in flux in this professional narrative.

Bravery in briefing

Design's co-dependency on Business can impact decision making, and without addressing the financial commitments of a practice (limiting employee 'mouths to feed', reducing overheads et cetera) this co-dependency could lead to saying yes to projects that infringe on the space allocated to transition design. Saying yes is a design industry habit, and the underlying aims of a pre-determined industry brief are rarely redirected. To break the habit of saying yes, critical questioning must sit bravely between a brief and the response to it. This criticality and the possibility of saying no to a brief must become a conscious practice. Like any change in habits this can pose challenges, and in this instance those challenges often have financial implications (hence the concept of sacrifice raised earlier). The concern of financial commitment looms large for many practitioners, and if ever there was an argument for a smaller practice base with increased agility this is it. The importance of criticality cannot be understated; critical questioning, challenging the desired outcomes of briefs and engaging in conscious deliberation over a brief's suitability can change the power

dynamics of the client-designer relationship. This bold political act requires empowerment, but brave designers will reap the rewards of curated space for the work of transition design and a relocation of power in relation to client-fed projects.

Conclusion

This paper has discussed several aspects of transition: a personal, political and professional transformation, transitioning a practice while exploring transition design projects, and an overview of four accompanying tensions that arise from this process. It has presented a case for curating space, designing a process of sacrifice, for allocating adequate time to transitions and for being open to business structure changes that can increase a practice's agility and make financial sacrifices manageable. Moreover, it reveals the existential nature of design for transitions, demonstrating the important role that personal and political transformations can play in the process of transitioning a design practice.

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The influence of design thinking tools on NGO accountability

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There is continued criticism regarding the over-reliance on donor-centred accountability mechanisms in aid projects. Conversely, there is increasing interest in Design Thinking as an approach to support greater beneficiary-centred accountability. Accountability can be conceptualised as 'felt' *virtue* which privileges internal motivations *of* decision-makers; and as 'imposed' *mechanism* which privileges externally enforced structures *on* decision-makers. However, there is limited understanding about whether Design Thinking tools can influence the accountability of decision-makers. This participatory action research study utilised semi-structured interviews and observations. The analysis revealed decision-makers perceived two tools, being Personas and Journey Maps, as having influenced their 'felt' accountability. Suggestions on how the tools may be contributing to the 'felt' accountability of decision-makers include: building a shared picture among diverse groups, humanising complex information, grounding discussions in realities, and deepening empathy. This study contributes to extant literature by showing that Design Thinking can enhance, decision-makers' 'felt' accountability through new sense-making practices and tools.

Keywords: Accountability, NGOs, Design Thinking, HCD, Personas, Journey Maps

Introduction

For the past 20 years, there has been increasing scrutiny of developmental Non-Government Organisations (NGOs) to assess the impact of their projects on beneficiaries (Andrews 2014; O'Dwyer & Unerman 2007; Ebrahim 2009; Madon 1999). As a result of this increasing scrutiny, NGOs have been institutionalising a host of accountability mechanisms (Ebrahim 2009; Schmitz et al. 2012; O'Dwyer & Boomsma 2015). To date, the mechanisms employed are often founded on quantitative-heavy and linear, cause-effect models of change in human systems (Ronalds 2012; Britton 2005). However, decision-makers within NGOs who oversee projects have protested that imposed donor-centred accountability practices have become too dominant and undermine more beneficiary-centred accountability practices (Schmitz et al. 2012; Murtaza 2012; Porter & Kramer 2011). With this ongoing accountability tension as a backdrop, individual decision-makers within NGOs have turned to Design Thinking for new inspirations and tools that could support them in aligning with beneficiary needs and preferences (see for examples, Bazzano et al. 2017; Toyama 2017; Jackson 2015; Amatullo 2015; Fotso & Fogarty 2015; Catalani et al. 2014). Since this is a recent development, not much is known about the effects of using Design Thinking within NGOs. This paper seeks to fill this gap by examining the effects of Design Thinking may have on accountability within two different NGO contexts. The two cases

highlighted in this paper are snapshots of longer-term design processes facilitated by professional design firms who were commissioned for the projects.

Theoretical Framework

Accountability

Tetlock (1985, p. 307) defined accountability as *'*a critical rule and norm enforcement mechanism: the social psychological link between individual decision-makers on the one hand and the social systems to which they belong on the other.*'* This definition is somewhat limited in scope because it does not encompass the possibility of self-accountability (Dhiman, 2017). Building on the definition of Frink and Klimoski (1998, p. 9), we see accountability as "perceived need to justify or defend a decision or action to some audience(s) which has potential reward and sanctions power", which may also include the perceived need to justify or defend a decision of action to 'the self'.

A useful way to break down accountability as a concept is to distinguish between its most common uses; firstly, as a 'felt' virtue and secondly, as an 'imposed' mechanism. As a *virtue*, accountability is perceived as a characteristic where a decision-maker demonstrates a willingness to accept responsibility, while as a *mechanism*, accountability is perceived as a process in which a decision-maker is obligated to explain their actions to another party who has the right to pass judgment on the actions as well as to subject the person to potential consequences for their actions (Bovens 2014; Tetlock et al. 1989).

In aid project settings, imposed accountability regimes are predominantly made up of formal oversight and control mechanisms placed on NGOs and their individual decision-makers (O'Dwyer & Boomsma 2015, Edwards & Hulme 1995; Najam 1996; Roberts 2001; Sinclair 1995). In this type of regime, people need to justify their actions through 'the giving and demanding of reasons for conduct' (Sinclair 1995, p. 221). This translates into compliance-based accountability that takes the form of short-term accounting for resource use, activities and outputs (O'Dwyer & Boomsma 2015). In contrast, 'felt' accountability regimes would privilege the internal motivation of decision-makers instead of the external pressures placed on them by funders and/or their own NGO structures (O'Dwyer & Boomsma 2015). Within this type of regime, individuals possess an intrinsic responsibility to 'feel' accountable or answerable to themselves in the form of their own values, ethics and morals, which they seek to align with those of other key stakeholders (Lewis & Madon 2004; Sinclair 1995). In practice, 'felt' and imposed accountability regimes co-exist to varying degrees (O'Dwyer & Boomsma 2015). Given the very different characteristics of both regimes, decision-makers will need to manage their co-existence by attempting to balance externally imposed accountability demands with internally driven 'felt' accountabilities (Dempsey 2007; Fry 1995; O'Dwyer & Boomsma 2015).

Accountability literature proposes several elements that influence the process of an individual decision-maker's accountability. Frink & Klimoski (1998) have identified different elements, which include social context in which agent is situated; observation and evaluation by a principal; standards and expectations against which agent's behaviour is judged; agent's belief that they will have to answer, justify or defend the decisions; decision related outcomes highly valued by agent (specified or unspecified, objective or subjective); and actual decision or action. Typically, decision-makers can find themselves in situations with conflicting accountabilities due to a number of contradictory elements coming from different directions and stakeholders (ie. being pulled in different directions based on NGO, donor, beneficiary, and self).

It has been argued that decision-makers of aid projects tend to prioritise donor-centred accountability, at the expense of beneficiary-centred accountability, as they depend on donors for professional survival (Edwards & Hulme 2002). Some of the institutional pressures most commonly referred to in the literature include logical planning approaches (Golini, Landoni & Kalchschmidt 2018; Bakewell & Garbutt 2005), linear project processes (Edmonds & Cook 2014), and quantitative-heavy data dependencies (O'Dwyer & Boomsma 2015). Many decision-makers of aid projects have adopted these traditional management practices which have brought with them stringent audit cultures fixated on procedural numbers and obligatory reporting (Angus 2008). However, these practices of accountability are susceptible to criticism for expecting decision-makers to sacrifice their personal empathy and sense of solidarity. This kind of personal empathy often comes from shared experiences and qualitative activities such as storytelling and collaborative future-making (Gair 2012).

Design Thinking

Design thinking's role in aid was recently highlighted by Escobar (2018) as supporting the 'collective determination towards transitions' that is based on a pluralism of perspectives. What Escobar refers to as the 'pluriverse' in his book is specifically referring to pluralism of perspectives without pre-existing universals (Blaser, de la Cadena, and Escobar 2009). In this book, he asks, could a new breed of designers be thought of as 'transitions activists'? (Escobar, 2018: 7). There is extensive discussion in the broader management literature where decision-makers from other sectors have turned to Design Thinking for new inspirations (Liedtka 2000, 2004).

Within the broader management literature, Design Thinking has been described as the best counter to constrictive management approaches – and as the best way to be creative and innovative (Liedtka 2018; Liedtka 2000; Johansson-Sköldberg, Woodilla et al. 2013; Boland & Collopy 2004; Dunne & Martin 2006). The term 'Design Thinking' has varied meanings depending on its context. According to Dunne and Martin (2006) and Liedtka (2015), Design Thinking is a human-centred and open-minded approach to problem-solving, based on the way designers think and work. In contrast to conventional management approaches, Design Thinking therefore offers decision-makers a 'human-centred' knowledge system rooted in empathy with users, a pluralism of perspectives, experimentation and co-design of solutions (Liedtka 2018; Liedtka et al. 2013).

A large number of possible design methods and tools can be used to facilitate a Design Thinking process in a project setting. Alves and Nunes (2013) created a taxonomy based on a study of ten sources and review of 164 methods and tools used by designers. The 10 most commonly used and referenced Design Thinking methods and tools according to Alves and Nunes (2013) are: Service Blueprint, Journey Map, Focus Group, Interview, Observations, User Personas, Prototyping, Scenarios, Shadowing, and Storyboarding.

A Framework on accountability in aid projects

When the notion of accountability is understood more broadly than an institutionally imposed *mechanism*, but also as an individually felt *virtue* that is driven by personal ethics, then this may present an opportunity to re-calibrate the accountability debate taking place in the aid sector to a more balanced one that includes both interpretations. Very few accounts explore the notion of 'felt' accountability at the individual level which may be considered to hold a great deal of promise for decision-makers in allowing them to continue their 'vital' work (McGann & Johnstone 2005). Although the criticality of accountability in aid projects has long been acknowledged, and there are some decision-makers turning to Design Thinking to support more beneficiary-centred accountability, there remains limited academic attention to examining the role of Design Thinking tools in this context.

The theoretical concepts from the accountability body of knowledge have been consolidated into Figure 1.

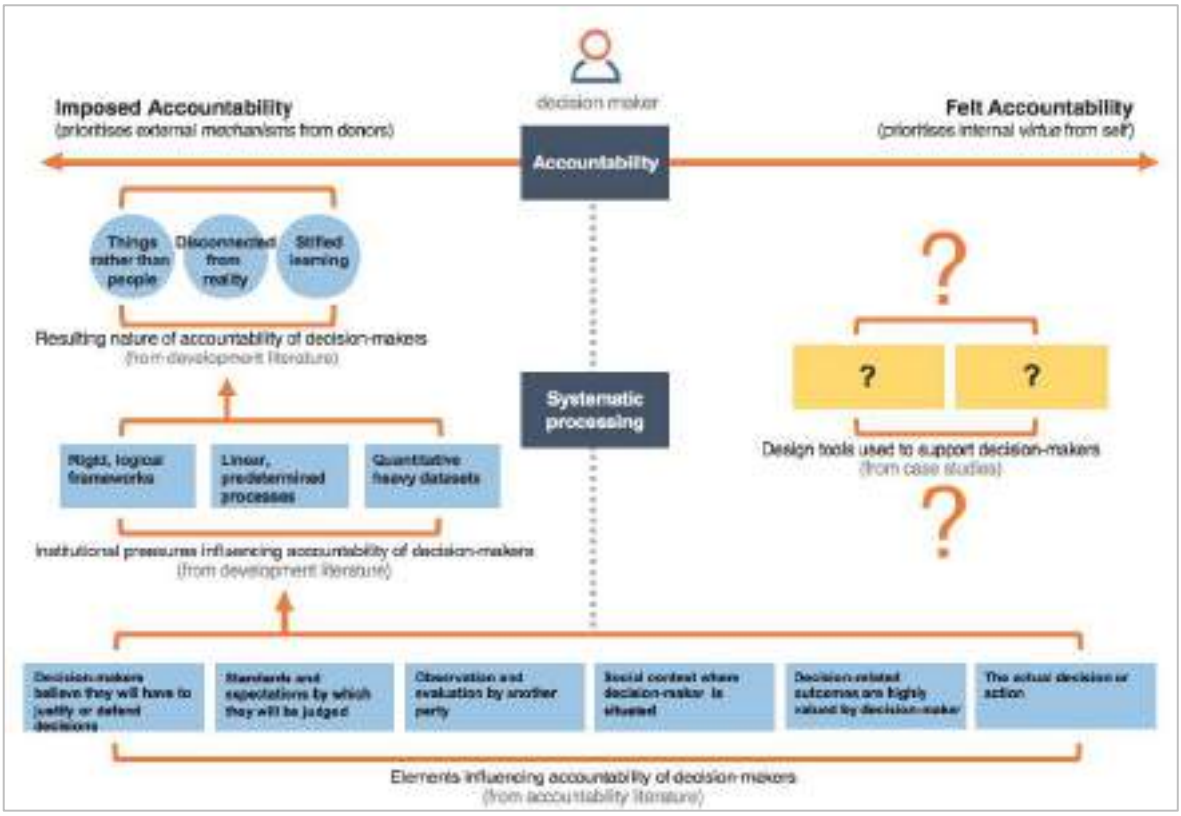

Figure 1: Consolidated concepts from literature review.
Source: Authors consolidating concepts from theory and literature review

Based on this consolidation, the primary question guiding our research is:

> **Can Design Thinking tools influence 'felt' accountability of decision-makers in aid projects? If so, which ones and how?**

This paper demonstrates how design thinking tools support the 'collective determination towards transitions' by opening up decision makers within NGOs to a variety of new sense-making and accountability practices (Escobar 2015, 2018).

Method

The researchers sought to observe and construct explanations based on 'real world' phenomena (Guba & Lincoln 1994). The notion of constructing explanations based on 'real world' phenomena pointed the research design to inductive processes, which produce theory rather than a clear conclusion or hypothesis (Cooper & Emory 1995; McMurray et al. 2004). The theory produced is based on an *'*inferential jump beyond the evidence presented*'* (Cooper & Emory 1995, p. 27) and is described by McMurray et al. (2004, p. 70) as *'*the only sensible manner of proceeding*'* when too little is understood about the phenomenon being researched. Taking an inductive approach has meant this study is unable to provide a truly valid theory because there still stands the potential for many other alternative explanations (Abercrombie et al. 2000; Cooper & Emory 1995).

The combined action research and supplementary qualitative methods involved a cycle of 'plan-act-collect-reflect' (Kemmis and McTaggart, 1988) in two 'real world' projects. The plan stage involved research design and case/participant selection. The act stage involved the researcher actively engaged in the project by facilitating the Design Thinking process. The first author engaged in natural observation as a participant in the projects, especially in relation to non-verbal behaviour in day-to-day activities while part of the teams (McMurray et al. 2004; Ticehurst & Veal 2000; Baily 1978). The observe stage involved the researcher conducting semi-structured interviews with decision-makers. Using semi-structured interviews enabled the

capture of stories, feelings, values and relational aspects (Engel & Schutt 2009). The reflect stage involved grounded theory (Strauss & Corbin 1994), which provided the systematic guidelines for gathering and analysing data using inductive strategies (Bryant & Charmaz 2007). It was used to guide the manual analysis of category themes, supplemented by software-based analysis using NVivo 10. The theoretical analysis of the data relied on key issues emerging rather than forcing concepts into any pre-conceived categories. Lastly, the notion of the 'case' as a bounded system (Smith & Johnson, 1973) for this study refers to two particular project cases bounded by geography, timeframe, organisation and sectoral focus. For this study, the notion of a case study provides a bounded focus and real-world inspiration toward new ideas for better understanding the phenomena being studied (Stake 1978, 1994).

We studied two case studies.

The first case study, indicated as *Rethinking Humanitarian Action*, was focused on rethinking humanitarian action led by a research NGO in the United Kingdom (UK). The Design Thinking process involved over 100 participants, who ranged from aid recipients to funders, to implementers, and policy-makers across 16 locations and 73 organisations worldwide. Although a meaningful effort was made to speak to as many different perspectives as possible, there was a particular emphasis on the protracted humanitarian crisis caused by the Syria conflict, which involved primary research in the refugee host country of Lebanon. This project applied six out of ten of the most commonly used Design Thinking methods and tools, as surveyed by Alves and Nunes (2013). These were 75 x Interviews, 1 week of Observations, 14 x Personas, 12 x Journey Maps. and several co-design workshops with Prototyping and Scenarios (ie. Role Plays).

The second case study, indicated as *Care Community Hub*, was focused on researching, designing, building and pilot-testing a mobile phone application to support community health nurses in delivering care in Ghana. The Design Thinking process involved approximately 110 people comprised of 60 community health nurses, 12 nurse supervisors, 18 pregnant women and nursing mothers, as well as more than 20 stakeholders from the partner organisations in Ghana. This project applied eight out of ten of the most commonly used Design Thinking methods and tools, as surveyed by Alves and Nunes (2013). These were: 10 x Focus Groups, 12 x Interviews, 2 weeks of Observations, 3 x Personas, 4 x Journey Maps, and several co-design workshops of Prototyping, Scenarios (ie. Role Plays), and Blueprinting.

The two cases highlighted in this paper are snapshots of longer-term design processes facilitated by professional design firms who were commissioned for the projects. In both cases, Design Thinking was not aimed at producing new academic knowledge, but rather at framing challenges and developing solutions in a human-centred way, through the words and imaginations of people experiencing them.

Findings

Case Study 1: Rethinking Humanitarian Action

Which tools were identified as most influential?

In this project, Personas and Journey Maps were repeatedly cited by interviewees as being most influential for their individual processes of 'felt' accountability over any of the other Design Thinking tools or methods. As will be demonstrated through quotations from the interviews below, both of these tools were mentioned by the interviewees as helping them 'walk in the user's shoes' and identifying more meaningful user experiences (Holmlid & Evenson 2008).

There were 14 Personas created to represent the needs and preferences of six groups of primary and secondary users of the humanitarian system. The Personas were based on patterns and composites of the 75 interviews. The personas were differentiated in way that demonstrated a user's relative capacity to influence change as well as their relative degree of 'affectedness' as it relates to crisis. Other characteristics used to differentiate between the personas included a combination of intrinsic and extrinsic qualities. There were six persona categories 1) Persons affected by crisis; 2) NGO Responders; 3) United Nations; 4) Funders; 5) Hosts; and 6) Knowledge Generators. Each persona was elaborated on (see figure 2 below):

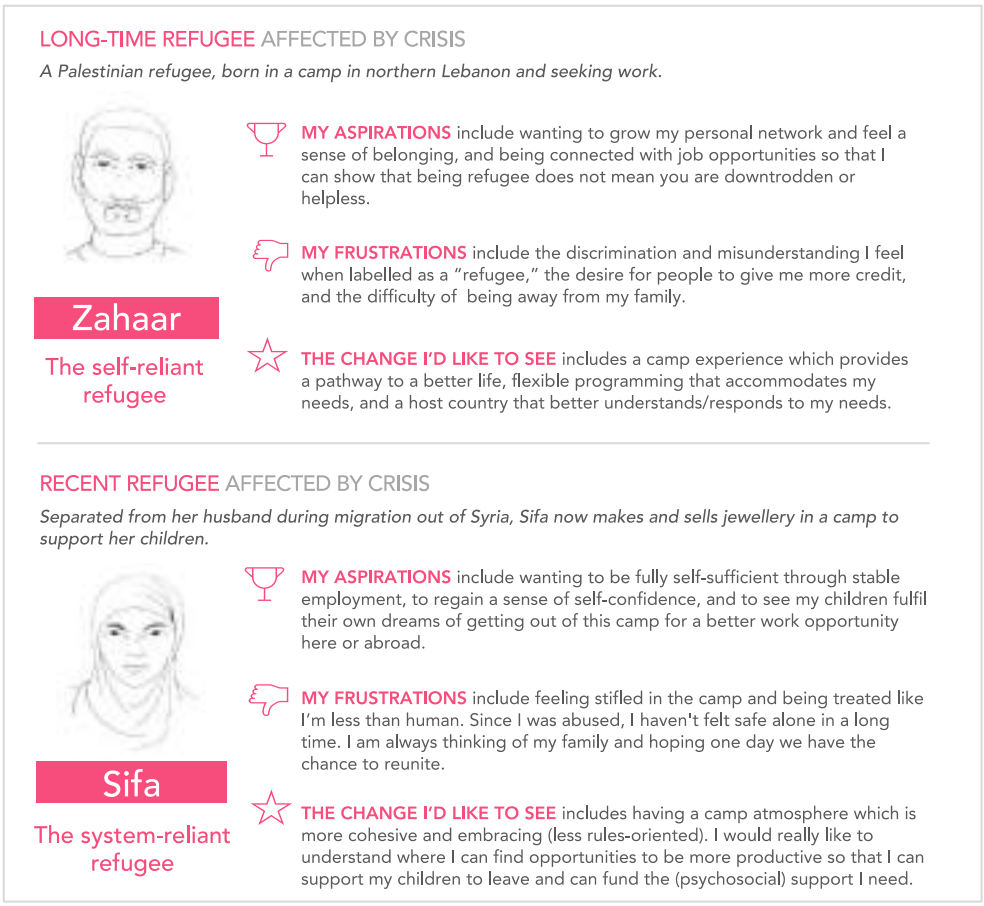

Figure 2: Two personas from 'Persons affected by crisis' category.
Source: ODI A Design Experiment – Imagining Alternative Humanitarian Action Report (2018), with permission.

In addition to the personas, there were 12 Journey Maps created to represent the stories and experiences of various users in the humanitarian system. The stories were shortened and consolidated but were maintained in the raw 'first-person' verbatim form. In one example (Figure 3), the 'reluctant host' being the municipality mayor of a village in northern Lebanon shared his experience.

Figure 3: One example of journey / experience maps
Source: ODI A Design Experiment – Imagining Alternative Humanitarian Action Report (2018), with permission.

What was the influence on 'felt' accountability?

The interviewees shared that for them personally, the Journey Maps (also referred to as experience maps) and Personas were the most influential of the design tools. Interviewees described the influence of the tools in both functional and emotional terms:

> *[The personas] deepened our empathy to develop a more user-friendly human system – Decision-maker C*

> *Throughout the project, nothing that anyone else said struck me or touched me as much as what was in those experience maps – Decision-maker D*

Another interviewee shared that the Journey Maps showed her how human experiences of the same phenomena could be diametrically opposed. This deliberate opportunity to dive deep into many different and conflicting perspectives had significant implications for someone in a decision-making position. She stated that she thinks of humanitarian aid experience as having a certain dynamic where there are 'givers' and 'receivers'. The Journey Maps helped surface those relational differences, making them more explicit when decisions were being made.

> *Because I am part of the givers, and although I could see the benefits and drawbacks of the system from my giver position, the [design] tools demonstrated to me that the receivers did not see those benefits and drawbacks in the same way. – Decision-maker A*

One decision-maker touched on the value of grounding across a 'spectrum of users' as it allowed him to better focus on the 'real issues' and avoid being side tracked by the usual requirements coming from donors and elsewhere. This interviewee shared how he noticed people regularly referred to the Personas to consider whether to design a certain feature or idea. Another interviewee shared why he believed the Persona tools were one of the main strengths of this project:

> *The main strength was the immersion in the user experience, and the continued reference back to it; and to thinking across a spectrum of users – like in the personas – rather than one or two stereotypical ones. – Decision-maker C*

When looking to make more human-centred decisions, the Personas helped reorient and ground conversations in the actual lives of people who would be affected by those decisions. This interviewee shared they were now more open to making decisions that were not driven by their own assumptions having gone through the Personas. The same interviewee shared how the design tools influenced the way he asks questions and the way he interacts with people on the receiving end of his work.

> *There was a granularity that tells the story, and you are able to see things that normally you wouldn't. At the level of director, you don't read things properly, you read things that summarise up, they are not as grounded, but these experience maps were compelling as they surfaced real issues – Decision-maker B*

> *After my experience with the design tools, it has influenced the way I approach my work. I ask a lot more questions. I ask very different questions. I ask much more granular questions rather than generic ones like 'how is this service?' – and I put more people and resources on seeking these more granular answers. – Decision-maker D*

The design tools helped change the nature of inquiry processes at an individual decision-maker level, as well as change the nature of conversations taking place on an interactional level. When asked about whether the Journey Maps influenced their sense of accountability, one responded with 'I just felt it' and went on to elaborate with the following reflection:

> *In a humanitarian response, whether you are in London or on the ground, there is a sense that people affected are 'other' – they are different to you, they have a different culture, religion, situation, like, they are in crisis and you are not. There are a host of reasons why you distinguish yourself from them. But what those experience maps did was put me at the centre of their crisis. In that moment, I remember feeling like I was transported to their world. And it made me ask myself – What would I do?*

And the truth is, instead of turning to the usual technical tools, I just wanted to do whatever I would do for my parents, my brother, my friend – Decision-maker A

The Journey Maps influenced her 'felt' accountability in a way that her decision making could be based on what she would want for herself and her family if she were in that situation. The tools clearly influenced her 'felt' accountability through facilitating a different position from which to base her decisions:

[The design tools] drove me to consider my role as being more deeply embedded in the human experiences of others – I was no longer separate from them, there was a direct connection – Decision-maker A

She no longer subscribed to her own othering attempts to distinguish herself from 'them', rather she was able to connect with others' experiences in a more human to human way.

I felt frustrated for them, I could see what was happening to them and it just pissed me off… It touched me, I had empathy for people who are in many ways unlike me, and in many ways just like me – it definitely increased my individual felt accountability towards them. – Decision-maker A

This emotional connection provided a strong drive and motivation for seeking a change and feeling more accountability to a particular group experiencing a particular problem. From the viewpoint of another decision-maker, there were still some strong emotional reactions prompted by the Journey Maps for other reasons:

When I read them, they made me very angry and very sad. The corruption ones, the ones from the Syrian refugees in Turkey and Palestine talking about how corrupt the UN system was, that made me angry in that self-righteous way. I wanted to drop everything else and go out and correct that corruption. It stoked the flame of action within me. – Decision-maker B

Though, when asked whether these feelings influenced his sense of individual 'felt' accountability, there was some tension in the response:

If you want to save the world, but the feedback from the experience maps told you what you're doing isn't right, then it triggers more than a 'felt' accountability. For me, it triggered a self-interest to want to do a good job for myself, it is kind of pleasure seeking. – Decision-maker B

The influence the design tools had seemed 'more than a felt accountability' and this interviewee questioned whether it had more to do with a desire to do good and look good rather than it being accountability related:

There's a different feeling that comes out with Design Thinking that makes me act better, make better decisions, change what needs to change in a program… I don't know if this is about accountability as much as it is about an individual's moral investment in doing a good job. Accountability, to me, has always been something external to me: It is the ability of someone else to hold me responsible for what I have done. Whereas Design Thinking put me in touch with the fact that I may not be doing a good job, so for me that is about self-esteem and self-interest. – Decision-maker B

However, based on the literature on the six different elements which can influence someone's 'felt' accountability discussed earlier, those elements such as a self-interest to do a good job can still be considered accountability related, theoretically speaking.

Because of the experience with the design tools, not only was a sense of 'felt' accountability influenced, but also broader influences on how to approach problems differently in their roles. Solutions to systemic problems in the aid sector should not always be technical, some need to be more behavioural. This contrast between the technical and the behavioural also resembles some parallels with the literature on accountability and the contrast between the mechanism (more akin to technical) and the virtue (more akin to behavioural).

Case Study 2: Care Community Hub

Which tools were identified as most influential?

The Design Thinking tools that were singled out and identified by decision-makers as enhancing their 'felt' accountability for this project were Personas and Journey Maps. Both of these tools were mentioned by the interviewees as helping them put the user front of mind (Floyd, Jones, & Twidale 2008).

In this project, three nurse personas were created through collaboratively debating the differentiating characteristics and patterns based on real nurse quotes and stories. Two dimensions were prioritised along two axes, where one axes represented if a nurse was purpose-driven (driven to provide care for the sick) or paycheck-driven, while the other axes represented a nurse's ability to be resilient or become dispirited in the face of challenges (Andrawes, Moorthy & McMurray 2016).

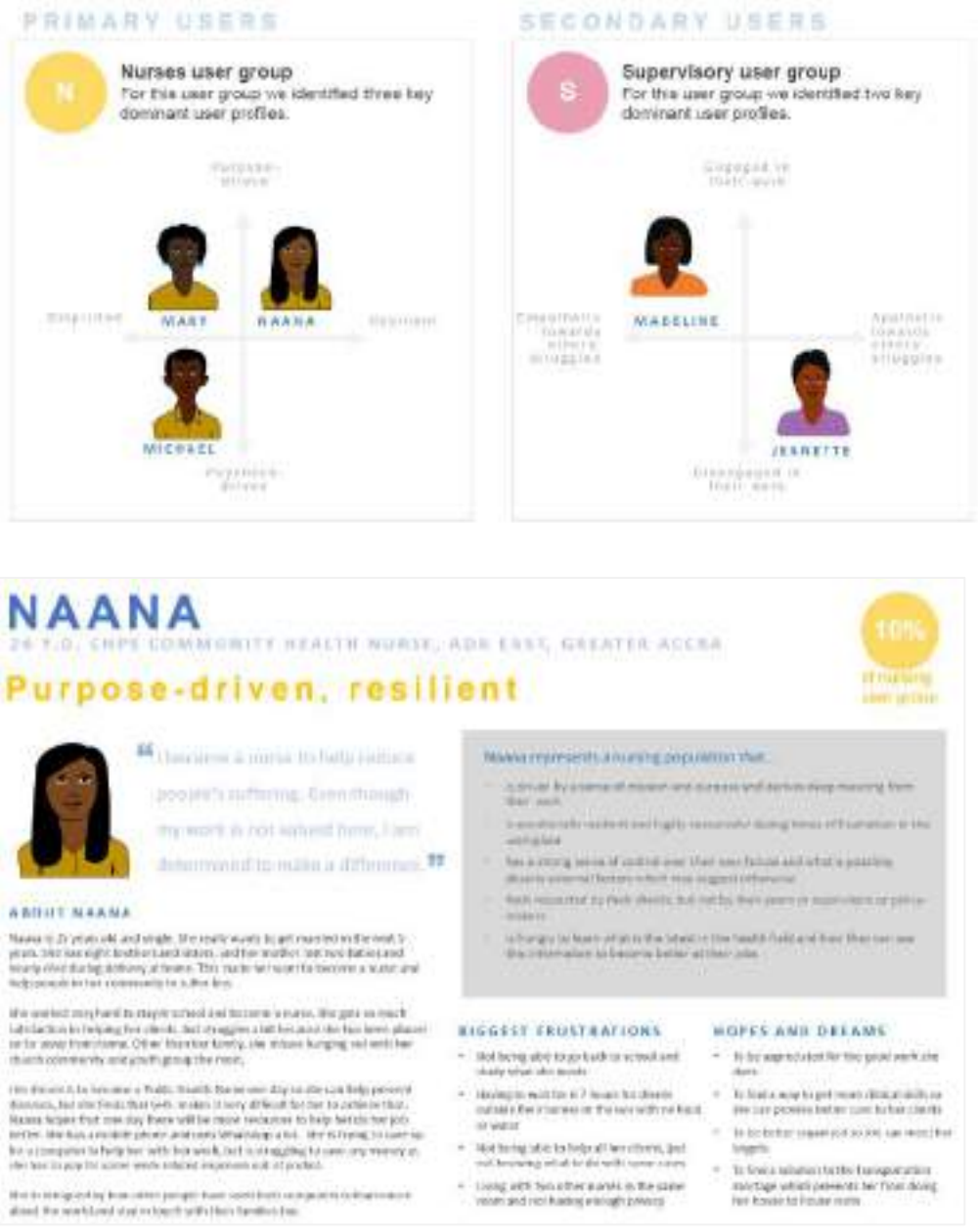

Figure 4: Persona framework and example
Source: CCH Service Design Blueprint (2014), with permission.

A series of process mapping of the steps, the highs, and the lows of the most common workflows were conducted to capture the four journey maps. These included: (1) routine home visits; (2) community outreach or clinics; (3) supervisory visits; and (4) monthly data reporting. See example below:

Figure 5: Journey/Experience Map for Routine Home Visits
Source: CCH Service Design Blueprint (2014), with permission.

What was the influence on 'felt' accountability?

Interviewees who worked closely together in the field, shared how the Personas helped them place emphasis in their day-to-day work on Mary, Naana and Michael. Instead of adopting the organisation-wide notion of accountability tied to a goal of 'reaching' 30 million people, they perceived the Personas as influencing their sense of accountability in a very personal and individual way.

> *Taking time out of what is considered to be my job in my job description, and walking in the shoes of the nurses, this changed my entire outlook on the project and whom I am going to work for everyday – Decision-maker IM2*

Their personal goals and targets in their jobs were no longer about reaching the greatest number of people possible to report back on, but rather invest wholly in making a real and marked impact on the lives of people whom they did reach. For another interviewee who was not in the field, also commented on how the personas provided a useful counter narrative to 'humanise' the statistics that usually guide their decisions:

> *These actual human stories helped humanise our user and kept me thinking about that individual user in mind – or multiple personas if you will – throughout the project, it influenced me in a different way to the usual thinking in statistics – Decision-maker IM5*

Reflections from decision-makers in this project suggests the potential for real and marked impact on the lives of users can be hindered when the interviewees felt like they were being forced to be made accountable based on the number of people 'reached' than more meaningful (relational or behavioural) changes that can be more difficult to account for.

The personification of beneficiaries otherwise referred to in numerical terms influenced the interviewee's sense of who they felt they worked for – from the 30 million number senior management had set or the real-life impact on Mary, Naana or Michael. Decisions became about the latter rather than the former when impact was defined in ways they could relate to and connect with on a human level.

> *I would wake up in the morning with the nurses' on my mind. My sense of accountability to them felt different to my sense of accountability on other projects. – Decision-maker IM1*

These decisions would take place within the confines of boardrooms and NGO offices, but by putting the personas up on the walls and keeping the nurses' voices present, it made them feel like they were able to stay accountable to their beneficiaries.

> *The personas gave us a whole new language to speak about the reasons why behind every decision... because this person is like that, we need to do it like this… This made me feel like I was doing my bit for the nurses. – Decision-maker IM1*

One interviewee who was not part of the design research activities early on in the process reflected on the longer-term influence of this:

> *I wasn't able to go to the field with the others. But those personas you all created helped bring – and keep – the nurses voices in our boardroom decisions and meetings for months and months after the fact – Decision-maker IM5*

For another interviewee who was heavily involved in the early stage design research reflected on how this experience was different for them:

> *But being able to slip into the nurses' shoes or the supervisors' shoes was easier for us to do naturally in the process, but not so much for the newer staff, they had to rely more on the personas and journeys – Decision-maker IM2*

For those who were part of the development of the tools, they felt a natural understanding and connection to the users. This made decision-making more naturally human-centred even without referring back to the Personas or Journey Maps as perhaps what they had learned had become intrinsic.

The Personas and Journey Maps were also used to facilitate the generation of ideas and this was noted by one interviewee as enhancing his 'felt' accountability towards the nurses:

> *The ideas were generated directly with a sample of those end-users in the room with us physically, and when they weren't in the room, the ideas were generated or built upon with a persona lens, so that at least, at a subtle level, the end users were still 'in the room with us' and I felt more accountable to them that way because we were still honouring their preferences in their absence – Decision-maker IM6*

Quantitative formulations of accountability mechanisms within NGOs, such as defining targets based on number of beneficiaries reached, can influence how the interviewees described their individual sense of accountability. Regardless, all interviewees shared how the Personas enhanced and supported their personal 'felt' accountability, whether through informing more user-centred decisions, or having a personified user to remind of the why their work is important, rather than objectified statistics.

Discussion

The analysis points to the use of Personas and Journey Maps as having four influencing factors on decision-makers' 'felt' accountability:

1. Builds a shared picture
2. Humanises complex information
3. Grounds discussions in reality
4. Deepens empathy and connection

Influencing Factor 1: Builds a shared picture

Instead of decision-makers having to make sense of contradictory pictures of reality and competing narratives (Liedtka 2004), the design tools were perceived by interviewees to help build a shared picture that supported alignment among decision-makers. For example, when one decision-maker shared that reading all the Journey Maps at the same time solidified how different people experienced the same thing differently depending on where they stand in the system. The Journey Maps helped the decision-maker seem to be less likely driven by individual cognitive bias (Liedtka 2015). In this case study, establishing a shared picture has suggested that it may be more likely for decision-makers to feel an enhanced accountability towards the beneficiaries, without neglecting the other key stakeholders.

Influencing Factor 2: Humanises complex information

Instead of the usual over-reliance on statistical and survey data that has been criticised for disconnecting decision-makers from realities on the ground (Angus 2008), the design tools were perceived by interviewees to humanise otherwise complex information for decision making. The visual depictions used in the project were not intended to be accurate representations of absolute realities, they however provided decision-makers with new ways of understanding abstract issues that were lived experiences for the beneficiaries (Andrawes et al. 2016). For example, the journey map tool helped decision-makers get to the 'granularity' of stories without getting lost in the complexity of the problem, with decision-makers saying it helped them 'see things' they normally would not see themselves. Both tools embodied knowledge that could not easily be articulated using tables, words and numbers (Andrawes & McMurray 2014).

Influencing Factor 3: Grounds discussions in reality

Instead of decision-makers basing things on boardroom conversations and rigidly linear project plans (Edmonds & Cook 2014), the design tools helped ground discussions in actual situated stories and realities. This was in contrast to the status quo of basing decisions on 'expert' input, or averages and numerical samples from quantitative data sets. Prioritising the design based on the words and ideas of beneficiaries themselves, the Personas and Journey Maps helped decision-makers avoid the trap of making decisions based on what they thought beneficiaries want. Rather they were freed to base their decisions on what beneficiaries actually value.

Influencing Factor 4: Deepens empathy and connection

Through both tools, decision-makers shared a sense of a strong, grounded empathy for all their decisions. For example, one decision-maker used words like 'pissed off' and 'sad' and 'angry' to describe what they felt as they read through the Journey Maps. Although the tools were pervasive in the lives of decision-makers, they also provided a safe space, and a guided framework that triggers action for a potential change from the existing situation into a more preferred one (Simon 1967). The Journey Maps allowed decision-makers to walk in others' shoes, where they were able to better think about the decisions they have to make from those perspectives. Both the Personas and Journey Maps helped decision-makers develop a very personal and deep empathy that is directly traceable to the barriers and opportunities as articulated by the beneficiaries in their own words. From this knowledge, they shared how they were more likely to plan, design and make things with those other perspectives in mind.

Below, Figure 6 is a depiction of how these four influencing factors and the use of the Design Thinking tools fit in to the earlier framework derived from the accountability and development aid bodies of literature:

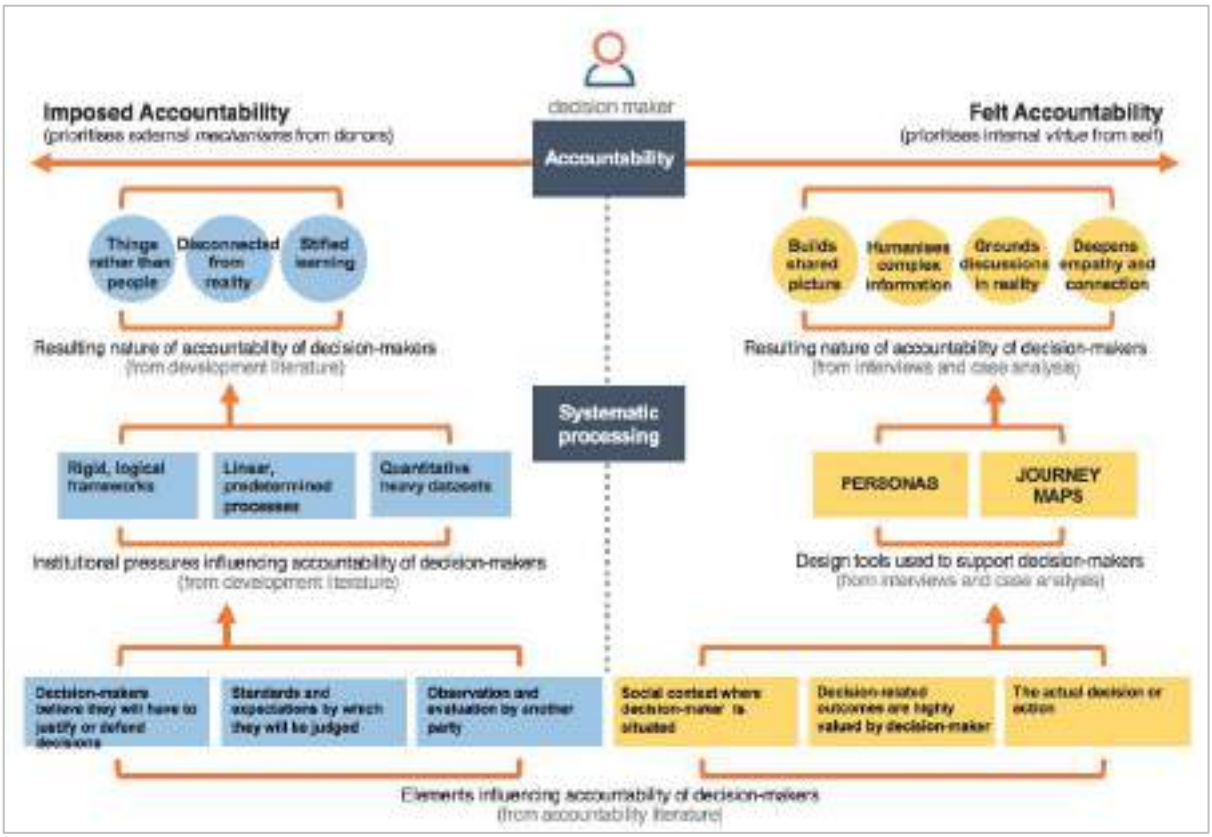

Figure 6: Conceptual Framework combining literature and findings
Source: Authors consolidating literature and findings

The conceptual model above demonstrates on the bottom right side that when the decision-related outcomes are highly valued, or the social context where decision-makers are situated is in close proximity to the beneficiaries, there seems to be an impact on accountability (Frink & Klimoski 1998; Tetlock 1999). When Design Thinking tools are used the impact is an internally *felt, virtue* version of accountability that is based on shared understandings, humanised information, contextually grounded discussions and deep human to human connection. Whereas on the bottom left side, when decision-makers believe they will have to justify their decisions (especially numerically) or have certain standards/expectations by which they will be judged or evaluated by another party. These seem to be enabling conditions for institutional pressures based on logical frameworks, linear processes and quantitative heavy dependencies to lead to an externally *imposed*, *mechanistic* version of accountability that reports on resource use, short term impacts and is disconnected from reality. It was observed that when decision-makers greatly valued the decision-related outcomes themselves – the use of the Personas and Journey Maps seemed to influence the decision-makers individually 'felt' accountability through the four contributing factors to their systematic processing. The four factors in this conceptual model are suggestive as to how Design Thinking tools could potentially contribute to enhanced 'felt' accountability in aid projects.

Conclusion

Although the debate around accountability in the aid literature has been growing in prominence, NGOs have maintained a track record of institutionalising mechanistic accountability regimes that prioritise donor requirements over beneficiary needs. Consolidating concepts from various bodies of literature and real-world practitioner experience, these action research case studies explored whether Design Thinking tools can influence the 'felt' accountability of decision-makers in an aid project.

This study's findings are timely and relevant because of the growing body of critique mounting against decision-makers in NGOs. The currently dominant model is weighted heavily towards imposed, mechanistic accountability that is not working adequately. New models of accountability need to be tried and experimented with to calibrate towards a more balanced practice of accountability. This study adds to the

specific arguments for an adaptive accountability in aid projects by Ebrahim (2009) and O'Dwyer and Boomsma (2015). Utilising Design Thinking tools and methods have supported decision-makers – according to their own accounts – in being able to practice a more enhanced 'felt' accountability towards beneficiaries in their day-to-day work. In this case, the Design Thinking tools that were identified as most influential on decision-makers' 'felt' accountability were Personas and Journey Maps. Findings from the case study show that when decision-makers 'greatly valued the decision-related outcomes themselves' (Frink & Klimoski 1998) the use of Personas and Journey Maps seemed to influence the 'systematic processing' (Tetlock 1985) of their 'felt' accountability through the four influencing factors of building a shared picture, humanising complex information, grounding discussions in reality, and deepening empathy and connection – where more personal and subjective materials supported decision-makers to feel the needs of the beneficiaries as their own.

Escobar's (2018) most recent analysis of design's role in development suggests that aid decision-makers ought to engage in a 'collective determination towards transitions' that is based on a pluralism of perspectives. Earlier in this paper, we asked, could a new breed of designers be thought of as 'transitions activists'? (Escobar, 2018: 7). This paper demonstrates how designers can use some of their tools to support aid decision-makers in their 'collective determination towards transitions' by opening up to a variety of new sense-making and world-making practices (2015, 2018).

The originality of this study is clear given there has been no prior attempt to understand whether Design Thinking could influence 'felt' accountability and supplement 'imposed' accountability mechanisms in aid projects. This study contributes to the aid accountability debate as it suggests that the inclusion of Design Thinking tools can influence, and even enhance the 'felt' accountability of decision-makers towards beneficiaries. In doing so, it contributes from a unique and interdisciplinary perspective, to the accountability debate in the aid sector. The findings also contribute to the more general, broader body of work on decision-maker accountability by the likes of Tetlock (1985), Lerner and Tetlock (1999) and Frink and Klimoski (1998), and Vance et al. (2013, 2015). For accountability researchers as well as decision-makers in practice, they could benefit from taking this study as a starting point for the use of Design Thinking in enabling more 'felt' accountability that balances out the heavy weighting towards imposed accountability.

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Track 2.e Introduction: Design Innovation and Philosophy of Technology, the Practical Turn

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Introduction

Human-technology relations are one of the key issues in design innovation and the shaping of our future. Also in the Philosophy of Technology human-technology relations are a central theme. New insights in the complex interplay between humans and technology can be gained from collaboration between Design and Philosophy of Technology, especially in the current of the so-called 'empirical turn' where the focus is on individual technologies and real-world contexts (Achterhuis, 2001; Verbeek, 2005). Design Innovation can use the frameworks of philosophers to theorize the findings from practice or to make sense of past developments. And designing actual things provides a powerful laboratory to test philosophical frameworks in practice. Through the collaboration between design innovation and philosophy these conceptual frameworks can become 'practical'. Therefore, in analogy with the empirical turn in philosophy of technology before, the further step of the present collaboration with design is termed a 'practical turn' (Eggink & Dorrestijn, 2018a).

Outlook

Philosophy of Technology has a substantial track record in thinking about the impacts of technology and innovations on our daily lives and social behaviours (Brey, 2012; Dorrestijn, 2012; Verbeek, 2014). Combining this conceptual toolkit with design innovation, with its capability of actually changing things, promises a powerful approach to developing critical future-making practices. This approach focuses on anticipating possibilities and consequences of innovations. As such, it is related to responsible innovation, social design and critical design, but also different in being more reflexive and explorative (Eggink & Dorrestijn, 2018b).

Using philosophy of technology frameworks to make sense of the world, we can also come to new insights and perspectives on the application of technology in innovations (Raub et al., 2018). In this sense it can also be a valuable addition to the Design Driven Innovation approach by Verganti (2009), where radical innovation is realized by changing the meaning of things (Eggink & Rompay, 2015). Especially when this approach is being criticized in the sense that "[t]here seems to be a need for more practice-based studies that connect Verganti's (2009) theoretical DDI framework […] with design practice." (Kristiansen & Gausdal, 2018, p. 2).

Papers

Under the notion of a practical turn in the philosophy of technology this track brings together papers in which either insights from philosophy of technology become concretely applied in design innovations; or the other way around, the practice of design and innovation becomes a way of philosophical enquiry into technology. These papers reflect such a practical turn in the philosophy of technology in a broad variety, from practical design cases to a theoretical inquiry into the nature of contemporary design problems.

The first paper *Changing Things: Innovation through Design Philosophy* by Johan Redström and Heather Wiltse is the most theoretical. Redström and Wiltse make a case for using a Philosophy of Technology approach to develop design theory. As design is of course always future oriented, design theory is also always about change. However, in this paper the authors convincingly show how change is no longer a matter of time and place but rather has become a central characteristic of the products itself. We are therefore in need of new concepts to understand these changing products, for which Redström and Wiltse propose some insightful examples.

The second paper *Towards a Tangible Philosophy through Design, Exploring the question of being-in-the-world in the digital* age by Jonne van Belle, Jelle van Dijk and Wouter Eggink is more towards the practical side, containing a design case about the use of mobile phones in everyday life. In fact, van Belle et al. are broadening the concept of the practical turn by adding the term *Philosophy through Design*. In analogy with the concept of Research through Design (Findeli, 2010; Frayling, 1993), they are exploring a Philosophical concept inspired by the work of Tim Ingold through the design of concrete artefacts.

The paper *Values that Matter: Mediation theory and Design for Values* by Merlijn Smits, Bas Bredie, Harry van Goor and Peter-Paul Verbeek is the most practical of this track. In this work the authors show how specific Philosophy of Technology theory – in this case mediation theory by Verbeek (2015) – can inform design practice and design methodology alongside a case for value sensitive design.

In the last paper *From Hype to Practice: Revealing the Effects of AI in Service Design* Titta Jylkäs, Andrea Augsten and Satu Miettinen literally take a step back and zoom out again when they philosophise about the consequences of new technology – in this case the development of Artificial Intelligence – on the lives of people in general and service designers in particular. Therefore, this contribution nicely suits as a conclusion to this track, not by elaborating yet another philosophical design tool, but by showing "reflection in design" in the context of design research.

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Changing Things: Innovation through Design Philosophy

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Digital networked technologies are currently at the forefront of contemporary innovation, driving changes in sociotechnical practices across industrial sectors and in everyday life. Yet technical innovation has been outpacing our capacity to make sense of these technologies and the fundamental changes associated with them. This sense-making enterprise is the focus of our current research in developing a design philosophy for changing things. We describe a conceptual framework developed around the concept of things as fluid assemblages to investigate and articulate what is going on with things, and how their development might be (re)directed toward preferable futures. Specifically, we here examine the important role of design philosophy in innovation, using the conceptual framework developed as a way to point toward potential sites for innovation in the current sociotechnical landscape. The line of investigation we pursue suggests that doing philosophy should become a central part of innovative design practices.

Keywords: Fluid assemblages, design philosophy, design theory, networked, computational

Introduction

New technological developments require new ways of making sense of them. We can draw on conceptual tools we already have, but also need to make new ones that are more precisely tuned to what we now have in front of us and need to account for.

In this paper, we describe a conceptual framework that evolved in our ongoing research on developing a design philosophy for *changing things*. With this design philosophy we aim to more adequately account for networked computational things that are more inherently changing and changeable than the things we have known, designed, and lived with before. This account of what is going on with things is a necessary first step for working to change the more pernicious developmental trajectories of networked computational things toward preferable futures.

If, as we believe, the true measure of innovation is its capacity to bring about positive transformation of human experience and practice, then it is crucially important to address foundational questions regarding the role of innovative technologies and systems in human affairs. One of the central issues for design and innovation with respect to the networked computational things that are now at the forefront of technological research and development is therefore that we develop an ability to match technological drive with the conceptual and methodological developments that are required to make sense of them—and their consequences—at human scale.

Beginning with the background of key technological developments and a brief overview of historical innovation through design philosophy, we move on to describe how the conceptual framework we have been developing around things as *fluid assemblages* opens up new sites and approaches for innovation in relation to

digital, connected things. In the context of this paper, we use this work primarily as an illustration of why new sociotechnical developments and corresponding increases in complexity can require making new theory, and how this can open up new vantage points from which to approach understanding and innovative action.

Background: Need for new perspectives

The networked computational things (embedded computers, tablets, smartphones, smartwatches, apps, 'smart' assistants, etc.) we now live with are inherently different from past everyday things. Software changes visual forms and functions dynamically over time and across contexts; information processing capabilities change the ways we relate to things and what we expect of them; connectivity changes the ways things relate to each other and their scope and scale of action; and all of this changes our everyday practices in relation to the things in our lives. Networked computational technologies and the forms they take in the world are, in many senses, *changing things*. Understanding the character and scope of these changes is an important challenge, arguably one of the next big challenges for design and related fields oriented toward human experience and society. Changing things in directions that are amenable to human flourishing and desirable forms of life is an associated challenge that we now face.

There is, then, both tremendous opportunity and responsibility when it comes to making sense of the landscape of changing things, as well as finding and articulating the foundations that can support responsible innovation, education, research, and practice in relation to them. This requires thinking in new ways – building on existing perspectives, but also recognizing when they break down and no longer adequately account for things that have become substantively different. In order to properly see and understand the new, it will not suffice to think only in terms of the old. We need new conceptual frames, new methodological approaches, and new representational and discursive strategies within design, philosophy, and the social sciences in order to do justice to what is at stake and urgently calls for our attention and care.

Of course, there is already interesting and promising work in this space: for example, in investigating "thing perspectives" (Wakkary et al. 2017, Giaccardi et al. 2016), exploring the experience of "network anxieties" and their possible design metaphors (Pierce and DiSalvo 2017), and drawing on philosophy in order to better understand connected things and their relations (Hauser, Oogjes, Wakkary, & Verbeek, 2018; Wakkary, Oogjes, Lin, & Hauser, 2018) (Wakkary et al. 2018; (Akmal & Coulton, 2018; Lindley, Coulton, & Akmal, 2018). There have also been larger shifts within interaction design and related areas toward looking at ecologies of artifacts and connected services rather than single things (Dubberly, 2017; Forlizzi, 2008; Janlert & Stolterman, 2017; Stolterman, Jung, Ryan, & Siegel, 2013). Our purpose here is to complement this often more empirical work by trying to get to the bottom of changes that are taking place through working at the level of theoretical foundations, orientations and assumptions; and to explore practices of *making theory* as vital components of contemporary design research able to grapple with increasing complexity.

While these are big and complex challenges, and theory might on the surface seem rather far removed from practical impact, there is actually an encouraging precedent of innovation through design philosophy.

Approach: Innovation through design philosophy

The current need and also ambition of our ongoing work is the development of a design philosophy that can form and inform contemporary design practice in the domain of digital, networked, and as a result hugely complex systems, media, and artefacts. Given design's inherent focus on practically solving problems, it may seem odd to seek significant innovation in the realm of the conceptual and philosophical. However, design philosophies have been crucially important for innovations in the field, considering how design has developed historically.

In the early 20th century industrialization had come to a point where the influence of mass-production in everyday life had become so significant that it was clear that new approaches to design were necessary. New materials and technologies, not to mention the production techniques as such, had up until this point primarily been used to reproduce existing designs; but as things evolved it became increasingly obvious that a new approach was needed. There came a realization that what in fact was needed was a different understanding of design, another way of relating to form and material that made better use of the new possibilities. Today, we refer to this change in the making of things as the emergence of industrial design, distinct from craft. It is perhaps difficult to see this today since we are so used to it, but at the time reframing the relation between art and technology was actually a significant innovation at the level of design conceptualization. This was done

through using new ideas, such as that beauty resides in the usefulness of things – as expressed in the idiom ”form follows function.” Such ideas, or idioms, did not necessarily provide an answer to what designing should be in detail. However, they offered a way of thinking that opened up new perspectives on what could be done and how, when giving form to something had become separated from the actual making as the latter was industrialised. Indeed, it eventually provided the direction for an entire industrial sector engaged in the production of everyday things, and the field of industrial design.

Reflecting upon such historically important approaches to design, it could be said that the early industrial design philosophies were largely oriented toward *aesthetics* as a matter of resolving emerging complexities. Certainly, notions such as ’function’ place ideas about use at the center; but use at this point was largely seen as a matter of finding the most appropriate expression of such functions. In other words, it concerned the basic aesthetic design problem of how to make something present, to come forth. Over time, however, we can see a gradual shift towards methodology as a way of responding to complexity. Instead of seeking solutions in a particular kind of expression or aesthetics, solutions are sought by means of systematic design methods, as in the approaches developed at The Ulm School of Design, the design methods movement originating in the UK in the 1960’s, and in what came to be Scandinavian user-centered design. These were all responses to a kind of design complexity that design could not resolve by drawing. Instead, design had to become a multi-disciplinary effort. Attention thus turned to how information and ideas are obtained, shared and acted upon during the design process of moving from initial brief to final proposal.

Today we face a related change in design complexity, but one that neither form nor method can completely resolve. The basic reason is that our ordinary and, up until fairly recently, rather stable, categories are breaking down. For sure, design has for a long time worked with largely unknown possibilities that can only be grasped through iterative attempts at prototyping what that something could be, bringing it to presence in material form. But doing so we have still been able to rely on certain basics: such as that things remain largely the same over time in terms of their forms and functions; that it makes sense to distinguish between design and use, between production and consumption; and that designers in general, through design, control the actual outcome of the process. In fact, the point of structured design methodology is to do just that: to make design outcomes predictable. We believe, however, that there are strong reasons for not taking these basic assumptions for granted any longer.

The current sociotechnical context includes staggering and rapidly increasing complexity of current technologies and their systemic interconnections (both intentionally designed and emergent), dynamic networks, responsive things, and machine learning and artificial intelligence as new design materials. Facing this situation, there is a need for new *conceptual frameworks* that account for the consequences these changing things have in terms of human experience and society, both now and in the future. The new design philosophy that is now needed must respond to a networked, data-intensive society in which data about activity is the new basic resource generating economic growth (The Economist, 2017; Zuboff, 2015; 2016; 2019), and everyday connected things are the prime generators of this resource – and importantly, these are issues and aspects as ‘new’ to design as was once mass-production.

Just as design originally responded to the needs and dynamics of an industrial society, it must now figure out how to respond to a new and very different form of production and its social consequences. New technologies will always require new design methods, new development processes, new ideas about what services they make possible and so on and so forth – but they also require us to *think differently* about what it is that we are designing. When the car first came around it was called a ‘horseless’ carriage. Today we find this amusing – and yet, we talk about ‘mobile’ phones and ‘wireless’ networks. We understand the new in the terms of the old. And that is precisely why we need new conceptual frames and new design philosophies in order to also think and design in new ways that are more effective at grappling with our current reality. While recognizing the continuing importance of the aesthetic and role of designed things in human experience and society, they must also foreground the character of contemporary computational technologies in order to, in the end, adequately account for the role of these changing things in the world and in human experience.

While we have a significant toolbox of methods and methodology when it comes to solving problems, the more complex the problems become the less applicable become our tools. And as we approach the issue of design philosophies, it is far from obvious how to proceed. Fortunately, there is much to build on. From philosophy, we bring methodology regarding conceptual and argumentative precision, how discourse is created and challenged in forms such as texts and debates. From design research, we bring methodology pertaining to the materialization of complex ideas and issues through design experiments, prototypes and

more, where these processes and outcomes of making also enable associated discourse. In our work, we aim to combine the methods and methodologies of philosophy and design research, with the explicit purpose of crafting a design philosophy suitable for the conceptual, discursive, and practical intervention that is now needed. While it is not relevant to seek to direct practice by mere instruction, it is quite possible to influence it through catalyzing and scaffolding needed conversations in key spaces and discourses, and providing conceptual tools that can support thinking in new ways. This is the approach we take.

A conceptual framework: Fluid assemblages

Contemporary digital, computational, connected things are significantly different from the everyday things of even a couple decades ago, as well as these earlier objects of industrial design. They are constantly changing, both in response to specific contexts and users but also on the basis of software updates and multiple new versions tested against specific metrics (as in design by progressive optimization in agile development methodologies, using A/B testing methods and similar). They are also composed of a variety of physical and digital resources, both contained within things themselves and accessed via network and platform connections. Older things, too, have certainly been composed of a variety of elements, and it has been a primary task of design to intentionally compose these elements into unified wholes (Nelson & Stolterman, 2012). However, in the case of these newer connected things, there is a new scale of dynamism and scope entailed in these compositions. For these reasons, we have argued (Redström and Wiltse, 2015a; Redström and Wiltse, 2015b; Redström and Wiltse, 2019) that these things are better understood as *fluid assemblages* than as more traditional, stable things.

This notion of assemblages used here stems from the work of Deleuze and Guattari (Deleuze & Guattari, 1987). While it is not possible to do justice to the full richness of their conceptualization here, the concept deals with how something comes together. If we, in design, look at how different constituent parts can come together in a 'whole', an *assemblage* is different from both a collection and a totality. A *collection* does not gain any emergent properties, but can be taken apart with each part retaining its individual properties. A *totality* has emergent properties, but cannot be taken apart – in other words, the process of making it is not reversible. An *assemblage* both has emergent properties and can be taken apart. Further, its properties depend on the continuous interactions between the parts, and as soon as these stop the emergent properties disappear. This points to a crucial difference between the traditional industrial object and these new 'things': whereas the traditional object is a totality, where all the constituent parts are fused into a new and stable whole, our networked computational things are constantly 'made', configured in runtime. And just as fast as they are 'made', they 'fall apart' should, for example, the battery run out, the network connection drop, the authorization be revoked, or the server fail to respond.

Indeed, one of the key overarching aspects of fluid assemblages is that they entail dynamic and constitutive relations between the local and global. A thing that is made available as a thing for use (e.g., an app on a smartphone, a tabletop digital assistant, a wearable health and fitness tracker, or a web service) is actually made as a thing in nontrivial ways at runtime on the basis of both global settings (e.g., software version, current state of machine learning algorithms, etc.) and local customization (e.g., specific user account, location, history, time of day, preferences, etc.). In addition to functionality, there are also new business logics driving these relations. Things have become key sites for the production of data about people's everyday activities, and they are designed to maximize this production. Everyday activities are carried out and filtered through the transactional logic of these things and the platforms on which they operate that also render activities visible (Wiltse, 2014), comparable, and computable in data form (Alaimo & Kallinikos, 2017; Plantin, Lagoze, Edwards, & Sandvig, 2017). This data is the primary resource that is processed and metabolized within surveillance and platform capitalism, generating value mainly for the corporate actors operating or otherwise utilizing the platforms that things connect and feed into (Zuboff, 2015; Zuboff, 2016; Zuboff, 2019; Srnicek, 2017a ; Srnicek, 2017b). And in fact, Zuboff's (2019) monumental work in diagnosing and describing the mechanisms of "surveillance capitalism" and strategy of "naming in order to tame" is much in line with our approach and purpose here.

Telecommunications collapsed human notions of space, in some ways eliminating the importance of location in the sense we used to depend on it for communicating with each other; computation collapsed human notions of time, and the time it takes to compute something. The combination of these technologies and more in what we now call fluid assemblages implies a collapse also of scale. Whereas design used to be conditioned by the relationships forged between production and consumption, moving from models via prototypes to the

one prototype to be mass manufactured, this chain is increasingly collapsing not just in terms of time and space, but also with respect to the gradual scaling up towards production. Instead, what we have is code that adapts, each instance in some ways the same (we use the 'same' app) but at the same time always unique as customization happens in runtime (we all see slightly different things when using that app, depending on factors such as which user profile we are logged in as, where we are, what we have done before, etc.)

Fluid assemblages can be seen as the result of several trajectories of historical development, including computation and computationalism (Finn, 2017; Golumbia, 2009), marketing and the "attention economy" (Wu, 2016), information science, media, and interaction design. There are thus a number of associated perspectives that can be used in order to make sense of them. However, none of these is on its own able to adequately account for the more specific emergent properties and dynamics of fluid assemblages, both existing and potential (Wiltse, 2017). Investigating fluid assemblages also requires engagement in close quarters, revealing certain aspects from always strikingly partial and situated perspectives; and adequately accounting for them requires making appropriate conceptual tools.

We thus made a set of concepts to work with in bringing these aspects into focus, as an initial toolkit for exploring, working with, and (re)making fluid assemblages. We describe a few of them in what follows.

Tuning formations

One of the basic concepts that we need is one that helps us to identify and understand the basic 'what' it is that is designed when it comes to fluid assemblages, and ways of going about designing them. A concept that we developed for this purpose is *tuning formations*.

Fluid assemblages are not made in the traditional material sense, but are rather formed through algorithmic processes that rely on networked resources and connections. The object of design is thus not a final form, but the rules by which fluid assemblages come to take form as things capable of interaction through assembling a variety of components into temporarily stable formations and figurations. These things and the processes that create them are tuned[1] in relation to data generated through use. They are tuned when they are instantiated in order to respond to particular user profiles and contextual variables, but also at a more general level in relation to goals of the producers. Fluid assemblages entail ongoing relations and dynamic compositions, and they are made through practices of *tuning formations*: calibrating functional relations among elements and their collaborative evolution over time.

The shift from giving definitive form to continuous tuning of form, or formation, is already quite visible in the methodology developed to produce these kinds of 'things'. Whereas their physical presence still follows prevalent principles of industrial design form, the way their software is continuously updated does not. In particular, the extensive use of A/B testing and other ways of obtaining data to ground design decisions is of some importance here: instead of having to predict what design solution will be 'best', multiple versions of it are rolled out with specific sets of metrics being measured to obtain data regarding what solution most effectively achieves certain targets. In this way, what was previously a clear difference between the use that follows the release of a product and the 'user testing' of prototypes during the design process is here completely blurred. There is no telling where development ends and 'real' use starts. Another area where this turn towards tuning can be clearly seen is in the runtime adaptation to specific circumstances of use and user, such as tuning towards the account used and its history and a massive range of variables regarding context. Thus, what we have here are not things that are once and for all configured, or 'made', to be in and stay a certain way, but a kind of assemblage that is constantly in the making, constantly being tuned to achieve its objectives[2] as use unfolds.

[1] The conception of tuning developed here has been in some ways inspired by Richard Coyne's conception of the tuning of space (Coyne, 2010).

[2] The objectives of the thing, in terms of the purpose for which it is designed, align only partially with those of the humans formerly known as users. In fact, end users are at least as likely to be used by things that are fluid assemblages as they are to use them. This is the basic dynamic of surveillance capitalism, in which users are primarily raw material resources rather than customers (Zuboff, 2016).

Multiinstability

This dynamic customization is a key aspect of fluid assemblages, one we point to with the concept of *multiinstability*. This concept builds on "multistability" from postphenomenology, the idea that people are able to choose to relate to technologies in different ways and for different purposes (Ihde, 1990). For example, a hammer can be used to drive a nail into wood, but it can also be used as a doorstop, paper weight, weapon, art object, and any number of other creative purposes. Multistability emphasizes human agency and intention in human-technology relations. However, when it comes to fluid assemblages, agency in shaping these relations comes from not only the human side. While humans can always choose to some extent how to relate to things[3], fluid assemblages also actively adapt themselves to particular humans and other contextual variables. An app such as Spotify will show up differently for different user accounts, in different countries, at different times of day, and so on. The versions of things that show up are also frequently serving as tests being run on the users against specific metrics: multiple versions are deployed live and at a massive scale in order to gauge which version is 'best' according to some desired target. Users of Spotify choose how to relate to and use it, and it is this human-technology relation that is in focus in postphenomenology through its concept of multistability. But Spotify as a system also 'chooses' how to present itself and relate to particular users – even using them as unwitting testers and as precisely-specified products served to advertisers in particular moments when they are deemed to be most receptive to particular kinds of content (see, for example, https://spotifyforbrands.com). Human-technology relations in this case have multiple possible stabilities – which can also be seen as *in*stabilities – on both human and non-human sides. The concept of multiinstability adds this other non-human angle and expands the typical focus on human experience to consider the ways in which things, too, can relate to those who 'use' them. Again using the example of Spotify: we need to investigate not only how people choose to relate to and use Spotify, but also how Spotify presents itself in particular ways in relation to particular user profiles. Variations are expressed not only in and through human experience, but also in things themselves.

Multiintentionality

One of the most fundamental and significant differences between fluid assemblages and more traditional objects of industrial design is that they entail ongoing relations between 'producers' and 'consumers' (or 'users'), and this is in fact key for how they generate value. There is of course use value for end users in a traditional sense, but also value for producers in that they are able to use connected computational things to monitor, register, and encode people's everyday activities into data form. Aggregated data is extremely valuable for platform companies that now rely on it to generate real-time insights about use and users and how they might be able to ultimately generate a profit. Things that are fluid assemblages mediate everyday actions and interactions of the people who use them, and they mediate access to these people's everyday lives and attention for the companies that design and operate them. The concept we use to point to this phenomenon of multiple mediating relations and intentions is *multiintentionality*.

Building on the concept of "intentionality" from (post)phenomenology, *multiintentionality* brings into focus the multiple intentional relations that are at play simultaneously in and through things that are fluid assemblages. Intentionality in a phenomenological sense (in extremely basic terms) has to do with the directedness of a human toward whatever it is that is constituting her 'world' at a given moment (through sensations, perceptions, mental formations, etc.). In postphenomenology, technologies are added to this equation in a mediating role, such that the world that a person can perceive is made accessible through the mediation of technologies. One of the most-used tools from postphenomenology is the basic analytic schema *I—technology—world* and its variations to illustrate different patterns of intentional relations. While this is quite useful, it needs to be updated in order to adequately account for fluid assemblages. A 'technology' such as Facebook can be used to access one's mediated social 'world'. Yet it is also and at the same time used by the owner of that social media platform as a tool to access people's social activities and interconnections, by

[3] This possibility for choice is of course much more limited in situations where people are required to use certain technologies for work or to access educational or government services, or when there are, for example, surveillance technologies in public spaces (Kallinikos, 2004). These political aspects of the sociotechnical landscape are very important to keep in mind, but do not contradict the more basic point (countering technological determinism) that humans always have some degree of agency when choosing how to relate to technologies.

advertisers as a tool to deliver marketing campaigns and assess their effectiveness, and by malicious actors as a tool to spread disinformation in order to achieve particular social effects. In the case of Facebook at least, these multiple roles have become quite present in popular media coverage and discourse; but they exist in less prominent cases as well, as the new normal in the design and operation of connected things.

The postphenomenological schema of *I—technology—world* puts humans in the center and focuses on what is present to them as their world, even as it emphasizes the co-constitution of humans and technologies (Verbeek, 2005). Multiintentionality expands this framework to consider also how technologies can mediate access to humans as the 'world' that is revealed for other actors, and often through acts of use. In fact, this model of use of things providing the mechanism for access to people's everyday activities through production of behavioral data is one of the foundations of surveillance capitalism; but it is not easily brought into focus through the traditional postphenomenological framework that focuses on what is present to humans. This is especially significant in that mechanisms of surveillance and control are typically very intentionally not revealed in acts of use. For example, in order to understand what Facebook is and does, it is not enough to look at only how particular people perceive Facebook and the world that it mediates through use (intentionality) but also at how Facebook mediates access to these users for others (e.g., advertisers, political campaigns) through their platform (multiintentionality). Getting to grips with what contemporary connected things are actually doing demands serious attention to multiple simultaneous roles, relations, mediations, and intentionalities—not to mention intentions.

New sites for design innovation

The concepts we have briefly sketched out here are in no way comprehensive in terms of accounting for fluid assemblages and the dynamics surrounding them. However, they do at least give us a decent foothold in identifying what seem to be key characteristics, which also allow us to begin to identify corresponding sites and possible practices of design innovation in relation to them. Especially, and drawing on our continued commitment to human-centered design (and the new forms it must now take), we can use *multiinstability* to note that the customization of things for particular users and contexts is a significant dimension of the design and function of things that are fluid assemblages, and one in which people using them could be given more agency. Similarly, current practices tend to use interfaces to conceal what is really going on with and through things, particularly in terms of data being collected and used for particular purposes; there could be a design opportunity here to make this more meaningfully transparent (extensive terms of service agreements clearly not meeting this descriptor). This would undermine what have become typical business models, but also provide an opportunity for differentiation in a space where many people are increasingly concerned and wishing for alternatives. If data collection and use were transparent and could provide clear benefits, people might even be willing to provide more and *better* data in a model that is cooperative rather than shady and manipulative. And certainly more possibilities for exploration could be added to this initial list.

These possible sites for innovation require new types of design practices. Current sources of innovation in this space often come from sophisticated marketing efforts and engineering-oriented optimization, while design provides the user-facing shells. But these shells seem to be increasingly brittle, as awareness of "dark patterns" of interface design and rampant data collection indicate that things are not entirely what they seem. Rather than innovating through tuning the dialog boxes that discourage users from understanding or caring what is going on, there could be an opportunity in designing to actually reveal and manage all of these relations and processes and types of value head-on and in a good way. And while these are matters that can show up at the surface of things, we argue that we actually need to start much deeper.

Toward new design practices

If we take a closer look at the conceptual frameworks and methodologies of the disciplines that made it possible for fluid assemblages to emerge, such as object-oriented programming, massively parallel and networked computing, sensors, and increasingly technological developments such as machine learning and artificial intelligence, they all, to some extent at least, engage in issues pertaining to ontology. For instance, unless you decide and specify what the 'world' is made of, you cannot develop computational principles for dealing with it, and this ranges from having to precisely define what category and kind a given variable is, to defining exactly what set of variables to work with. As restricted or inventive as such matters may be, it still puts development in close contact with what we could call ontology, and thus the need to constantly pay attention to how categories work and behave, what they can and cannot do. Clearly, this also includes being

innovative with respect to such issues, to find new ways of defining and describing (just think of the conceptual work regarding 'relations' and 'relevance' grounding the algorithms used in search engines).

If we instead turn to design, our typical awareness of matters pertaining to ontology is much less explicit, if at all present. And while we certainly relate to categories, we typically do not have to be very explicit about how we do so. In fact, we can largely rely on this being a non-issue: when we are designing a vehicle we find comfort in the notion of 'cars'; when working with an office setting, we rely on notions such as 'chair', 'table', 'cabinet' etc. being there for us to navigate the design space. Much of what we traditionally do is to renew and refine – but not *replace* – such categories.

And so let us take a very brief look at what happened when we had to design for a new category that was not there before, and for forms of use we were not already used to: the personal computer. Transitioning from the programming environments that used to characterize what using a computer was like, the invention of the graphical user interface was an enormous breakthrough with respect to accessibility and ease of use. And to achieve this, the strategy was again to build on existing categories: the file and document, the folder and filing cabinet, the trash bin… Faced with the need to come up with an ontology, we persisted in our practice of renewing and refining, but not replacing. The notion of an 'information appliance', or now more commonly 'app', is unfortunately not much different: an application is "a program (such as a word processor or a spreadsheet) that performs a particular task or set of tasks" (https://www.merriam-webster.com/dictionary/application). It focuses our attention on that special purpose we intend to act upon as we pick it up, not its interconnectedness and its massive exchange of data across activities and areas we perhaps do not even see as related.

We believe this attitude of seeing new technologies in terms of old categories is approaching a breaking point in the context of fluid assemblages, much like industrial production eventually came to a point where one could not just continue to imitate what was previously made by hand. Certainly, much can still be achieved (or, more cynically, gotten away with) in terms of acceptance and ease of use by using familiar forms, but it is increasingly obvious that this approach also hides much of what is actually going on. To use the phrase coined by early industrial designers in their critique of mere imitation, this approach is not 'true' to the materials and forms of production we are now working with. This insight is motivated by a range of observations that can be made about current sociotechnical realities: from the simple but still far-reaching insight that 'deleting' something does not mean it is gone, to the uncanny feeling of a widening gap between what I think I'm doing with an app (e.g., using an app to check the weather) and what is actually going on that involves detailed tracking of my movements to harvest data that can be sold to other parties (Valentino-DeVries, Singer, Keller, & Krolik, 2018). Managing one's exposure to dataveillance (Raley, 2013) is also a relatively new category of 'task', and one that is typically (and intentionally) not well-supported by current applications.

Conclusion and future directions

To move on and find new ways of designing the continuous tuning of increasingly complex relations between us and the technologies we live with, we strongly believe design scholarship and practice must start to pay attention to ontology in ways they have not up until now. We also need to create a shared discourse between design and technology regarding algorithms as literally a new design material and design partner (Finn, 2017). Design researchers and practitioners have been working with 'conceptual design' for a long time, but this will now take on a partly new and much more central meaning and role. We depend on design philosophy to lead the way here: not as critical reflection from a distance after things have already been made, but as part of new ways of designing that consider doing philosophy part of a vital design practice, rather than its antithesis.

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Research Perspectives IN THE ERA OF Transformations

Towards a Tangible Philosophy through Design: Exploring the question of being-in-the-world in the digital age

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The combined philosophy and design approach called Philosophy-through-Design (PtD) is proposed using an exemplary project about being-in-the-world in the digital age. PtD is a practical way to do philosophy through designing interventions, and involves various people in the exploration of philosophical concepts. It stems from the overlapping questions found in philosophy and design regarding human-technology interaction. By intertwining both, they benefit from describing, understanding and proposing human-technology interactions to unfold new questions and perspectives. In the exemplary project, being-in-the-world refers to a way of being that is embodied, active, open-ended and situational, based on the phenomenological and embodied theories of Tim Ingold. This concept questions what it means to be human in the digital age and how our lives with technology are built. The first results show the process of weaving together observation, creation and reflection, which presents Philosophy-through-Design as a promising method for designers to practice a tangible philosophy.

Keywords: Philosophy through Design, Tim Ingold, Embodiment, Practical Turn, Interaction Design

Introduction

The aim of this paper is to elaborate the combined philosophy and design approach that we will call Philosophy-through-Design (PtD). Philosophy-through-Design, as developed in this project, is a practical way to do philosophy through the design of interventions, and aims at involving a range of different people in the process of exploring philosophical concepts that are of importance in their daily lives. The approach is a way of exploring a philosophical question from the everyday practice using the practice of design. It combines both qualities of philosophy and design in order to act as a tangible way of doing philosophy.

The development of PtD stems from the overlap in the kind of questions found in both philosophy (of technology) and design (Eggink & Dorrestijn, 2018; Hauser, Oogjes, Wakkary, & Verbeek, 2018). These questions are about how humans and technology relate to each other in the past, the present and the future. Designers might try to find solutions to the problems related to these questions and philosophers might try to understand why, but both can benefit from describing, understanding and proposing new ways in which technological solutions interact with the societies in which these solutions are used (Eggink & Dorrestijn, 2018; Findeli, 2010; Hauser et al., 2018; Ingold, 2011).

Starting from this overlap, in both philosophy and design a development can be found to make use of the knowledge and methods existing in the other field of inquiry (see figure 1). In philosophy, the empirical turn marked a shift to bring philosophy more into practice by taking part in and analysing real-world case studies

(Achterhuis, 2001; Verbeek, 2005). In the design of interactive and use products, a trend can be found of applying philosophical insights and taking the human being and society into account in the design process (Dorrestijn & Eggink, 2014; Hummels & Lévy, 2013, Tromp, Hekkert, & Verbeek, 2011). However, PtD differentiates itself from these two approaches by intertwining both processes into one approach guided by a philosophical research question. At the start of the approach there is no predefined perspective regarding the research question in the form of neither philosophy nor design. The questions, creations and reflections found during the approach will interact with each other to develop and contribute both to the field of philosophy and design, not by finding answers, but by unfolding new questions and new perspectives.

In this paper, we will elaborate Philosophy-through-Design by an exemplary project in which the philosophy of Tim Ingold is used to investigate his concept of being-in-the-world. Ingold's ideas pose interesting questions in a society in which digital products take up such a ubiquitous presence in everyday lives and experiences. As a starting point, we will focus on the iconic object that is omnipresent today: the smartphone. The aim of this project is, thus, to question what Ingold's philosophy means in the context of the digital age, using a project revolving the smartphone as a design case to understand our being-in-the-world in the digital age. First, we will offer some background to PtD by relating it to other methodologies, such as empirical philosophy and Research-through-Design. We will then move on to the philosophical background by introducing the philosophy of Tim Ingold and his conception of being-in-the-world. After that, we will introduce the case study of the smartphone and the digital age and elaborate on the focus points, questions and steps we have chosen to guide PtD. Finally, we will provide an overview of the first results and elaborate on them in the discussion and conclusion in light of the validity of Philosophy-through-Design as a method for doing philosophy hands-on.

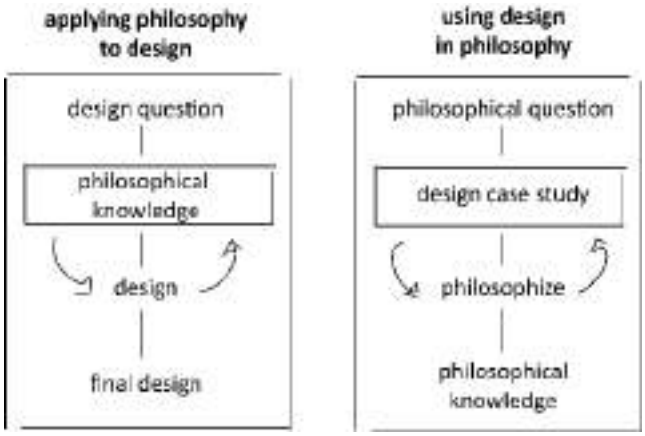

Figure 1: Schematic overview of applying philosophy to design and using design in philosophy

Philosophy-through-Design background

PtD could be considered as connected to the empirical turn and the developments in the field of Philosophy of Technology that came afterwards. PtD indeed acknowledges a similar beneficial relationship between philosophy and design, however, PtD differentiates itself from the empirical turn in a subtle, but substantial way. With the empirical turn, philosophy became more concrete by incorporating more case studies and collaborations with other disciplines (Achterhuis, 2001). This turn opened the way for philosophers to 'come down from their ivory towers' and create philosophical tools, methods and forms of assessment to use in practice and apply in other disciplines, such as design (Eggink & Dorrestijn, 2018). By making philosophy empirical, however, the new approaches are criticised for losing their critical and ethical qualities in the concreteness (Scharff, 2012; Winner, 1993).

A variety of initiatives to bring these qualities back after the empirical turn are proposed, together considered as an "ethical turn" (Brey, 2010; Verbeek, 2010). Eggink and Dorrestijn (2018), in line with Verbeek's (2010) proposal of philosophical accompaniment in technology development, go even further by proposing the "practical turn" in which philosophers and designers collaborate by applying philosophical theories and methods in a design context after which the design project can lead to a better understanding of Philosophy of Technology. In other words, the designer profits from a more reflexive perspective on their designs, while the

philosopher uses the design of actual things as a way to test philosophical frameworks in practice (Eggink & Dorrestijn, 2018). The difference with both the empirical turn and the practical turn is that in Philosophy-through-Design, it is not a philosopher doing the philosophy while watching a designer design, but a designer practicing a form of tangible philosophy through the design of things. The outcome of a PtD project is thus not necessarily an abstract philosophical concept, idea or question, but a tangible artefact. PtD aims not to analyse material things in a philosophical way, but PtD explicitly intends to materialise philosophy.

Philosophy-through-Design might sound familiar to the well-known design research methodology Research-through-Design (RtD) (Faste & Faste, 2012; Findeli, 2010; Frayling, 1993) in which it is acknowledged that designed artefacts can embody an answer to a research question (Biggs, 2002; Faste & Faste, 2012). PtD can be seen as a specific way of executing the 'design' part of an RtD project. RtD, as shown in figure 2, can be described as design activity that operates as research (Faste & Faste, 2012): a general research question is answered with a design project, which in turn can form a partial answer that reflects back on the research question (Findeli, 2010). Philosophy-through-Design has a similar aim but specified for a philosophical question and offers an approach in which philosophy can inspire the design process not only as starting point but throughout the whole project. The design informs, thus, the philosophy as much as the philosophy informs the design *simultaneously*. As shown in figure 3, the philosophy and design perspectives are *interwoven* to develop further, not to a final design answer or philosophical answer, but to new questions and new perspectives.

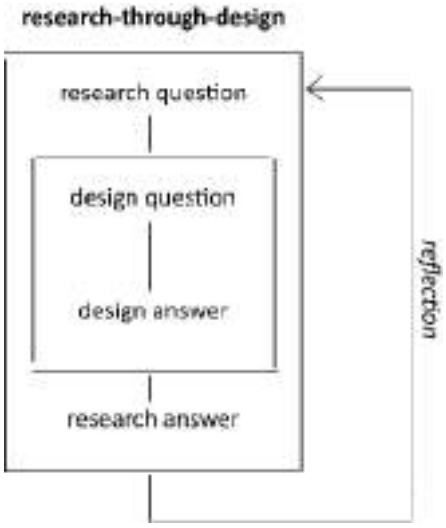

Figure 2: Schematic overview of Research-through-Design (adapted from Findeli, 2010)

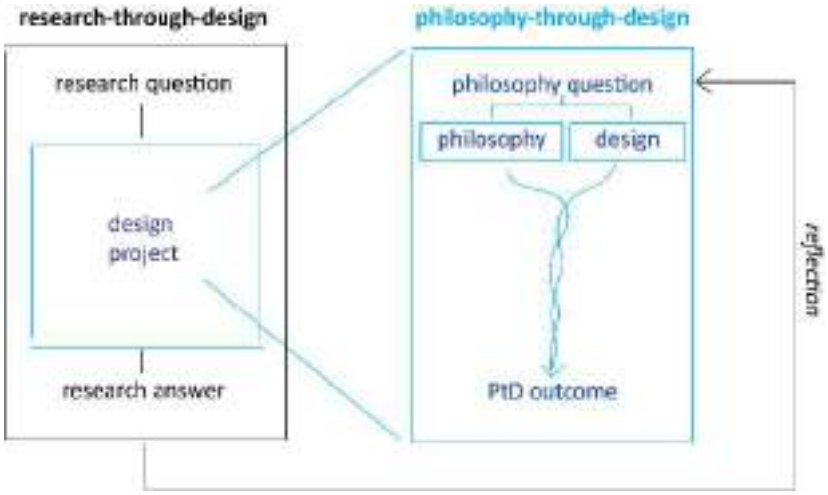

Figure 3: Schematic overview of Philosophy-through-Design in relation to RtD

Philosophical background

The design case, chosen for this PtD project, is about being-in-the-world in the digital age as inspired by the ideas of Tim Ingold (2011). Ingold is originally an anthropologist, but his thinking has transformed into a philosophy about art, architecture and anthropology, or rather a philosophy of what it means to be alive. He is influenced by many philosophers and thinkers that are associated with the idea of being-in-the-world. The term itself was introduced by the philosopher Martin Heidegger (1927), but has in different terms influenced others in the philosophical movement of phenomenology, such as Merleau-Ponty (1962), and other thinkers in the theories of embodiment (e.g. De Jaegher & Di Paolo, 2007; Suchman, 1987; Varela, Thompson, & Rosch, 1996). The ideas of phenomenology and embodiment have also spilled over to other disciplines such as human-computer interaction (e.g. Hollan, Hutchins, & Kirsh, 2000) and interaction design (e.g. van Dijk & Hummels, 2017; Van Dijk, van der Lugt, & Hummels, 2014). As a result, Ingold's theory about being, life and anthropology comes from concepts such as thinking through practice (Schön, 1983), the coupling of action and perception (Gibson, 1979), and skilled practice and situated actions (Suchman, 1987). Ingold then developed his own by using terms such as *wayfaring*, *weaving* and *the meshwork*.

According to Ingold, our being is a dynamic being that is always moving, learning and developing in the forcefields of its environment. The world is a *meshwork* of all the interwoven lines of life, growth and movement of all the beings and things occurring there (Ingold, 2011, pp. 63-94). It is not a platform on which beings live, rather beings emerge in a world-in-formation, along the lines of their relationships (ibid, pp. 63-75). Referring to phenomenology, consciousness is not confined in the head, but spills over into the environment along these pathways of sensory participation (ibid, pp. 51-62). In other words, Ingold talks about *weaving*: our being is woven together from all the different influences that occur in our lives (ibid, pp. 63-75). If every story would be a thread, being alive means weaving all the stories of your life together into one being. To know something, is to know its story. It is by this continuous process of following and creating stories that we acquire knowledge and live in the world. Ingold calls this trail-following *wayfaring*. Wayfaring requires an open attitude, improvisation, sensitivity to cues, and a capacity to respond with judgement and precision. The difference between an expert and a novice is not how much they know, but how well they are able to skilfully act in the meshwork of storied knowledge (ibid, pp. 141-175). From the concept of action-perception couplings, learning is accomplished by trying over and over again and following the stories of exemplars to copy their gestures (ibid, pp. 177-226). Therefore, the condition of being-in-the-world, to Ingold, calls for more than immersion and being involved: it calls for an openness to observe, to be active, and to be astonished by the world we inhabit (ibid, p. xii).

Based on these ideas, being-in-the-world, in this project, will refer to a way of being that is embodied, active, open-ended and situational. It is about the possession and mastery of skills to be able to react appropriately to all the influences within the flow of the process. Decisions are made unconsciously by following the traces without being paralyzed by possible consequences and having to make a decision. It means that the human is inseparable from the world in which it lives and is always moving in, reacting to and creating with the situations it is in. This conception raises an interesting question in the digital age, where new technologies shape an apparent division between online and offline practices and close off people's movements, reactions and creations from the bodily sphere. How can we understand this division? How do these two contexts relate to each other? Do they replace each other, do they augment each other or have they become so intertwined that we are alienated from and lost in understanding the world in which we live? What does the term being-in-the-world, our way of being human and our world, then mean?

Case study: being-in-the-world in the digital age

The digital age refers to a historical period in the 21st century characterized by a rapid shift to a society based on information and networks (Volti, 2014). Connection is a keyword, since anyone with any type of access to the digital world can potentially reach anyone who is similarly equipped almost instantaneously (Volti, 2014). As philosophers and designers, we may ask what the digital age actually means to the people who are living in it in their everyday lives and what an improvement or change of the digital age could, or perhaps even should, look like. In this context, the digital age points to the way people live and communicate with each other in a world that has been augmented by new digital technologies. With 'digital', we specifically refer to the invisible, complex and distributed processes that occur all around us, of which most of us can only perceive and understand small parts (Schiphorst, 2007). The hiddenness of much of the digital processes poses problems on our everyday lives such as a loss of privacy, misuse of data and jobs taken over by AI.

Nowadays, the digital world can be accessed through different interfaces, such as your smartphone, your laptop or tv. All of which have their own influence on how the world is experienced. The focus in this project will be specifically on such an interface, rather than focusing on a wide-ranging conceptual problem such as privacy or big data. The interface of the smartphone is chosen specifically, because the introduction of the smartphone marks the start of a new phase in the digital age. The smartphone is an interesting object as it is both a physical device that we carry around with us as well as an access point to what we call the digital world. In just a few years' time, it has become the dominant device with which we are digitally active (Deloitte, 2018; Kemp, 2017), changing how we go through our day to day lives, and changing the kind of digital content and digital activities that are available. In 2017, about 66% of the global population used a mobile phone and about 37% of people use social media at least once a month, of which more than 91% of them via mobile devices (Kemp, 2017). By being easy to use, small and portable, the smartphone is blurring the lines between our digital and physical practices. The average number of hours spend on the internet each day in the UK is 5h47 of which 1h48 on social media alone (Kemp, 2017). This makes the smartphone an interesting object to inspect more closely in relation to theories on embodied being-in-the-world, since it allows us to focus on the transition between the digital and non-digital and how the design influences in what manner this relation is experienced and understood.

There are many reasons why the smartphone could have become such a dominant device in society today. It carries all different kinds of tools; our clock, dictionary and more into one device. It makes it easier to stay in touch with friends and family from near and far and makes us more flexible in how we go through our daily lives. However, the extensive use of the smartphone is related to multiple negative effects regarding both mental health (e.g. Alhassan et al., 2018; Elhai, Dvorak, Levine, & Hall, 2017), and physical health (e.g. Jung, Lee, Kang, Kim, & Lee, 2016; Korpinen & Pääkkönen, 2009), affecting social skills and dependency (e.g. De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016), and influencing happiness, social connectedness and life satisfaction (e.g. Alter, 2017; Schnitzler, 2017). These problems pose an interesting problem for designers to look for solutions on how to improve the design of the smartphone to help people to be better equipped to move through a world that incorporates both digital as well as physical practices. This could be done for example by changing the physical design or adding new modes of interaction as done by Stienstra, Overbeeke and Wensvee (2011).

From the perspective of philosophy, the problems linked to smartphones pose different questions. Looking specifically from the ideas of Ingold (2011), the interface of the smartphone makes our experience of the world more ambiguous. Since the whole body is involved in our being (Ingold, 2011, pp. 15-62), how does that apply to the use of the smartphone which offers this immense non-bodily world to us? Ingold offers the example of using a saw to talk about (1) how tool use is not an operational sequence of small tasks, but of processional movements that inform the next move, (2) that using does not entail the attaching of an object to a body, but of joining a story to the appropriate gestures and (3) how the movement of tool use comes from feeling what you are doing by coupling perception and action with concentration (Ingold, 2011, pp.51-62). The question is, however, how the smartphone fits into this picture, when the design of the smartphone seems to have evolved into a more indistinguishable shape that leaves no variety in how we use and experience it. When the bodily gestures to talk to our friends, to follow the news and speak in public are all the same, and our concentration to feel the flows of movements around us, in both the physical and the digital world, is constantly challenged by notifications, sounds, vibrations, and moving images; how then, can we be in the world?

The philosophical question for this project is, thus, formulated as follows: '*What does being-in-the-world mean in a digital age dominated by smartphones?*' To translate this question into a design question, the question is reformulated so that it asks for a change in how users interact with their smartphones to understand their experience, and is posed the following: '*How to stimulate users to have more agency in being in a digital age dominated by smartphones?*' Agency in this case means, referring back to the conception of being-in-the-world by Ingold (2011): being able to make the right decision right away based on experience and skill. From these questions and the aim of PtD, the design goals in this project are to design three physical smartphone interventions that will:

- make clear the role of the smartphone in the daily lives of users
- stimulate agency in users to do what they really want to do and to be who they really want to be
- start a conversation about being, agency and the world in relation to the smartphone

The Philosophy-through-Design approach

In PtD, the design of interventions will function as both tools for thinking and traces of knowledge acquirement. Both the philosophical and design question will guide the exploration and work together through a few stages (see figure 4). The stages are (1) First Person Exploration, (2) Experience Conversations and (3) Design Conversations. In every stage, reflection plays a key role in guiding the next steps. The design researcher, to keep track of their ideas and reflections, will keep a notebook that will in the end serve as a visual trace of knowledge acquirement during the project.

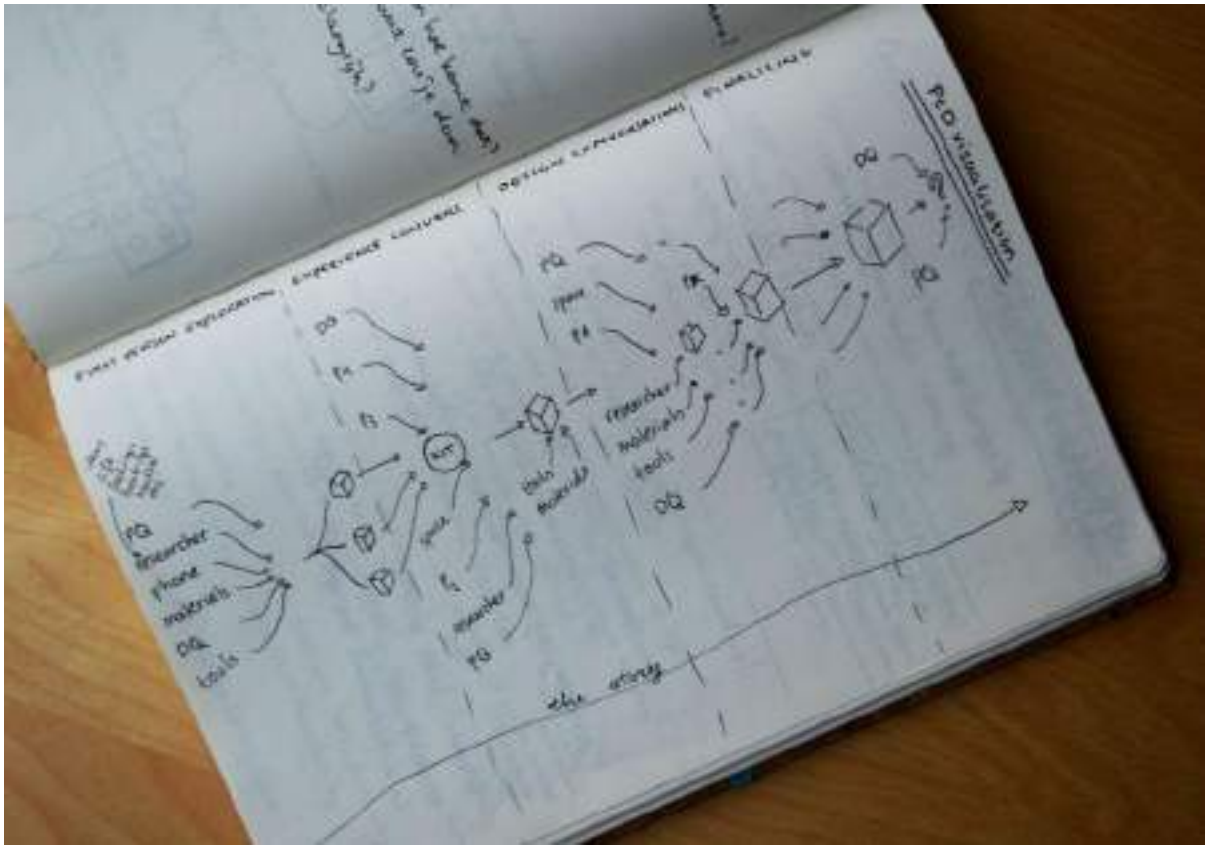

Figure 4: Schematic overview of the PtD process taken from the researchers' notebook

Stage 1: First Person Exploration

The process starts with the design researcher exploring and describing their personal felt-experiences about the philosophical question. This method is based on first person methodologies in embodied theory and somatics (Höök, 2010; Schiphorst, 2007). The method of these explorations consists of a few activities: (1) describing the personal experience, (2) designing and making interventions, (3) using the interventions, (4) describing and reflecting on the personal experience of using the interventions in regard to the design and philosophical question and (5) formulating a personal answer to the philosophical question.

The focus on individual experience is taken up specifically in first-person methodologies and somatics. In these methodologies, knowledge is accessed and constructed through the body and requires that experience be directed through awareness (Schiphorst, 2007). The body-in-motion and its felt-experience are the source for exploration and it can include an autoethnography in which the author provides a detailed description of their experience (Höök, 2010; Schiphorst, 2007). The idea is that we can learn from our own specific practices and use the qualities to transfer them into more general knowledge (Höök, 2010). In this specific project, the main design researcher will start with an autoethnography of their smartphone behaviour. The autoethnography will be supplemented with the making and using of interventions to make certain uses and aspects of the smartphone more obvious and conscious. From this autoethnography certain qualities about smartphone use can be distracted.

The *making* of artefacts, which intervene in our own habits, serves to engage the design researcher to explore their habits more in-depth. Making for exploration is a common method in the design process which is characterized by ambiguity and a lack of planning, but functions to engage the designer in a reflective dialogue to catalyse the decision process. It brings together the stories and materials to perform as incentive for understanding (Frens & Hengeveld, 2013). Hummels and Lévy (2013) reveal design not as a process of problem solving or organisation, but as a process of opening up, exploring new horizons and engaging in new situations. Through the embodied acts of making, building and experiencing prototypes, makers can exploratively facilitate access to and express meaning of the everyday to guide new directions to take. They share with Ingold (2011) that the act of making enables designers to explore the unknown, guided by their practiced intuition and sensory capabilities in a dialogue with the materials and the world around them. Thus, through describing, making and using the design researcher creates a personal answer to the questions to make certain qualities of the smartphone explicit.

Stage 2: Experience Conversations

In the second stage, the design researcher will take the third-person perspective by involving other participants by inviting them to use one intervention for a set amount of time. The interventions are handed over to the participants in a kit containing the intervention, small assignments and means to make notes. Inspiration is taken from Gaver, Dunne and Pacenti (1999), who used cultural probes to research the lives of elderly communities without dominating the conversation. They found that through the informal style of communicating and research, they were able to familiarize and connect with the communities in an appropriate manner that lead to both inspiration and grounded knowledge to base design decisions on (Gaver et al., 1999). Similarly, in Philosophy-through-Design the design researcher aims to engage with the participants to start a discussion about their smartphone use and the impact on their daily lives.

After using the kit, the design researcher will have a one-on-one conversation with the participant about the experience of using the intervention and their insights regarding their being-in-the-world in the digital age. The interventions serve in this conversation as a tool for thinking (Kirsh, 2013; van Dijk & van der Lugt, 2013) and joint sense-making (De Jaegher & Di Paolo, 2007). As recognized in the theory of distributed cognition, the body and its surroundings can be incorporated in the process of thinking (Hollan et al., 2000; Kirsh, 2013). The handling of the intervention as a 'cognitive scaffold' can lead in conversation to shared insights between participant and design researcher (Van Dijk & Van der Lugt, 2013). The interventions in the PtD process will in this way serve as objects to think, to build an understanding of their experience and start a discussion in which an answer to the philosophical question can be formed.

The reflection and analysis of the data is inspired by the Interpretative Phenomenological Analysis (IPA) approach (Smith, Flowers, & Larkin, 2009). IPA is a qualitative research approach that examines how people make sense of their personal life experiences. Offering a systematic way of analysing them makes this approach phenomenological and hermeneutic. The IPA approach is specifically interested in major life experiences that make people more aware and reflective of the significance and meaning of what is happening (Smith et al., 2009). In Philosophy-through-Design it is not a major life experience that will bring people out of their daily flow of (unconscious) experience, instead it will be an intervention that will disrupt their smartphone use leading to awareness and reflection, with which the design researcher can engage.

Stage 3: Design Conversations

In the third stage, the design researcher will iterate further on one intervention and improve it according to the results of the previous stages. Again, participants are invited to use the new intervention to fuel conversations about the design question and the philosophical ideas behind it. The discussion will guide the next step in the design process where the participants are also invited to help to improve the design together with the design researcher. In this stage, the first two stages will be brought together to create meaning through conversations, joint designing with regard to the question of being-in-the-world in the digital age.

Taken from participatory design (PD), PtD aims to use design as a method for mutual learning between participants and design researcher through reflection-in-action (Garde, 2013; Robertson & Simonsen, 2013). Important values in PD that are also applicable to PtD are (1) cooperative design, (2) equal and democratic (power)relations, (3) situation-based actions & design and (4) the use of tools and techniques to help participants (Garde, 2013). In one sentence these qualities ensure that in PtD human activity is examined in its context productively and ethically in cooperative and equal partnerships (Garde, 2013; Spinuzzi, 2005). The

difference between PD and PtD lies in the outcomes of the process, where participatory design desires to learn the aims, context and design ideas of the participants to design a solution, instead the PtD process desires to use the unfolded aims, context and design ideas to start a conversation and explore a philosophical concept.

The results of the design conversations will be discussed and reflected upon to come to an answer to the design question with a final intervention. The created interventions during the whole process together with the researchers' notebook serve as data to show the story of how the research has developed to new insights about being-in-the-world in the digital age. This story of things and insights will serve as the tangible philosophy with which philosophical ideas, questions and perspectives will be constructed for further research.

First results

At the point of writing this paper, the first stage 'First Person Exploration' has been completed by the main author. In the present and the subsequent section, the pronoun 'I' will be used to describe the subjective experiences of activities executed during PtD. During the first stage, the design researcher has analysed their own smartphone behaviour, designed three interventions (see figure 5a-c), used them and reflected on them. In figure 6, an overview of the process can be found including pictures of their researchers' notebook, an autoethnography booklet, the creation of the interventions and their use.

Figure 5a-c: The interventions, (a) Pink Screen, (b) De-distractionizer, (c) In-touch

The first intervention is the 'pink screen' (see figure 5a). This is a phone case made from pink felt that can be folded around the smartphone. When opening, the felt forms a screen that makes a clear division between the smartphone user and the situation they are in. It is designed to amplify the 'I am not here, but in my phone'-effect when using the smartphone, but turned out to be a message to bystanders to not disturb. The second intervention is the 'de-distractionizer' (see figure 5b). This is a machine that protects from unfiltered and distracting stimuli of the smartphone by simplifying the options of what to do without a smartphone. It uses the same casino effect as many applications to keep you interested by blinking and randomly picking a task when you put your smartphone on top of it. In the beginning it was new and funny and helped me to check my smartphone less, but I quickly found a way to hack the system, making me uncomfortably aware of my lack of agency in my smartphone use. The third and last intervention is the 'in-touch' (see figure 5c). This is a multisensory phone case that feels soft to the hands, makes sounds when you shake it and you can dig your fingers in it. It challenges the boring smartphone design by making your smartphone fun to play with in a bodily sense, and invites you to not only stay digitally in touch with others, but also to keep in touch with your different senses to build a more positive relationship to the smartphone itself. During the use of this intervention, I found, not to my dislike, a playful side of myself not only in how I played with the intervention, but also in how I engaged with my friends face-to-face.

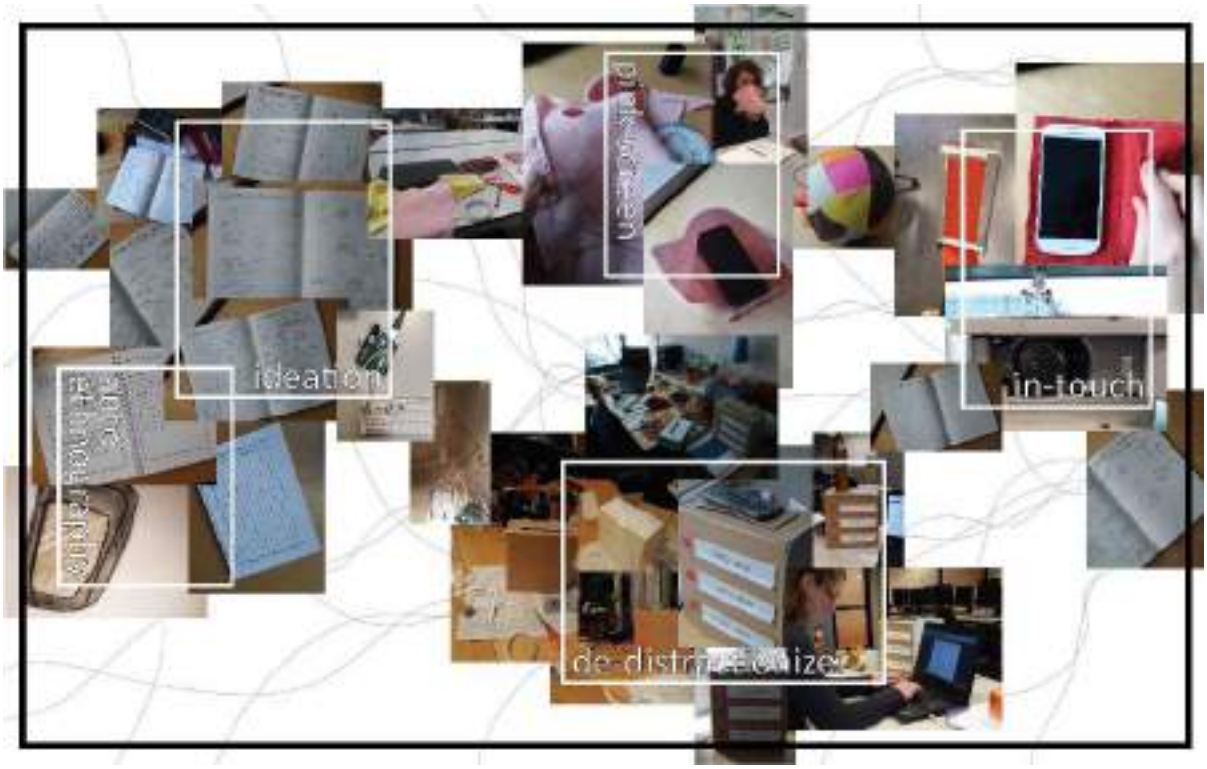

Figure 6: Overview of the process of stage 1, First Person Exploration

The personal experiences and reflections regarding the use of the interventions have been tracked in an autoethnography booklet. From this data, I found that, (1) regarding the design question, on the long term, an intervention that requires me to have self-discipline in using it, such as the de-distractionizer, will not help me to have more agency in my smartphone use. Old habits seem to take over quickly and hacking the system was a common occurrence. The intervention that actually made me feel to have more agency was the pink screen, because it helped me to focus better on the situation I was in, be it physical or digital. In light of Ingold's theory (2011), I was more tuned in to the current situation to be able to react appropriately to subtle cues to follow what is going on. Regarding the philosophical question (2), I realised that my being-in-the-world is a constant paradox. I am attentive of everything at the same time, but as a result do not have any real attention for the present moment. The digital seems to be embodied in me, while my being in the digital is disembodied. As a result, my online identity is filtered to what can be digitized and does not feel like me, but is at the same time shaped by the unfiltered stimuli and practices from the digital world. Overall, it seems that my world and my role in it are overwhelmingly vague, and making sense of it has become a full time job that distracts me from actually being attuned to the moment. My being-in-the-world, in opposition to what Ingold describes (2011), is in the digital age, thus, closed by an abundance of unfiltered cues and scattered attention, so I am less open to be astonished by the world.

Discussion

The first stage of Philosophy-through-Design showed how philosophy and design were interwoven to both inform the process simultaneously. By actually using and reflecting on the designs as first user, I found new problems, ideas and questions that made me return to philosophy. When I was using the pink screen, for example, with which I had intended to make a clear division between the online and the offline world, it turned out that many people asked me if it was designed to protect my privacy. These comments did not only make me realise that the design did indeed seem to make smartphone use secretive (a *design* reflection), but it also stimulated me to dive again into the *philosophical background* to see if a connection between privacy and being-in-the-world could be found to base further exploration on in the following design stages.

By designing and making the interventions, I came to understand the theory in another light. I noticed how the different ideas, materials and people were acting as different threads that weave together into this project. During the process, I started to create a meshwork of my project (see figure 7) to understand how my

development had travelled, or to use Ingoldian terms: *wayfared*. Ingold (2011, p. 240) would claim that a researcher is at any time following traces from the past and projects themselves into the future along lifelines, forming their own self along the way. An example is that the creations of the interventions were for a great part influenced by the available materials, tools and skills I had to learn. At some point, the sewing machine broke and I had to find another way to create an intervention, which changed the design and therefore also how I approached the question of being-in-the-world. In many design projects, however, the final design is often presented as the perfect embodiment of a function or idea, when in fact it came into being as a weaving pattern of different ideas, available materials, tools, experience, etc. Philosophy-through-Design makes this weaving of different influences more explicit, to be philosophized about, and is in that way also inspired by Ingold's ideas of being-in-the-world and knowledge acquirement based on exemplars, experience and mastery of skills.

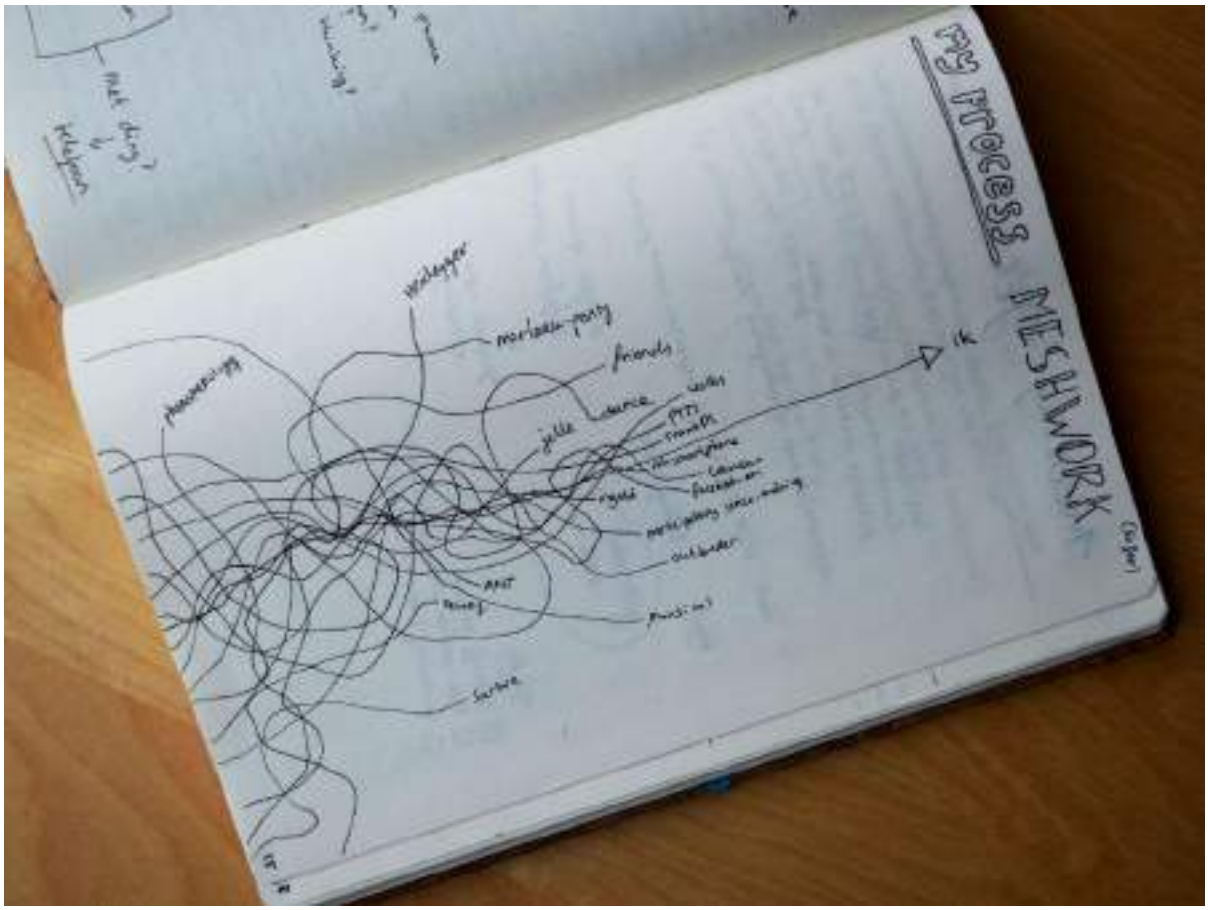

Figure 7: 'My process meshwork (so far)' taken from the researchers' notebook

Limitations

A limitation one could offer to PtD is how the design of the interventions, and with that the personal opinions and abilities of the designer, could determine the course of the philosophical exploration, alongside their already existing explicit influence and experience as a first user of the interventions. However, the idea that academic endeavours and science as a whole could be objective, is exactly the point that PtD, in accordance with Ingold's thesis (2011), tries to overcome. Science and knowledge building are more akin to a form of craftmanship, where the researcher joins the flows of materials, people and circumstances to compare, understand, describe and move with the different ways of being (Ingold, 2011, pp. 226-240). The specific design will always influence the course of the project, but that does not have to be a problem. The involvement of other people in PtD is, therefore, a way for the design researcher to engage with other opinions. It is, thus, of importance that the design researcher, independent of their own beliefs, opens themselves to the world they study.

Related to this point is the question if PtD can actually be called to be a form of philosophy. Philosophy is in this project, similarly, not seen as an objective academic endeavour, but as a personal philosophy, or in other words: a way of life that could be practiced by anyone. This view on philosophy refers back to the Hellenistic and Roman eras where philosophy meant a mode of existing-in-the-world (Hadot, 1995). An associated view can also be found in the ideas of Dewey (1917), the father of the philosophical school of pragmatism. Dewey acknowledged that one would never be able to realize complete wisdom as a definitive state or to find the real truth, and so philosophy should abandon the project of finding certainty and create theories, but instead to practice philosophy from the everyday so it can guide actions and ways of life at every moment with participation of the layman (Dewey, 1917). Philosophy as a way of life, in accordance with the ideas of Ingold (2011), is not about studying philosophy, but it is about living it (Hadot, 1995).

Looking back, however, at Ingold's presentations of what a study from within the world (Ingold, 2011, p. xi) would look like, it seems to remain limited to a number of examples (such as sawing through a plank (ibid, pp. 51-53)) and various drawings in between the lines of text. Philosophy-through-Design aims to be the first step into the direction where Ingold's ideas will be put to the test by working them out in a more considerable design project. Further research could look into the possibilities of philosophers using PtD, in their own way, to practice a tangible philosophy in the world. This project about being-in-the-world in the digital age is, however, an example of what such a project could look like from the perspective of a designer, by using the ideas of wayfaring, stories, weaving and embodied situational practices to *do* philosophy.

Conclusion

The Philosophy-through-Design approach, as developed during the case study about being-in-the-world in the digital age, proposes a relevant method in which design can function as a way to materialise philosophy. Or in other words, to bring abstract philosophical inquiries back into the everyday where an actual change can be made. By combining both philosophy and design into one approach, both can benefit from describing, understanding and proposing the ways in which technological solutions interact with the societies in which these are used. The results of the first stage of PtD show a promising process that weaves together observation, creation and reflection in the design and use of smartphone interventions. In the following stages, the approach will be taken into practice even more by involving various smartphone users to further explore the question of being-in-the-world in the digital age. In conclusion, Philosophy-through-Design seems promising as a method for designers to practice a tangible philosophy by design.

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Values that Matter: Mediation theory and Design for Values

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Philosophy of technology could bring new insights when applied to design practice. This paper brings together mediation theory and design for values. We present a new design for values methodology: Values that Matter. Via the four phases; explore, conceptualise, anticipate and test, VtM allows for anticipating value dynamics. It starts with the assumption that value expression and definition arise in the interplay between users and technology. An extensive mediation analysis then helps to provide insight in and allows for anticipation on potential effects of technology on users and value dynamics, something that current value sensitive design approaches cannot deliver. Those insights are tested with involved actors to bring about best values by design. VtM has been applied to the case study of ViSi Mobile, a medical device developed for continuous monitoring of vital signs in hospitalised patients. A redesign was proposed that better empowers these patients.

Keywords: Values that Matter, Design for Values, Design for Value Change, Mediation Theory, Responsible Design

Introduction

How to integrate ethics in design practices? Among the various approaches that have been developed at the interface of the ethics of technology and design research, the approach of Value Sensitive Design (VSD) (Friedman, 1996) emerged as a key. The main focus of this approach is the identification of the values that are at stake in relation to concrete technological innovations, in order to take these into account in design practices and to concretise these in a material design. Values refer to what a person or people consider important in life (Friedman, Kahn & Borning, 2006). Or, as described in more detail by Van de Poel and Royakkers: “lasting convictions or matters that people feel should be strived for in general and not just for themselves to be able to lead a good life or realize a good society” (Van de Poel & Royakker, 2011, p.72).

VSD’s methodology is threefold. First, the ‘conceptualise’ phase aims at identifying and ordering all values at stake. Consequently, ‘empirical investigations’ is for studying the ideas of stakeholders on values. Finally, existing technologies and their embodied values are studied as part of the ‘technical investigations’ followed by the design of the new product. One of the standard examples in the field – in which this methodology actually pioneered – is the development of interfaces to fine-tune the cookie settings of web browsers, integrating the value of privacy in the actual design of information technology (Friedman, Kahn & Borning, 2006).

VSD lacks a clear methodological framework despite the fact that it has been frequently used (Winkler & Spiekermann, 2018). VSD falls short especially with respect to its understanding and use of values. Namely, VSD "seems to assume that values remain stable during adoption and use" (Van de Poel, 2018). We believe, however, that values only arise in the interplay between users and technologies and are far from stable. It is therefore impossible to design for values without considering the interaction between technology, users and resulting values.

Technologies are not neutral tools. They help to shape the behaviour, experiences and even frameworks of interpretations of their users: a smartphone is not just a tool to make phone calls and exchange information, but also has important implications for people's attention and concentration, the character of friendships, the ways in which people listen to music and watch movies, et cetera (Verbeek, 2010). Users' perception, behaviour and resulting values are not stable properties, but artefacts of the technologies used. Designing for values should, therefore, anticipate the user-technology-value dynamics.

We take the 'safe cigarette' as an example. The safe cigarette was an initiative of the American National Cancer Institute in the 1970s. By embodying 'health', as a value with stable properties, in the design of a cigarette, the institute developed a cigarette with a better filter containing lower levels of nicotine with the aim to decrease nicotine intake and a better health of the smoker (Warner & Slade, 1992). Yet, after introduction to the market, the nicotine intake of cigarette users only increased (Nakazawa, Shigeta & Ozasa, 2004). As smokers were so used to their normal levels of nicotine, the safe cigarette created unconscious behaviour changes; smokers smoked more often, inhaled deeper and broke off filters to be satisfied in their daily doses of nicotine. So, instead of positively influencing the health of people, the safe cigarette negatively affected it.

This example shows that designing for values as stable properties instead of anticipating the influence of technology on user behaviour and values could end in designs 'biting back'; resulting in other and even opposite effects from the ones inscribed (Tenner, 1997). We can identify two types of value dynamics. First, there is a dynamic in value expression. The way in which technology affects a value depends on users' perception and behaviour as a result of the technology. In the example, the value of health is not improved but threatened due to users' behaviour changes. Second, there is a dynamic in value definition. The definition of a value is subject to the technologies that embody and express the value. With respect to the example, embodying 'health' in a 'safe' cigarette creates a shift from 'healthy equals non-smoking' towards 'healthy equals safe cigarettes'. This change in value definition results in undesired behaviour. A major question then concerns how one can design for values when the content of what constitutes the values is subject to the design itself?

In summarising, we believe that VSD fails to adequately design for values as it considers values as stable properties instead of products of user-technology interactions. The user-technology interactions create two types of value dynamics: dynamics in value expression and value definition. This paper aims to go beyond the Value Sensitive Design approach, on the basis of the perspective of the philosophy of human-technology relations, and more specifically, from the approach of 'technological mediation'. This approach analyses technologies as 'mediators' between users and their environment (Verbeek, 2010). From this perspective, the ambition to design values 'into' technologies needs to take into account that these technologies will always have mediating effects, by reorganising the behaviour and experiences of users, and sometimes even by affecting the value frameworks from which they can be evaluated.

We will report here an approach to 'design for values'. It takes the phenomenon of technological mediation as the starting point to anticipate the effects of design on value expression and definition. First, we introduce the approach of technological mediation. Thereafter we propose the design methodology 'Values that Matter' (VtM). This four-phased methodology; explore, conceptualise, anticipate, test, provides a responsible way to design for values and value change. To illustrate the methodology, VtM is brought into practice with a case study of a medical wearable wrist device used to continuously measure vital signs of patients in the hospital; ViSi Mobile (VM) (Sotera Wireless, CA, USA). We will study the mediating effects of ViSi Mobile and propose an alternative design that better takes into account value dynamics.

Mediation theory

The approach of technological mediation is built on the idea that technologies are not neutral. Humans shape technologies and become simultaneously shaped by them. The mediation approach originates from the

postphenomenological work of the North-American philosopher Don Ihde (Ihde, 1993). Postphenomenology studies the relations between humans and technologies and the implications technologies have for human practices and perceptions (Rosenberger & Verbeek, 2015). Rather than being 'objects' opposed to human 'subjects', technologies should be seen as 'mediators' between human subjects and the world: when technologies are used, they help to establish relations between the person using the technology and her or his environment. For example, cars do not just move people from one place to another but give them a different experience of the world than when they would walk or ride a bike. A car, for example, may provide individuals with the value of autonomy as it opens up a new world unable to be reached before. Likewise, diagnostic devices in healthcare do not only help doctors to obtain a diagnosis but also greatly affect the value of responsibility, as it takes along new ones (Verbeek, 2008).

Technological mediation typically has two dimensions (Verbeek, 2010). There is first the 'hermeneutic' dimension, related to the impact of technology on perception and interpretation. Technologies can here amplify or reduce the perception of certain elements of the world. The other dimension of technological mediation is the 'existential' one. It focuses on how technologies help to shape actions and social practices. Technologies thereby can invite for or inhibit certain behaviour. MRI imaging is a good example of both types of mediation. Hermeneutically, MRI scanners help neuroscientists to understand the brain and to develop ideas about the human mind and human behaviour in relation to the brain, which also results in new societal frameworks of interpretation, like the idea that 'we are our brains'. At the same time, existentially, these scanners reorganise the actions of doctors and the interactions between doctors and patients, while also changing social practices, like marketing ('neuromarketing') and psychiatric care ('neuropsychiatry') (De Boer, Te Molder, & Verbeek, 2018).

A special category of mediations is the mediation of moral frameworks. Interestingly, technologies cannot only be evaluated ethically but also have an impact on the ethical frameworks for evaluating the technologies. An example is the birth control pill. While being a product of the sexual revolution, it also helped to shape that same revolution. By loosening the connection between sex and reproduction, the birth control pill has shifted normative frameworks regarding sexuality: what counts as 'normal' takes on a different meaning. An interesting example of this moral mediation is the impact of the birth control pill on the acceptance of homosexuality. As Mol has shown, the disconnection between sex and reproduction also resolved an often-used argument against homosexuality: the argument that it was unnatural to have sex with somebody of the same sex, since this sexual relation cannot result in reproduction (Mol, 1997). Since the introduction of the birth control pill, the norm that sex is connected to reproduction has lost its self-evident validity.

A more recent example of this moral mediation, which has been studied empirically, is the impact of Google Glass on definitions of the value of privacy. By analysing how people discussed Google Glass online, in comments on YouTube videos of Glass users, it appeared to be possible to investigate how the value of privacy gets redefined when people apply it to a new technology (Kudina & Verbeek, 2019). Technology and morality are intricately connected. This gives an extra dimension to the ethics of technology since it implies that the ethical frameworks with which we evaluate technologies are themselves co-shaped by these technologies.

Mediation theory provides a clear framework for understanding value dynamics; the impact of user-technology interaction on value expression and value definition. Therefore, it could help a design for values methodology to anticipate in a structured way the effects that design will bring about. Only a few other authors have introduced mediation to design (Swierstra & Waelbers, 2012; Verbeek, 2013), but none have proposed a way to do this systematically. We present a design methodology based on the approach of technological mediation and aiming to anticipate technological mediations of interpretations and actions at the individual and social level, as well as the technological mediation of normative frameworks. This methodology is called Values that Matter.

Values that Matter

The design for values methodology Values that Matter aims at developing designs that embody and anticipate important values. Its name is twofold. First, it refers to the important contribution of values to life. Second, it stresses the context-dependence of values as the type of values result and depend on user-technology interactions. The methodology consists of four phases, shown in figure 1. It starts with the exploration phase in which the important actors and values become identified. Based on that, the conceptualisation phase aims to develop a concept that does justice to the identified values for the identified actors. These two phases are quite similar to the VSD methodology. It is in the anticipation phase when value dynamics comes to play a role

and where the difference starts with VSD. This phase aims, via mediation theory, to provide an anticipatory understanding of the interplay between users, technologies and values before actually implementing a technology. The testing phase allows for testing actual mediations and value conflicts as an input for conceptualisation and helps understanding how the anticipated values become appreciated subjectively in real life. Together with the previous two phases, conceptualise and anticipate, this phase allows for multiple iterations to optimally improve values by design. All four phases and their intermediate steps are illustrated in detail.

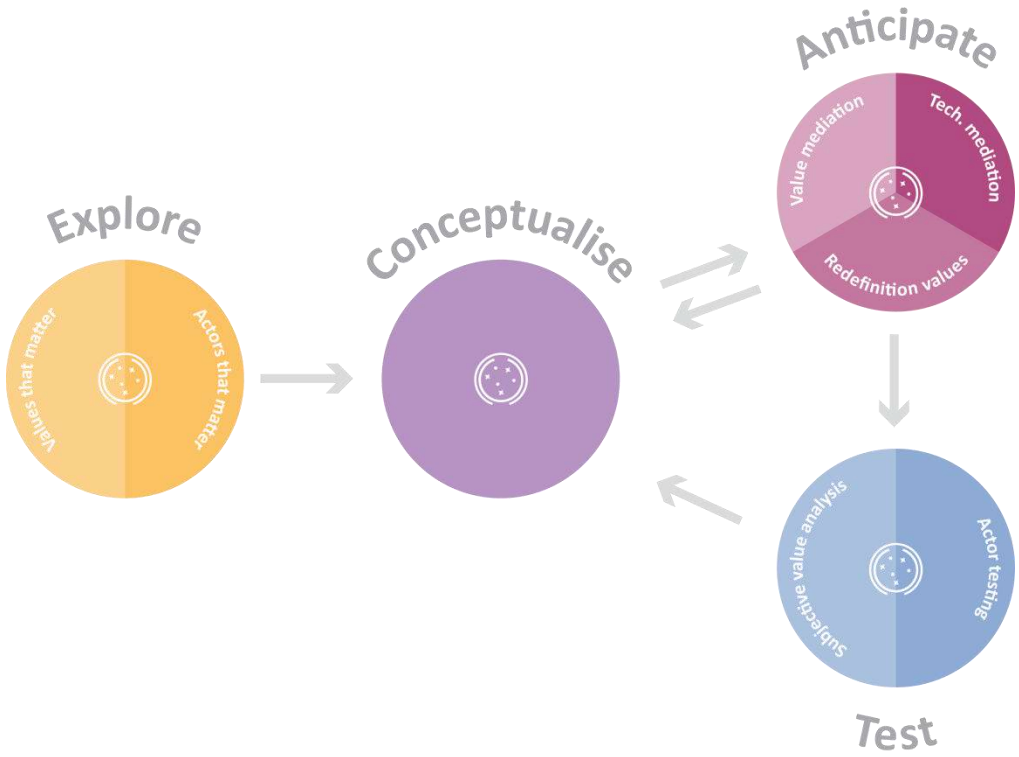

Figure 1. Framework Values that Matter

Explore

The exploration phase is for mapping out the context of the design problem. In this context, we focus on two important elements: actors and values.

Actors that matter

At first, the design team needs to identify all actors, (groups of) individuals, of importance in the design problem. Those actors need to be involved in one way or another with the design problem and will be in (in)direct interaction with the future design solution. Identification of actors could be facilitated by means of literature studies on the context of the design problem and interviews with certain actors to identify potential others.

Values that matter

Each actor has a different relationship to the design problem, resulting in different preferences, needs and values. The design team should identify per actor which values are important and to what extent. Some values might be important for all actors, whilst others could matter for just one. To understand which values matter and to define a hierarchy in values, the design team should first turn to the actors themselves by means of qualitative analyses (e.g. interviews, diaries, questionnaires...). Yet, actors reason from their current context. As values arise from the interplay between users and technologies, a new technology might change the context and introduce new values. Only the designer is able to anticipate these additional values. Brainstorming about values, literature reviews on the design problem and reviews of similar existing design solutions could help the designer to identify the additional values.

Conceptualise

The identified actors and belonging values together form the preliminary value framework. The design team starts ideation just after finishing this framework. This process of ideation should result in a concept. A concept can be anything from an abstract idea to a fully developed prototype. By means of iterations with the following phases, the concept will be developed every time with more detail up until its script solves the design problem whilst simultaneously embodying the important values for the different actors. As value conflicts could arise within a concept, the defined value hierarchy could help in decision making.

Anticipate

The anticipate phase aims via an anticipatory technology assessment at understanding the effects of the concept on value dynamics within the earlier defined value framework. Mediation theory provides the knowledge to do so. The anticipate phase consists of three steps, each described below. This phase can be executed in a multidisciplinary team including a range of actors involved in the design problem, to gain the greatest understanding of all possible ways of mediation.

Technological mediation

It is in this step that the actual mediation analysis will be executed. To systematically assess the mediating effects of the concept on all involved actors, we propose to create an actor-matrix, shown in figure 2. An actor-matrix is a matrix that lists all involved actors in both the first column and first row. This will result in a matrix with two types of crossings: a crossing between the same actor and a crossing between two different actors. All crossings of the first require an 'individual mediation' analysis. All crossings of the latter require a 'mediation of relations' analysis.

Mediation of individual: in the individual mediation analysis, the design team studies how the human-technology relationship between the actor and the concept forms the perception and actions of the actor. Mediation of perception entails the effect of the concept on the way the actor perceives himself and the way he perceives the world around him. Mediation of action entails the effect of the concept on the actions of this actor.

Mediation of relations: apart from individual perception and action, a technological concept affects the relationships between different actors. The design team should identify what kind of relationship the concept constitutes between the two actors. This should always be seen from the perspective of the actor on the left towards the actor on the right, as the relationship might be differently seen from the opposite perspective. A concept might influence how one actor perceives another actor and acts towards this other actor.

This systematic mediation analysis helps to gain a deep understanding of all the potential mediating effects of the developed concept on the different involved actors and relationships between those actors.

	Actor 1	Actor 2	Actor n...
Actor 1	**Human-technology relationship** *Mediation of perception and action towards the self and the world*	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology-human relationship** *Mediation of perception and action towards the other*
Actor 2	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology relationship** *Mediation of perception and action towards the self and the world*	**Human-technology-human relationship** *Mediation of perception and action towards the other*
Actor n...	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology-human relationship** *Mediation of perception and action towards the other*	**Human-technology relationship** *Mediation of perception and action towards the self and the world*

Figure 2. Actor-matrix for the Values that Matter methodology

Redefinition values that matter

A preliminary list of values that mattered per actor is developed during the exploration phase. Those values matter in the context of the design problem. When a concept becomes introduced to solve the design problem, it does not leave the list of values unaffected. The design team should, therefore, redefine their value framework. The mediation analysis is of help here. Some of the earlier defined values that were considered important might disappear, as the concept does not affect those values. New values might be added that become affected by the solution. For each value that disappears during redefinition, the design team should ask the key question: Does this matter? The answer to the question depends on the relevance of the value and the corresponding actor. When an important value has been lost, the design team should return to the conceptualise phase and reconceptualise their concept so that it will after all again embody the lost value.

Mediation of values

On the basis of the mediation analysis and the redefined list of values, the design team can now start the mediation of values analysis. They identify the effects of their concept on the different values that matter. Each identified value could get one of three labels: 'threaten', 'enhance' and 'transform' (Manders-Huits & Zimmer, 2009). A value gains the label threaten when it becomes affected negatively by the concept. A value with the label enhance will, on the contrary, become improved by the concept. Finally, the label transform is left. When a value gets this label, we deal with the mediation of moral frameworks. The concept then changes the content of what constitutes the value. Value transformations are not by default burdensome. Designers could even decide to consciously design for positive value transformations; design for value change.

After the value mediation analysis, the design team analyses their concept. How many values does it affect negatively (values labelled as 'threaten' or 'undesired transformation') and to whom do those values belong? Are there conflicting values? Are there values that cannot be given a label, as it is still unknown which type of technological mediation will be dominant? Based on the questions, the design team can either decide to return to the conceptualise phase or proceed to the test phase. Considering the first, they should redesign the source of the concept that creates the shortcomings of the design. Considering the latter, the design team can test with the actors questions brought up by the mediation analysis.

Test

In the previous phases, a concept has been developed that embodies an anticipated set of values. This phase is for testing the anticipated technological mediation. The design team should have clear questions at the start. Those could include which type of technological mediation will become dominant or how to deal with value conflicts. Moreover, it allows for studying how the anticipated set of values is actually experienced subjectively by the different actors.

Actor testing

The design team should bring their concept to the different actors and study its mediation. Via qualitative studies as, for example, interviews, observations or diaries, they can gain an idea about the real technological mediation of the concept, actors' appreciations of certain values over others or the effect of the concept on the values that matter.

Subjective value analysis

The study results of the previous step should now be analysed to answer all questions defined upfront. Answers to questions on most common type of mediation or value conflicts provide input for reconceptualisation. Answers to actors' experienced value mediation should be studied. Is the concept ready to be implemented in society or do actors experience a threat to the identified values? For each threatened value, there is an imbalance between the anticipated effect on values and the subjectively experienced effect on values. Designers should aim to find the best balance between 'what we think is good for the actor' and 'what the actor thinks is good for him'. When they conclude a value is threatened, the team should again identify the source of the concept causing the threat as input for reconceptualisation. The result of a few of those iterations between conceptualise, anticipate and test is a product that optimally improves both anticipated and subjective experienced values.

Case study: ViSi Mobile

As VtM makes the greatest difference in its anticipation phase, we will illustrate this phase by means of a case study. The case study comprises the medical device ViSi Mobile, shown in figure 3. ViSi Mobile is a wearable device that continuously measures five vital signs of hospitalised patients: arterial blood pressure, heart rate, respiration rate, oxygen saturation, and skin temperature. All data are displayed on a module on the wrist of the patient and sent to an external computer. A computer algorithm converts the vital signs into a Vital Risk Score (VRS). This score reflects the physiological state of a patient and is used as a warning for clinical deterioration. When the score is above certain predefined settings the medical staff is alarmed for extra checking on the patient (Sotera Wireless, 2018).

ViSi Mobile could create a paradigm shift in the wards of hospitals. Traditionally, nurses have to collect the vital signs of patients manually, three times a day. It takes approximately six minutes to measure, via several devices, the necessary data of a patient, write it down and insert the data in the electronic health record system. Nurses taking vitals may be less reliable and is subject to inter-observer variability. Furthermore, the large gap of eight hours between two subsequent manual measurements could result in missing data relevant for patient's care. ViSi Mobile is able to overcome these drawbacks and moreover can provide a detailed insight into the data of a patient with potential for prediction and prevention of disease course. Apart from a few minor and solvable technological problems such as a fast decay of its batteries, false-positive alarms and lost contacts between skin and sensors, ViSi Mobile has been reported a promising new device in hospital care (Weenk et al., 2017).

ViSi Mobile has been developed by the American company Sotera Wireless. In 2017, the Radboud University Medical Center in Nijmegen started a pilot study with the device to assess its potential in improving healthcare. The pilot study involved 60 patients at the internal medicine and surgery wards and showed the superiority of the device in measuring patients' vital signs in comparison to daily measurements of nurses (Weenk, Koeneman, et al., 2019).

In this setting, we studied the potential mediating effects of ViSi Mobile on their carriers: the patients. Via our Values that Matter methodology we aimed at finding mediating effects of ViSi Mobile, the potential for improvement and recommendations on actual implementation. First, we studied the mediating effects of ViSi Mobile without involving any actors. Consequently, mediating effects were discussed with patients wearing ViSi Mobile and with hospital staff. Moreover, mediating effects were derived from a first set of semi-structured interviews with 60 patients, 20 nurses, 3 physician assistances and 6 medical doctors on the positive and negative effects and perceived facilitators and barriers of the device (Weenk, Bredie, et al., 2019). We illustrate only the mediating effects of ViSi Mobile on the perception, action and values of patients that we anticipated and were simultaneously confirmed by the different actors themselves. We end with a few recommendations for the hospital on improving ViSi Mobile's design and way of implementation.

Figure 3. ViSi Mobile

Anticipate – technological mediation

Mediation of individual

Each patient is unique. Consequently, there is not one type of technological mediation. Below, we present potential mediating effects of ViSi Mobile that different types of patients can and have experienced. First, with respect to mediation towards the self, ViSi Mobile might affect patients' ideas of health. For patients, health is something intangible; invisible for the human eye, including mostly subjective feelings about one's own body. ViSi Mobile renders visible health. It quantifies health into a set of always the same objective qualities such as blood pressure, respiration rate and heart rate. ViSi Mobile is a material translation and construction of reality. Using ViSi Mobile changes patients' intentionality into a combination of original subjective feelings over own body with quantifiable data perceived on a screen.

This could have both positive and negative effects on the perceptions and actions of a patient. When patients feel similar as the device tells them they feel, patients could experience the same positive feelings as the reasons people have for using self-tracking devices at home (Gimpel & Nißen, 2013). ViSi Mobile could first provide self-entertainment: the enjoyment of data collection of own body. Second, it could contribute to self-association, in which ViSi Mobile provides the tools to understand the self in relation to others. Third, self-design might become affected. In that, patients can optimise their own bodies. It furthermore creates a ground for self-discipline: having a sense of purpose and motivation. Finally, it allows for self-healing: becoming more independent from regular healthcare, being able to leave their bed and walk around.

Yet, when the feelings of patients do not match with the data ViSi Mobile displays, which is when one feels bad or good and the data tells otherwise or when patients detect fluctuations in ViSi Mobile's data but do not understand those, ViSi Mobile mediates patients negatively. This mismatch between feelings and data could reintroduce Descartes' notorious mind-body dualism in which feelings are mind and data of ViSi Mobile body. Patients could then start to either lose trust in the data or in own feelings. In the first situation, patients could distrust ViSi Mobile and maybe even the surrounding healthcare of the hospital. In the second situation, patients could lose self-consciousness and self-confidence. They might feel anxious and suffer from feelings of alienation from themselves.

Apart from mediation towards the self, ViSi Mobile affects patients' perceptions and actions towards the world. The idea of continuous monitoring could, on the one hand, might make patients feel safe, being observed and looked after for. On the other hand, it might make patients feel exposed and objectified as a study object: unable to hide or simply opt-out.

Mediation of relations

ViSi Mobile does not only affect the patient as an individual but mediates the relationships between patients and other actors. Although many relationships between actors become affected by ViSi Mobile, we will here only consider the mediating effect of ViSi Mobile on the relationship between the patient and the nurse, seen from the perspective of the patient, summarised in the actor-matrix shown in figure 4. Due to ViSi Mobile, the patient might either see the nurse more or less often, depending on the behaviour of the nurse. ViSi Mobile provides nurses with time by replacing the time-consuming manual measurements. Nurses can now either decide to spend this gained time on socially interacting with the patient or on spending this time on other tasks. The first may lead to increased and possibly better patient-nurse contacts. This could result in an improved relationship with the nurse, feelings of trust, safety and being cared for. The latter would lead to decreased patient-nurse contacts. This might negatively affect patients' experiences. The relationship with the nurse might deteriorate, patients might feel alienated by hospital personnel, stressed for not knowing whether they are actually monitored or could experience feelings of exposure to an unknown monitoring 'eye'.

	Patient	Nurse
Patient	**Patient - ViSi Mobile relationship** *Patients might enjoy self-entertainment, self-association, self-design, self-discipline and self-healing.* *Patients might distrust VM's data or own feelings. They can lose self-consciousness and self-confidence.* *Patients might feel safe.* *Patients might feel exposed and objectified.*	**Patient - ViSi Mobile - Nurse relationship** *Patients might see nurses more often. This might result in feelings of trust and safety.* *Patients might see nurses less often. This might result in stress and feelings of alienation.*
Nurse		

Figure 4. A segment of the actor-matrix of ViSi Mobile

Anticipate – redefinition values that matter & mediation of values

Several values seem to become affected by ViSi Mobile based on the previous short mediation analysis. A selection of those values includes autonomy, bodily health, relations, bodily integrity, purpose, identity, safety and privacy. We report here the first three as these provide the opportunity for improving the design and implementation of the device.

At first glance, autonomy could be labelled 'enhanced', as ViSi Mobile seems to provide patients with the autonomy to look after their own health, understand own health and act based on that knowledge independently from the hospital staff. Yet, this label is debatable for two reasons. First, it requires that patients can interpret the displayed data and the meaning for healthier behaviour. However, from conversations with patients, we often found the opposite. Patients did not understand ViSi Mobile's data and when they did, they did not know how to act. Instead of enhancement, autonomy then may become threatened. Second, where patients gain autonomy in relation to the hospital personnel, they lose autonomy with regards to the medical device itself. Namely, ViSi Mobile takes away the autonomy to define health.

Bodily health is labelled 'transformed', as ViSi Mobile changes patient's definition of health from current and past subjective feelings into objective, current data only. ViSi Mobile excludes from the definition of health feelings and past healthcare records. This value transformation is burdensome as it might make patients feel confused, anxious and stressed, unable to relate their feelings to their bodily data.

Finally, with respect to the value relations, the relationship between patient and nurse becomes affected by the way ViSi Mobile is implemented in the care path. When the implementation of ViSi Mobile results in fewer visits of nurses, the value becomes threatened. Meanwhile, when nurses come by more often, the value will be enhanced.

Reconceptualise

Although ViSi Mobile provides benefits for the hospital, there are opportunities for improvement of the design and recommendations for implementation when the device is adopted on a larger scale. Some are discussed.

The device could benefit from a redesign with respect to the values of autonomy and bodily health. Those become negatively affected by the design of the display of ViSi Mobile on the wrist of patients. This display shows the data that can cause confusion by the patient. A redesign could target this display to improve both values. First, ViSi Mobile can help patients with the ability to be independent, converting the negative label of autonomy into a positive. Such may be done by providing patients with healthcare advice. On the basis of the physiological data of a patient, ViSi Mobile could provide this patient with tangible advice via pop-up notes on its display. For example, ViSi Mobile senses that the heart rate of a patient increases. The patient could be stressed. ViSi Mobile could advise him to find relaxation. Likewise, a patient with a low oxygen saturation could receive the advice to sit in bed and do breathing exercises. As well, when ViSi Mobile senses that a patient has not moved during the day, a pop-up note could recommend making a walk. These tangible goals allow patients to actually use ViSi Mobile's data to become autonomous by understanding how to independently improve their health.

To prevent the negative transformation of the concept of bodily health, ViSi Mobile should take into consideration the feelings of a patient and her or his healthcare records. It should include first the feelings of a patient, for example by allowing patients to report on their subjective well-being via pop-up notes. Furthermore, ViSi Mobile should provide patients with the opportunity to see their past healthcare records by, for example, entering a new screen on its display.

Finally, the double-sided mediating effect of ViSi Mobile on patient-nurse interactions shows the importance of involving nurses during the implementation of the technical device. Fostering close nurse-patient contacts would warrant for positive effects on their relations. With a few of those changes to the design and way of implementation of ViSi Mobile, the device will improve the values that matter and be able to positively reshape healthcare for both hospital staff and patients.

Discussion and conclusion

In this paper, we have developed Values that Matter, a design for values methodology inspired by the philosophy of technology. Value sensitive design approaches do, in their methodology, not greatly differ from more traditional design approaches. When we take, for example, the often used Double Diamond Model, it includes the phases discover, define, develop and deliver (Design Council, 2007) and follows thereby, just like any design methodology, a process with iterations between analysis, idea generation, prototyping, testing and implementation. The main difference between traditional design approaches and value sensitive design approaches lies in the focus on creating value for the company over creating –literally- value for the user. Yet, VtM is not like any other design approach. The main difference with other design (for values) methodologies, is the anticipatory approach and, in particular with respect to VSD, its understanding of values as a result of the interplay between users and technologies. The methodology of VtM is built around the 'anticipate' phase that makes the methodology unique. Other design methodologies could benefit from adopting such a phase to understand and anticipate design's effects in the real world.

As such an anticipatory phase requires guidance, VtM aims to provide this methodological guidance by proposing the phases 'explore', 'conceptualise' and 'test'. To optimally contribute to the 'anticipate' phase, all phases require follow-up research.

First and foremost, with respect to the exploration phase, questions still need to be answered concerning the actors and values. For example, what range of actors should become involved? Apart from actors present during the use of a design, should actors involved in the production and recycling of it be taken into consideration as well? And in case of conflicts, can certain actors become prioritised over others, and, when possible, is that ethical? Furthermore, with respect to values, is it possible to create a list of all potential values that could become embodied by design? What qualifies as a value? Are there values that matter in each situation compared to values that only matter in particular situations? And is it then possible to make a universal ranking of values, and if not, how to facilitate value ranking per context to solve conflicts in values?

Second, the conceptualisation phase needs a clear methodology. How to actually translate values into design requirements and embody values in design? Third, with respect to the anticipation phase itself, follow-up research should define this phase's ability to guide each designer through the anticipating process. Is more guidance, for example, necessary with respect to what type of mediation is studied? The case study showed it might be necessary to demarcate between the mediation of different personas within the same actor (each patient is unique) and different periods of time over the adoption of a technology. Finally, with respect to the testing phase, a more detailed understanding is essential in the balance between the 'objective' anticipated and the subjective experienced values. Actors are not always aware of what (value) is best for them and might need little anticipated help of designers. Yet, that could result in conflicts between 'what we think is good for you' and 'what you think is good for you'. When that leads to actors unwilling to use products, even though they are good for them, the products are useless. A detailed understanding is therefore necessary in how to deal with those situations.

VtM has been applied to the case study of ViSi Mobile. We have only studied the 'anticipate' phase and involved only a few actors in the process. The case study has nevertheless shown the potential of VtM to identify recommendations for design and implementation. When we would have used the traditional Value Sensitive Design approach, we would not have been able to identify the great range of value dynamics resulting from the mediation of ViSi Mobile. We would first not have been able to identify the different anticipated ways of value expression of 'autonomy' and 'relations'. Moreover, we would not have been able to

understand the change in the definition of 'health'. The used case confirms the applicability of the methodology and shows the necessity to proceed in the future with testing the entire design methodology, in greater collaboration with real design processes, companies and actors.

We have done a first attempt to provide a systematic philosophical framework for designing and anticipating value dynamics and piloted this in a relevant new technology for in hospital patient care. The preliminary results encourage the use of VtM to design more responsibly for values and even the potential to consciously design for positive value change.

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Track 3.b Introduction: Measuring and communicating the value of design

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Although design has become synonymous with innovation, a tool for good leadership and is seen as a critical factor in the success of many high performing organisations, it is still considered by many as a luxury that comes at the expense of stakeholder resources and speed to market. Many organisations must still be persuaded to employ design. Design strategy, or the politics of design, is emerging as a critical issue required to overcome the powerful forces that often inhibit the implementation of good design. Some organisations have attempted to measure design, but it is still an inconclusive practice. How do we make design impact, visible and measurable? How do designers convince decision makers of the tangible and enduring benefits of good design? How do organisations know that their designs are having the desired impact?

This track explored the theme of transforming business strategy, organisational practice and culture, influencing management decisions and impacting citizens through design evaluation. We were particularly interested in describing and providing metrics for the value of design. We were also looking to explore the ways that practitioners and academics have evaluated the success of design in organisations and society. The papers presented in this track were widely dispersed under this theme using a arrange of qualitative and quantitative research approaches.

The first of the papers presented by Menichinelli, Gerson Saltiel Schmidt and Ferronato, is a strategic view of the evaluation landscape. They map the relationships of designers, makers and social entrepreneurs using place as a frame of reference. This paper aims to define the community of designers such that the design ecosystem is visible and can be accessed.

The second paper by Münster, Kristensen, and Gabrielse is a direct look at the impact of store design and how it impacts consumer behaviour and product preferences using an experimental approach to product selection.

The third paper by Khan and Matthews, returned to the semantics of design to establish commonality on language and raises the point that there is great disparity in not only value but in how design is practiced.

The final paper by Johnson, Torrens and Storer focuses on fast moving consumer goods (FMCG) and provide a taxonomy of design considerations to make existing research knowledge more accessible for low involvement FMCG packaging designers.

The papers show significant promise in the developing field of design evaluation. However, the inability of the to demonstrate evidence of the connection of good design practice with effective outcomes remains a vulnerability of the field that practitioners will continue to face. Further work must be done to support the exploration and research into defining the value of design.

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Research Perspectives IN THE ERA OF Transformations

Mapping strategies for distributed, social and collaborative design systems of makers, designers and social entrepreneurs

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The practice of designers has recently evolved from a relatively closed ecosystem of professional actors to an ecosystem with less clear boundaries and roles. Makers can be considered (and often are) designers or a new kind of designers working with open, peer-to-peer, distributed and DIY approaches. And both makers and designers increasingly work with social innovation initiatives, becoming thus social entrepreneurs or collaborating with them. Where are makers, designers and social entrepreneurs, how many are there, how do we reach them and network them? This article presents a first exploration of literature, cases and datasets that represent direct or indirect approaches for mapping where they can be found. These formal or informal approaches are clustered in three groups: work, place and community. Each dimension generates a different perspective with different approaches and datasets, which influences our view and definition of makers, designers and social entrepreneurs.

Keywords: Maker Movement, Designers, Social Entrepreneurship, Distributed Design, Mapping

Introduction

The practice of designers (and the reflection upon them) has continuously evolved and the recent technological, social, and economic trends have transformed it from closed and defined processes to ad-hoc and open processes, from a relatively closed ecosystem of professional actors to an ecosystem with less clear boundaries and roles. The Maker Movement is a phenomenon that fits in this trend for at least two reasons: a) makers can be considered (and often are) designers or a new kind of designers, often working with open, peer-to-peer, distributed and DIY approaches; b) the technologies, systems and processes they adopt, build and promote are a key element further reinforcing this trend. Its preeminent characteristic of bridging the local and digital dimension and the often collaborative and social nature of its activities constitute a reason for identifying such movement as a clear example of digital social innovation (DSI) (Bria et al., 2015; Stokes, Baeck, & Baker, 2017). Moreover, this is a concept that extends the definition of social innovation (Murray, Caulier-Grice, & Mulgan, 2010): people, projects and organisations that adopt digital technologies to tackle sociotechnical and environmental challenges focusing on social or environmental impact over financial return, towards openness, collaboration, and citizen empowerment. Digital social innovation can be found in different

fields such as healthcare, education and employment to democratic participation, migration and the environment. In all of them, maker projects can be found. This represents another connection between the Maker Movement and Design, especially along the reflections about how designers (both expert and nonexpert, formally trained and informal amateurs) are developing and spreading social innovation initiatives toward sustainability (Manzini, 2015).

When creating and deploying social innovations both makers and designers can thus perform, at least partially, as social entrepreneurs, and the connection between design and social entrepreneurs have also been debated in positive terms (Brown & Wyatt, 2010; Fleischmann, 2013). Social entrepreneurs are motivated to address social problems using an entrepreneurial approach, develop and implement their innovative solutions to improve communities and the world in which we live, playing an important role in addressing social, economic and environmental challenges.

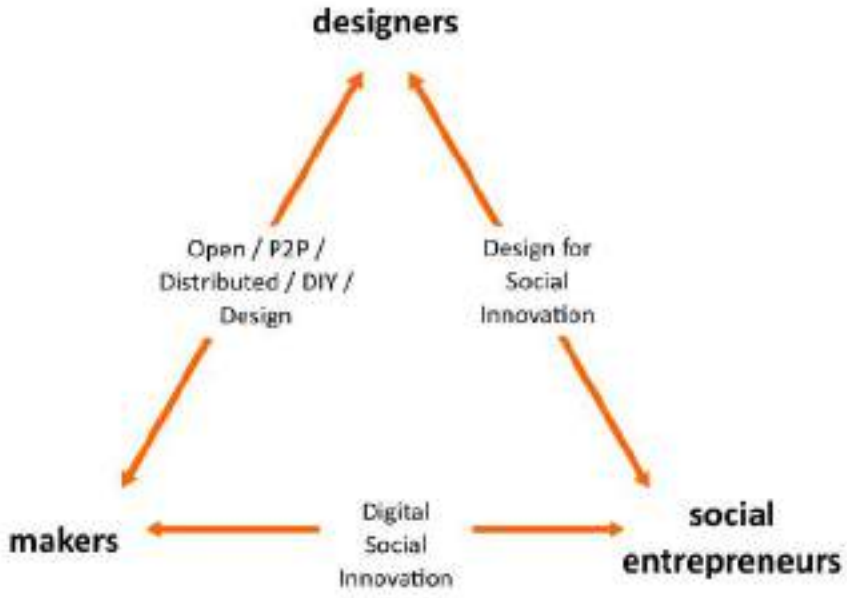

Figure 1: The distributed, social and collaborative system and its actors

While designers and social entrepreneurs have been extensively investigated and defined, the same cannot be said of makers. Both the design practice and research have already approached the Maker Movement, and one of the issues that have not been explored enough yet is the extension and distribution of this phenomena, and how much design could have a role in it. If the Maker Movement is a globally rising phenomenon, how big is it, how much is it growing and how many designers and social entrepreneurs are part of it or could join it? This is a strategic question that addresses how, where and how much the design research and practice could be influenced by and influence the Maker Movement, in the development of products, services and of social innovations. One of the main obstacles is the vagueness, complexity and uncertainty regarding the definition of makers. The meaning of being a *Maker* is broad, and it is related to *how* to clearly identify who are the makers. These characteristic are an arguable consequence of the loose and widespread nature of the definition of the term *Maker*, since its conception when Make Magazine was launched by Dale Dougherty in 2005 to promote technology, creativity, and fun (The Blueprint, 2014). Chris Anderson slightly narrows and improves its definition, considering specific practices and principles divided into three different features: a) the use of digital desktop tools for designing and prototyping artefacts; 2) the adoption of common cultural practices and collaborative processes of sharing these designs with their communities; 3) the production of artefacts with the use of digital manufacturing technologies, spaces and services (Anderson, 2012).

By exploring the size and distribution of the Maker Movement, Design and Social Entrepreneurship, this research aims

a) to understand how designers can join the movement;

b) to elaborate further research and strategies for connecting designers, social entrepreneurs and the makers;
c) to improve the definition of makers;
d) to strengthen the connection between these three actors, and therefore their work on creating and implementing social innovation.

A better understanding of this phenomenon is an exercise for both exploration and exploitation, especially if it is done with the goal of linking it to design. Moreover, it has a self-reinforcing nature: mapping helps at thinking about the identity(ies) of these actors, and the identity(ies) adopted inform our mapping. The article does not focus on the issue of the identity of makers, designers or social entrepreneurs per se, but it contributes to a small advancement in this direction if we consider that working on the identity of makers is a strategic design initiative, especially when developed with the focus of improving designers' practice and research.

Measuring and communicating the value of design is a strategic effort, and this article approaches it at the system level. Measuring the extension and distribution of the community of designers is another way of evaluating and assessing the value of design, not at the scale of single projects, but at ecosystem scale. Furthermore, understanding how designers, makers and social entrepreneurs are distributed is a further contribution towards understanding the social impact of design not just with industry but with citizens too, and the first step towards measuring it and making it visible. Innovative business initiatives often generate indirectly more jobs and economic value locally (Moretti, 2013), so the impact and importance of makers, designers and social entrepreneurs could also be higher than what expected, and this approach could be lay the foundation for further research upon the general value of design initiatives to society and economy. The main research question of this article is then: *Where are the makers, designers and social entrepreneurs, how many are there, how can we reach them and network them?* Operatively, as a first step towards answering this question, the article works with a more structured research question: *Which are the main approaches for mapping where makers, designers and social entrepreneurs can be found?* Exploring such approaches would enable us to choose the more appropriate strategies for mapping them, possibly quantifying the extension of the Maker Movement, Design and Social Entrepreneurship, and lay the foundations for the further steps of effectively mapping and networking them (and them with designers and social entrepreneurs). Therefore, it would contribute to measuring bottom-up and distributed social and collaborative systems in other contexts, adopting a triangulation of profiles for better understanding actors from different systems.

Strategies for mapping makers, designers and social entrepreneurs

This section represents a first exploration of literature, cases and datasets that represent direct or indirect approaches for mapping where makers, designers and social entrepreneurs could be found. The clusters emerged from the literature review and works on two levels: the first one can be found in the distinction between formal and informal work. On the second level, three clusters represent potential dimensions for mapping: by work, place and community. These are sometimes overlapping or connected dimensions and represent different perspectives for considering how to define the identity of makers, designers and social entrepreneurs.

Formal and informal (social and creative) work

All the mapping approaches documented in this section can be categorized as either a) based on formal definitions (and therefore formal datasets and procedures) or b) based on informal definitions or definitions of informal entities (and therefore informal datasets and procedures or indirect datasets and procedures). By definition the difference between the two categories lays in the existence of and accordance with officially recognized forms, structure or rules for the definitions or not, and in the independent and official and legal nature of the activities or not (Oxford Dictionaries, 2018a, 2018b).

Formal approaches mainly fall into official statistics and their related methodologies for measuring formal economy through employment, unemployment and underemployment. According to OECD[1], employment rates are typically defined as a measure of the extent to which available people to work are in the labour market, calculated as the ratio of the employed to the working age population. As most household domestic and personal services are not produced in the market, there are no market prices that can be used for

[1] https://data.oecd.org/emp/employment-rate.htm

measuring them and including unpaid domestic and personal services produced for own final consumption within households would lead to considering the whole adult population as employed and therefore with no unemployment at all. Unemployment is defined in the labour force framework as an extreme l lack of work, and situations of partial lack of work are normally considered as partly employment, or underemployment. Within formal statistics, population is usually divided into three mutually exclusive and exhaustive categories: employed, unemployed, and people not in the labour force (or not currently active); the first two categories compass the active population.

Formal approaches for identifying makers, designers, and social entrepreneurs could be then based on official statics or on their related methodologies, that explicitly do not consider activities outside the market, for which informal approaches might be more suitable. Conceptually, the "informal economy" is defined as "all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements" (ILO, 2002). More than 60% of the world's employed population earn their livelihoods in the informal economy and it represents more than 90% of Micro and Small Enterprises worldwide. More than 60% of the world's employed population earn their livelihoods in the informal economy and it represents more than 90% of Micro and Small Enterprises worldwide. According to WIEGO (Vanek, Chen, Carré, Heintz, & Hussmanns, 2014), the components used to measure informal employment inside the informal sector is comprised of all employment in informal enterprises, including employers, employees, own account workers, contributing family workers and members of cooperatives. A review of indirect methods includes (Williams & Schneider, 2016):

- the discrepancy between national expenditure and income statistics;
- the discrepancy between national the official and actual labour force;
- the transactions approach refers to a constant relation over time between the volume of transactions and official GNP (Feige, 1989);
- the currency demand approach considers who considered the correlation between currency and tax pressure (Cagan, 1958): this approach assumes that shadow (or hidden) transaction are undertaken in the form of cash payments, so as to leave no observable traces for the authorities (Tanzi, 1999);
- the physical input (electricity consumption method).

The key argument for direct methods is because they provide deeper understanding regarding the structure of the shadow economy, in opposition to indirect methods crude assumptions and that are far for being proven (Thomas, 1992; Williams & Windebank, 1998). In short therefore, as an exploratory analysis of what makes a good measure to identify makers, designers, and social entrepreneurs in the informal economy, the combination of these two main approaches can be suggested:

- A residual approach identifies a part of the population in relation to the total, an objective measurement.
- A multidimensional approach ("multilateral" or "direct methods") is a distributionally-sensitive metric (Alkire et al., 2015) related to normative choices, in terms of dimensions, indicators, weighting, the unit of measurements, and aggregation.

Figure 2: Formal and informal definitions and approaches

Considering the work dimension as a mapping strategy

The work dimension of makers

This dimension is where the new, emerging and under constant changing nature of the Maker Movement is connected to both informal practices and expectations, and forecasting of future working conditions (both formal or informal). If makers were considered as typical manufacturing professionals (just like craftsmen or manufacturing employees) formal jobs could be then easily found with official statistics and mapped accordingly, but the definition adopted here points to more informal profiles. For this reason, the main contributions about the work dimension of makers that were found in the literature review adopted in-depth interviews, focus groups and surveys as the main approach, and therefore are limited in scale and cannot be considered as representative of the whole movement. Joint Research Centre (JRC) provides insights into the expectations of the Maker Movement towards the future of work using eight thematic narratives: Automation, Globalisation, Micro-Factories, Sharing Economy, New Skills, Green Economy, Ageing, and Migration (Valente De Jesus Rosa, Martinho Guimaraes Pires Pereira, & Ferretti, 2018).

The *Makers' Inquiry* investigated the socio-technical and professional dimensions of makers in Italy, with a survey of 134 participants (Bianchini, Menichinelli, Maffei, Bombardi, & Carosi, 2015; Menichinelli, Bianchini, Carosi, & Maffei, 2017). Even with the limits in terms of participants and geographical focus, the research provided insights about at least three interesting issues related to this article. Firstly, it investigated three different profiles of makers: a) makers as technologically advanced people who tend to use digital technologies for communicating, manufacturing and sharing their projects (Anderson, 2012); b) (Indie) Designers: Individual design actors that own or manage all the competencies related to design, production, and distribution processes, thus becoming self-producers (Bianchini & Maffei, 2012); c) managers of Maker Laboratories. Secondly, it showed that regarding the formal working conditions (eg, work contracts) of makers, 38.7% of subjects that are self-employed individuals (with or without VAT), 17.1% have open-ended contracts and 5.2% fixed-term contracts, showing that making is mainly an independent and autonomous activity, a new way of working professionally and not just a hobby, even if a secondary or supplementary activity. Thirdly, there is an interesting overlap between the territorial concentrations of Italian makers within historical industrial districts and urban contexts, contributing an interesting insight: makers could be found within cities, creative and industrial districts.

The work dimension of designers

Given the historical connections of design with industry, traditionally formal work positions are arguably the most proper dimension for quantifying the number of designers. A report published in 2006 by BEDA (the Bureau of European Design Associations) aggregates statistics at national level from European countries and found, overall, a total of 410,000 designers in Europe that generated an annual turnover of 35 billion euros (Design Austria & BEDA, 2006). The report is made from aggregated data from different sources, so it is unevenly structured, and the focus is not only on the number of designers but also to their contribution to national economies. The importance of the contribution of design to business and industry is documented also in the *€ Design | Measuring design value*[2] project that aimed at providing tools for policy makers and decision makers to measure the positive impact of design to the economy. Another recent and relevant example in this direction is the *Design Economy 2018* report published by the Design Council about the state of design in the UK, which found +1,067,600 designers; the report is also relevant for its calculation of the economic impact of design, for the identification of local clusters and for the clear documentation of the methodologies adopted which could be then replicated in other countries (Benton, Miller, & Reid, 2018). At European level, Eurostat collects data about cultural employment by including all persons working in an economic sector defined as cultural, including all occupations relating to culture, finding around 8.4 million people in cultural employment across the EU (3.7 % of total employment)[3].

Data regarding professional designers could be extracted also from other non-official sources, like the Linkedin platform - through the overview page of designers[4], its search results (showing 7,280,175 designers at the time of writing)[5] or with more advanced techniques (Dai, Nespereira, Vilas, & Redondo, 2015). Similarly to the

[2] http://www.measuringdesignvalue.eu/

[3] https://ec.europa.eu/eurostat/statistics-explained/index.php/Culture_statistics_-_cultural_employment

[4] https://www.linkedin.com/title/designer

[5] https://www.linkedin.com/search/results/people/?keywords=%22Designer%22

Makers' Inquiry (and an inspiration to it), the Designers' Inquiry (Cantiere per pratiche non-affermative, 2013) also describes the profiles of Italian designers with a survey. Regarding the work dimension, the majority of them (41.3%) is a freelancer while less than a quarter (22%) is an employee and even less is a studio owner (10.6%); 57.8% of them does not have a contract, 36,4% has a second occupation of which 54,8% is still in the area of design. It is important to note that 48% of the Italian freelance designer does not have VAT, depicting thus the work of many Italian designers as closer to the informal economy.

It is important to mention that designers have often interacted with what is commonly regarded as informal economy (Kaya & Yagız, 2011) in poorer countries, but the presence of informal jobs is clear even in countries with an established design industry like Italy, and not just for designers but also for manufacturers of designers' products in the fashion industry (Paton & Lazazzera, 2018). Home work here is probably caused by the lack of a national minimum wage, the fragmented structure of the sector, the common practice of outsourcing. National statistics estimates that in 2017 there were 3,647 home workers in the manufacturing sector, operating with regular contracts, but other researchers calculate that there are 2,000 to 4,000 irregular ones (Toffanin, 2016). The informal dimension of design is becoming increasingly important with the current trends of design democratisation and the rise of social media (Gerritzen & Lovink, 2010), alongside with the growing ties between design, social innovation, citizen participation (Manzini, 2015). Moreover, the emerging possibilities at the intersections of design with open source, peer-to-peer, decentralised, distributed and diffuse design projects (Abel, Evers, Klaassen, & Troxler, 2011; Menichinelli, 2016a) also enhance the informality of design practice.

The work dimension of social entrepreneurs

In order to identify measurements for mapping professional social entrepreneurs, the Global Entrepreneurship Monitor (GEM) constructed a dataset on social entrepreneurial activities in 49 countries (Lepoutre, Justo, Terjesen, & Bosma, 2013). In an attempt to overcome country-specific definitions and differences in legal status, the researchers used telephone or face-to-face household surveys in the national languages that indirectly (to exclude country-specific legal or bureaucratic definitions of social entrepreneurship) identified social enterprises through questions on the predominance of a social mission with the creation of social value, the importance of innovation by delivering innovative products and services, and the role of earned income. The survey data was then weighted based on age and gender (and education and ethnicity whenever appropriate) to reflect the national population and harmonized with the other countries. The national context plays in fact an important role in shaping the characteristics of social enterprises in terms of sectoral specialisation, funding and employment: among the countries, higher rates of traditional and social entrepreneurial activities are correlated.

Mapping the third sector is a measurement for identifying where social innovations and social entrepreneurs are: for instance, by locating NGOs and Foundations registered in public institutions (Anheier, Krlev, & Mildenberger, 2019). Another possibility can be found in mapping B Corporations, business initiatives that balance profit with social and environmental performance and accountability (Cao, Gehman, & Grimes, 2017; Hickman, Byrd, & Hickman, 2014). Moreover, seeking funding for the idea of the social enterprise might require buy-in from public sector or third-sector agencies whose governance is in the public domain. Therefore, identifying where funding opportunities for social entrepreneurs comes from could be another indirect way of mapping the location of social entrepreneurs.

Considering the place dimension as a mapping strategy

The place dimension of makers

Makers often gather and meet in a series of local laboratories but that are often networked regionally and globally: Fab Labs, Makerspaces, Hackerspaces and so on. These laboratories act as schools, community hubs and professional centres where the Maker Movement has been emerging and building social and collaborative initiatives. The number of these laboratories is always changing, making it difficult to completely track them. However, because they are bottom-up initiatives, several platforms have been established through the years to map them, such as Fablabs.io[6], Hackerspaces.org[7], or the recent list[8] of makerspaces elaborated by MAKE

[6] https://www.fablabs.io/
[7] https://wiki.hackerspaces.org/
[8] https://makerspaces.make.co/

magazine. Such numbers could be a) considered as a proxy of the number of local makers, maybe assigning average quantities or b) each laboratory could be directly contacted to receive a more accurate estimate.

A JRC report was elaborated recently using several sources of data, including some of these platforms, reporting that Fab Labs account nearly for half of the makerspaces in the European Union (48%; 397 laboratories), Hackerspaces are 40% (327 laboratories) and then there are other type of laboratories for 12% (102). The average number of makerspaces per country is 29.5. France, Germany and Italy represent 53% of the makerspaces within the European Union (Rosa, Ferretti, Pereira, Panella, & Wanner, 2017).

The place dimension of designers

In a similar way, the number of designers and their distribution could be either estimated or asked directly to design schools and design businesses. The 2006 BEDA report (Design Austria & BEDA, 2006) provides some numbers regarding schools and design businesses, but it is unevenly structured, so more organized and complete databases should be found or created for this task.

A global list of art and design universities is maintained by the Cumulus International Association of Universities[9], which lists 286 members from 57 countries in 2018[10]. The DESIS Network is a network of more than 40 Design Labs based in design schools and in other design-oriented universities and operating with local, regional and global partners that connects designers and social entrepreneurs and aims at using design knowledge to co-create social innovation initiatives (Cipolla, 2018). The different clusters (food, ageing & ingenuity, distributed and open production, city-making, public & collaborative, etc) help to map how design for social innovation and sustainability is being built in theory and practice. The Service Design Landscape[11] is a research project developed by Politecnico di Milano and addressed to the forthcoming students of service design: a crowdsourced online map, lists 192 higher education programmes, 420 consultancies, 53 research centres.

The place dimension of social entrepreneurs

Depending on the business life cycle or specific needs, social entrepreneurs can rely on different physical spaces for developing their ideas and initiatives, which can then work as entry point for mapping the geographical distribution of social entrepreneurs. Coworking, incubators and accelerators are typical examples of place dimension for social entrepreneurs. Several coworking act as spaces for social entrepreneurship, where ideas are advanced through collaboration. Impact Hub[12] is the largest network focused on building entrepreneurial communities for impact at scale; it reports more than 100 locations in more than 50 countries, for a total of more than 16,000 members. The Centre for Social Innovation[13] is a coworking space, community, and launchpad for people who intend to change the world, and it operates nearly 100,000 square feet of space and supports more than 1,500 members by providing the spaces and tools they need to succeed more quickly and to have a far greater impact.

Considering the community dimension as a mapping strategy

The community dimension of makers

The social and collaborative nature of the Maker Movement has the consequence that the community dimension is relevant and present in different ways, at least on three levels: 1) a global community of local events and laboratories: the global Maker Movement, Fab Lab network, and so on; 2) local communities that form in and around local laboratories; 3) the communities that form around the development of projects, especially the ones that are shared and developed openly as Open Source Software, Hardware or Open Design, which then become community-based initiatives.

On the first level, a global community can be analysed and quantified through the analysis of social media platforms like Twitter (Menichinelli, 2016b); or through the analysis of specific platforms of the Maker Movement like Thingiverse, the most popular platform for sharing and downloading 3d printable models (Özkil, 2017; Voigt, 2018). Such analysis typically involves not only the quantification of users, labs and

[9] https://www.cumulusassociation.org/homepage/what-is-cumulus/
[10] https://www.cumulusassociation.org/homepage/members/
[11] https://www.servicedesignmap.polimi.it/
[12] https://impacthub.net/
[13] https://socialinnovation.org/

projects, but also of their connections and interactions through a social network analysis approach, resulting thus also an exploration of the social dynamics and structure emerging from makers and building the context for their work and further interactions and dynamics. Furthermore, such analyses are also able to quantify the output of such communities: the number of designs, innovations, collaboration and so on, providing thus a step towards understanding also their value generation and impact.

On the second level, local communities that form in and around local laboratories such as Fab Labs have been analysed especially through ethnography: a more qualitative approach, but also able to shed light about the dimensions of a local community and potentially also of its evolution over time (Ghalim, 2013; Maldini, 2014).

On the third level, the communities that form around the development of open source projects are often analysed in terms of their social structure, providing an overview of the outcomes generated by social networks of interaction (Bonvoisin, Buchert, Preidel, & Stark, 2018; Menichinelli, 2017). The participation in open and collaborative projects provide data and methods for assessing the geographical location of the participants: inferring locations from the top-level domains of participants' email addresses; self-reported locations or time zones of developers on platforms like GitHub; self-reported time zones (Gonzalez-Barahona, Robles, & Izquierdo-Cortazar, 2016; Takhteyev & Hilts, 2010). These approaches have enabled researchers to investigate geographic and organizational of projects (Bird & Nagappan, 2012), the impact of location over acceptance of individuals' contributions (Rastogi, Nagappan, Gousios, & van der Hoek, 2018) and the effect of geographic distance on social relationships (Heller, Marschner, Rosenfeld, & Heer, 2011).

This social dimension can be also considered as the context for research that aims to uncover the phenomena of lead users or user innovators (be them firms or individual consumers): consumers who develop or modify consumer products (von Hippel, 1988, 2005). These can be considered also as relevant for the Maker Movement, especially for their tendency to develop and share innovations freely, without intellectual property rights and with grassroots innovation processes (von Hippel, 2016). Research initiatives along this direction were able to estimate, with phone surveys and a database of consumers, the number of consumer-innovators aged 18 and over in UK (2.9 million), USA (11.7 million) and Japan (3.9 million) and their expenditures, which is sometimes larger than the expenditures of traditional firms (von Hippel, Ogawa, & PJ de Jong, 2011). It is also important to note that the work of lead users and consumer innovators is not only related to products and technology, but it extends from them to social innovation when coupled with Technological Reflectiveness (TR) (Schweitzer, Rau, Gassmann, & van den Hende, 2015), with the commercialisation of products and services for social purposes with social enterprises (Koers-Stuiver & Groen, 2015), with their connection with participatory design (Morjaria, Ross, & May, 2013) and service design for sustainability initiatives, like the research that originated the DESIS network (Meroni, 2007).

Research on lead users and consumer innovators has developed several rigorous approaches for mapping, identifying and reaching them. The first and most common approach is through mass screening of entire populations (a parallel search strategy) with written, phone and online surveys; the inefficiency of this approach and its requirement of a specific and established population have pushed for the introduction of new methods. One of them is broadcasting, where experts self-select according to their expertise after an initial communication of the problem, in a process similar to crowdsourcing (Jeppesen & Lakhani, 2010). More advanced methods work on the social dimension of lead users: one of the main methods is pyramiding (a sequential search strategy, where improvements can be done between iterations), a variant of snowball sampling, a process based upon the exploration of social structures where participants, thanks to their expertise, identify other participants to be contacted (von Hippel, Franke, & Prügl, 2009). Lead users have also been studied in terms of their position in social networks and commonly found in-between different social groups (Kratzer, Lettl, Franke, & Gloor, 2016). More recently, these approaches have been extended to online communities and digital methods, thanks to their flexibility and to the vast amount of accessible data, for example with netnography approaches (Belz & Baumbach, 2010), with focus on a single social media platform like Twitter (Pajo, Verhaegen, Vandevenne, & Duflou, 2015) or multiple social media platforms (Tuarob & Tucker, 2015). A further evolution of this direction can be found in digital anthropology, which allows a better accountability of the data through triangulation of different sources (Sánchez, Giacalone, & Goduscheit, n.d.).

The community dimension of designers

Considering designers mainly as professionals, within the scope of this article, their community dimension mainly consists of a) association professionals or online or b) global or online communities.

There are several associations of design professionals, mainly working at national or regional level, that promote their members and their interests and therefore typically maintains a list of their members and sometimes of their projects: each could be contacted, the gathered data organised in a coherent way for all of them. Examples can be found in the Italian association ADI (Associazione per il Disegno Industriale, founded in 1956), which claims to have more than 1,000 members[14] and maintains also a database of their projects, registered as an IP protection strategy. AIGA (American Institute of Graphic Arts, founded in 1914), a US-based professional association for design, comprises of more than 70 chapters and more than 25,000 members, that are listed in the Designer Directory[15], a database that allows search for AIGA members by name, location and/or area of practice. Furthermore, AIGA suggests searching for designers by browsing their AIGA Member Portfolios, posting a job or internship on the AIGA Design Jobs board or by contacting an AIGA local chapter. IDSA (Industrial Designers Society of America, founded in 1965) is an association dedicated to industrial design and consists of a network of Professional Chapters and Student Chapters in the United States, organised into five Districts based on geographical region[16].

More recently, global associations have emerged thanks to digital platforms and thanks to the now global extension of the design discipline, especially regarding more recent fields: IxDA (Interaction Design Association, founded in 2003), is a global network of more than 100,000 individuals and over 200 local groups dedicated to the discipline of interaction design[17]. SDN (Service Design Network, founded in 2004), is an online platform dedicated to connecting service designers, with 42 local chapters and 1,381 registered users[18]. Continuing this trend, from national official associations to global online organisations, now digital platforms are increasingly emerging for the promotion of designers with the sharing and discussion of projects like Behance (Halstead, Serrano, & Proctor, 2015; Kim, 2017). Such platforms might be easier to for accessing data and analysing it but represents a different way of community-building: fewer official organisations, less interest in collective political discussion, promotion and lobbying and more on individual or professional promotion.

The community dimension of social entrepreneurs

A range of social innovation organisations has emerged to network social entrepreneurs. Ashoka cultivates a community of change leaders that collaborate to transform institutions and cultures around the world, so that everyone can be agents of positive social transformation. Ashoka has elected more than 3,500 fellows from 92 countries, and the community of its fellows has been analysed (Meyskens, Robb–Post, Stamp, Carsrud, & Reynolds, 2010). Social Good Brasil[19] exists to enhance human skills and exponential technologies so that more people and organizations act to solve society's problems. It is made up of organizations and individuals who are protagonists in creating, collaborating and sharing innovations. here are 59 fellows, and 130 local and international mentors. SIC (Social Innovation Community)[20] is a Horizon 2020 Programme funded project that aimed at exploring relevant topics for researchers and setting out a roadmap for the future of social innovation research. Over 350 representatives from over 19 EU countries have played a role in co-producing a vision and 10 policy ideas related to the theme. The DSI Digital Social Innovation initiative[21] has been developed by several European organisations and currently has 1,440 projects and 2,230 organisations related to fields such as education, healthcare, democracy, environment, and employment.

Conclusions

This article presents a first exploration of literature review, datasets, different cases (digital platforms, organisations, research projects) that shows how the social and distributed design systems of makers, designers and social entrepreneurs could be mapped. These contributions work with formal and informal definitions, procedures, sources, and with direct and indirect focus at different granularity levels: country, region, city, organisation, and project. Adopting these approaches would bring closer the formal and informal

[14] http://www.adi-design.org/associazione.html
[15] https://www.aiga.org/designer-directory
[16] http://www.idsa.org/communities/districts
[1717] https://ixda.org/community/local-groups/
[18] https://www.service-design-network.org/community
[19] https://socialgoodbrasil.org.br/
[20] https://www.siceurope.eu/
[21] https://digitalsocial.eu/

nature of such actors, since makers are still informal actors, designers are increasingly becoming informal through freelancing, and the use of digital platforms is becoming an unofficial community space and source of data. Therefore, it is not a surprise that contributions regarding Lead Users are probably the ones with more experience and richness: they bridge the gap between amateur and professional, between bottom-up and top-down. After a first manual clustering of the contributions, several common approaches can be identified, be them existing formal or informal sources, or research methods to be applied (figure 3):

- data from traditional official organisations (public, associations, networks, businesses);
- surveys, interviews, ethnography;
- data mining of social media services and digital platforms;
- places related to actors' education, work, and their community hubs;
- methods based on the social structure of these systems (pyramiding, social network analysis).

This article is the starting point for a simple framework for future research on social and distributed design systems, and both the three profiles (makers, designers, social entrepreneurs) and the three dimensions (work, place, community) should be further investigated in depth. This exploratory analysis should be transformed into a more in-depth analysis; approaches and literature should be expanded, datasets checked, organisations contacted, their data evaluated in order to compile a more rigorous list of compatible approaches and how they could be integrated. Missing or not easily accessible datasets should be investigated and published openly; data should be made coherent among countries and at global level, and geographical differences between developed, developing, emergent countries should be weighted, analysed and highlighted. Future research should address these limitations and provide more coherent approaches and datasets: it should investigate how much these approaches influence the definition of the actors, their understanding and promotion. The social, economic and political dimensions of these approaches and therefore of the representations of the actors and of their social diversity should be considered: gender, ethnicity, language, race, religion, sexual orientation, cultural beliefs, age, class and the intersectionality linked to these social identities. These datasets and approaches are contributing towards a further definition of designers, makers and social entrepreneurs: such definitions are now temporary, and future research should address this topic more, with both data-driven and design-driven approaches, for example by clustering data with machine learning algorithms or with a research through design approach (Redström, 2017).

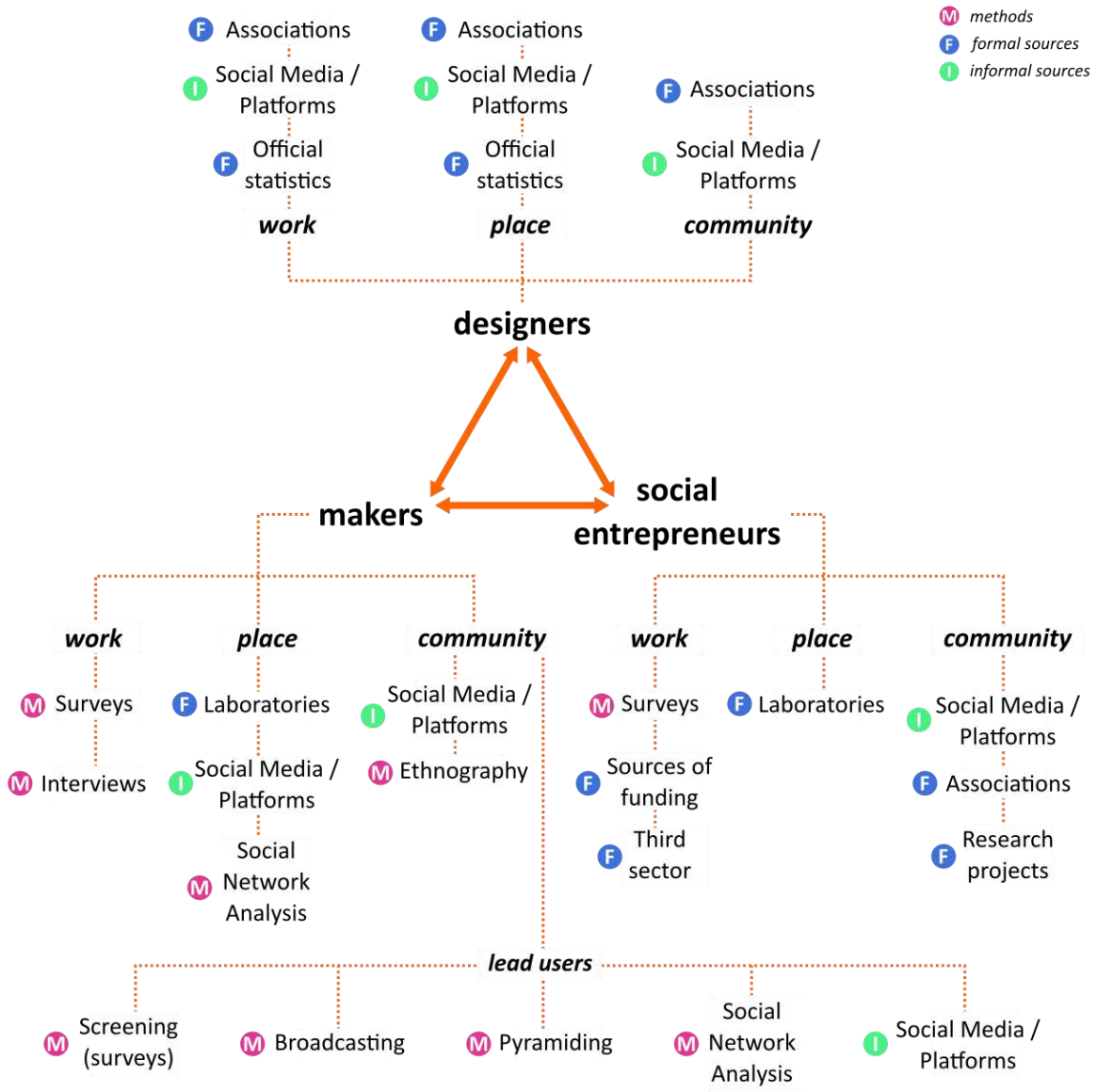

Figure 3: The main contributions for mapping the actors of distributed, social and collaborative systems

One of the consequent next steps would be to define a set of approaches and adopt them for creating a global dataset of the distribution of these actors at country and regional level, besides the creation of a simple multi-composite index that would then convert several measurement into a simple 0-10 scale for easy visualization and communication (OECD & JRC, 2008). Such index, a SDD Index (Social and Distributed Design Index) could then be used for comparison with other indexes, for example of well-being indexes (OECD, 2011, 2014) or the Digital Social Innovation (DSI) Index (Bone, Codrina, & Stokes, 2018). Moreover, the knowledge and insights that can be generated from such dataset or index could be the starting point for further studies, for example the measurement of generated financial value, employment and social and environmental impact, for example by connecting it with the metrics of the Sustainable Development Goals (SDGs).

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Retail designers often emphasize the importance of creating stores that consumers will find attractive. This paper challenges that commonly held view, presenting empirical results from a field experiment showing that a positive rating of a store interior does not affect the product rating to the degree expected. This paper proposes a method for measuring spillover effects, which ordinarily take place without conscious attention. The method was applied in an experiment where 50 shoppers were asked to rate six fashion products in three differently designed stores. Respondents were asked to rate stores and products from within the stores. Any discrepancy between the in-store ratings can be interpreted as the influence of the store design. Results indicate measurable spillover effects from store design to product preference. Surprisingly, however, only one of the three stores showed a significant correlation between the respondents' highest product rating and store preference.

Keywords: Retail design, store design, retail atmosphere, field experiment, consumer preference

Introduction

Throughout mankind's history, architectural spaces intended to enhance a particular experience account for significant expenditures of both effort and resources (Gehl 2011; Lawson 2001). It is also widely acknowledged that physical surroundings have an effect on not only our feelings and behavior, but also on our experience of other objects or entities in that environment, be they works of art, music, or artifacts (Clark 2006; Damasio 1995; Frijda 1989). Retailers are well aware that store environments have an influence on consumer behavior and emotion, and as a component of a marketing strategy often devote considerable resources to designing stores that display their products. Stores can be designed in countless ways, so what should the retail designer's priorities be, if the goal is to create store environments that attract consumers and sell products?

Philip Kotler (1973) was among the first researchers to acknowledge the effect of store design. He introduced the term 'atmospherics' to denote the intentional control and structuring of environmental cues. Since that time, scholars have undertaken various studies on atmospheric variables in retail spaces (J. A. Bellizzi, Crowley, and Hasty 1983; Donovan et al. 1994; A. M. Kent and Kirby 2009; Spence et al. 2014; Turley and Chebat 2002; Turley and Milliman 2000). In spite of these efforts, we know surprisingly little about how consumers are actually affected by a store design as a whole. Consumers are seldom asked to provide feedback about their experiences of store designs. Even when they are, this feedback is of questionable reliability, since most people are simply not able to articulate how an interior environment affects them, let alone their perception of products within that environment. At least some portion of atmospheric effects take place without conscious attention, and this circumstance casts a shadow over direct interrogation as a method of data collection. Previous research has addressed how context can affect product perception and refers to

this phenomenon as a ‘spillover’ effect (Hagtvedt & Patrick 2008; Leder et al. 2004) yet scholarship investigating the spillover effect from store design to product perception is meager at best.

This paper describes first of all a study design for measuring the extent to which store preference spills over onto product preference, and then compares this measurement with respondents' explicit impression of the store design. The method is tested in a field experiment conducted in three fashion stores with contrasting interior designs. In the experiment, the store design preferences of 50 shoppers are correlated with their product preferences within the three stores. Data from the experiment shows that a spillover effect from store design onto product preference is in fact measurable. At the aggregate level, product preferences are indeed supported by highly rated interiors. But analysis of ratings taken from within each of the three interiors separately reveals interesting differences. By virtue of repeated individual measurements carried out in the three different settings, we can see that the supporting effect of a highly rated store interior is present in only one of three test stores. No significant connection between store preference and product preference is identifiable in the two remaining environments. These results and their implications lay the groundwork for a theoretical discussion about spillover effects from within the context of retail design.

The following provides a brief introduction to existing studies on retail atmospherics and the perception of designed environments. We discuss literature supporting the contention that interior spaces affect product perception, and also describing the fact that environments are largely experienced unconsciously and how this complicates studying their effects. Following this we describe our methodological approach, document the field experiment, and then present and compare the results. Finally, the paper ends with a discussion of the theoretical, methodological, and managerial implications of these findings, and proposes areas for further research.

Background

Studying Store Atmospheres

A number of scholars have studied the effects of individual atmospheric cues in store design. The literature is replete with studies investigating atmospheric variables such as sound (Knoferle et al. 2012; Milliman 1982; Morin, Dubé, & Chebat 2007; North, Sheridan, & Areni 2016; Yalch & Spangenberg 2000), color (J. A. Bellizzi, Crowley, & Hasty 1983; J. a. Bellizzi & Hite 1992), odor/scent (Chebat et al. 2012; Herrmann et al. 2013; Spangenberg, Grohmann, and Sprott 2005), lighting (Areni and Kim 1994; Custers et al. 2010; Quartier, Vanrie, and Van Cleempoel 2014), and indoor climate (Frontczak & Wargocki 2011; Zhao, Kim, and Srebric 2015). But atmospheric cues are never experienced in isolation. Recently, scholars have begun to suggest that studies taking a more holistic approach to retail environments should provide a more realistic assessment of their effects on consumers (Baker et al. 2002; Ballantine, Parsons, & Comeskey 2015; A. M. Kent & Kirby 2009; van Rompay et al. 2012; Spence et al. 2014).

Several circumstances stand in the way of studying variables in store environments with any precision. First of all, as mentioned above, consumers do not experience individual cues in isolation, but rather experience the store environment as a whole (Ballantine, Jack, and Parsons 2010; Ballantine, Parsons, and Comeskey 2015; Mattila & Wirtz 2001). Moreover, store atmospheres are created as backgrounds for merchandise, and the influence of the atmosphere is largely experienced without conscious attention. Consumers do not enter a store to evaluate its interior, or to consciously identify qualities that attract their attention (Newman and Foxall 2003). The effect of the retail interior can therefore be difficult to verbalize and recall (Donovan & Rossiter 1982). Consumers come to stores to shop, and their attention is normally focused on the products, and not on the interior design. For these reasons, the use of direct interrogation as a method for studying retail atmospheres is problematic at best. To counteract the effects of quickly fading memory, measurements in any such study should be taken as closely as possible to the time and place of the shopping experience, and preferably from within the store itself, so that the influence of the environment is still in effect (Donovan & Rossiter 1982). Control of multiple variables also presents a challenge for researchers. Some studies approaching atmospheric cues holistically do exist, but most are made in artificial settings where variables are easier to control. Research shows, however, that people behave and react differently in an artificial setting than they do in a 'real life' setting (Frijda 1989; Groeppel-Klein 2005; Lynch, Jr. 1982; Tversky 2008). A subject's simple awareness of being in a laboratory or other artificial setting shifts his or her consciousness, and therewith any response he or she might give. In reality, a consumer’s experience of a store

consists of a blending of sensory effects, a commingling that is difficult if not impossible to achieve in artificial settings. This seems a strong argument for studying customer experiences in real shops, despite the problems presented by their complexity.

A small group of scholars have indeed braved these challenges and executed holistic studies of store atmospheres in real shopping environments. Ballantine et al. (2015) made on-site interviews to analyze atmospheric cues in store environments, while both Kirby and Kent (2010) and Petermans, Kent, and Van Cleempoel (2014) used photo-elicitation, where respondents are shown photographs of a store environment, to better understand how atmospheric cues are interpreted by consumers. This method provides a visual representation of the environment as a whole, and therefore to some extent represents the actual store atmosphere. Studies like these provide a good beginning to the study of consumers' store experiences from a more integrated perspective. Still, a significant problem is common to the method of these studies, and one that potentially clouds their results. This problem is that direct interrogation necessarily triggers respondents' reflection upon their own reactions, which colors the nature of their responses. In addition, interrogation presupposes respondents' ability to express how a store design affects them, when in fact this ability varies considerably among individuals. Actual experiences of interior spaces are immediate and take place without much conscious reflection. We therefore believe that we should not limit our investigations to respondents' conscious expression, but incorporate unconscious effects, which the respondent might not be able to articulate. We will expand upon these ideas, and how we approach this conundrum, in the following sections.

Beauty and Judgment of Store Designs

Most people will be able to recall the sensation of entering an architectural space that incites a bodily reaction, or perhaps even feelings, like happiness, excitement or fear. Most people can also recall a particular store where the atmosphere created a particular feeling, without being aware of what it might be that gave rise to that feeling. It is well known that variables like figural goodness, contrast, repetition, symmetry, and prototypicality influence aesthetic judgments (Kubovy 2000; Leder et al. 2004; Martindale & Moore 1988). It is also well known that aesthetic judgments are individual and depend on a person's memory, knowledge, experience and personal taste (Leder et al. 2004; Reber, Schwarz, & Winkielman 2004). Thus, the impact of a store design is highly context-dependent, and inevitably associated with a consumer's personal experiences of the individual store (van Rompay et al. 2012).

In order to investigate whether a consumer's appreciation for a store design affects their perception of the products in it, we need to be clear about what we mean. In the title of the paper we use the word 'beautiful,' which can mean many things. Studies of beauty are rare, perhaps because the concept is so difficult to define precisely, changing as it does according to time and place. A preponderance of the beauty studies that have been carried out are associated with Gestalt theorists such as Rudolf Arnheim (1974) and Ramachandran and Hirstein (1999). Aesthetic experiences are often supposed to be experienced intuitively. Asking people to articulate such experiences will usually receive a reply reflecting a rationalized version of what is assumed to be 'good taste.' For this reason, researchers rarely ask respondents to comment on 'beauty' or 'good taste' per se. Instead, most researchers focus on attributes like figural goodness, pleasantness, liking, or preference. The argument is that eliciting such simple judgments makes it is possible to identify the basic processes or modifying variables that underpin aesthetic experiences (Reber, Schwarz, & Winkielman 2004). Judgments based on the question 'how much do you like this interior?' are therefore believed to be closely related to how beautiful or aesthetically pleasing an interior is in the eyes of the respondent. For our purposes, we will define beauty in the following way: a subjective experience of pleasure produced by products/interiors and not mediated by intervening reasoning. This formulation hews closely to definitions of aesthetic experience used by Kubovy (2000); Martindale and Moore (1988); Reber et al. (2004) and Leder et al. (2004). This study is therefore designed around the question 'how much do you like this store/product?' which was used to elicit and determine respondents' expressed preferences.

Searches of existing literature did not reveal studies where preference for store design is studied in relation to product preference.

Objectives

With the abovementioned literature as a background, we propose studying retail atmospheres from a practical and process-oriented perspective, using actual customers' in-store preferences and behavior as indicators. Research investigating atmospheric cues in this manner is limited, as mentioned above, and where it does

exist, employs a predominantly qualitative approach. We contend that atmospheric cues are largely perceived unconsciously, and that qualitative methods using direct interrogation as a method of data collection are therefore inadequate. To address this deficiency, this paper proposes a method for discovering the extent to which expressed store preference spills over onto product preference, without bringing respondents' conscious attention to the store interior.

Tools for studying a store interior's effect on consumers should be of great interest to both retailers and design managers, both of whom have obvious interest in determining whether their designs are properly matched with their targeted market segment. The uncertainty surrounding how a design is perceived by consumers is often pointed out in design and marketing literature; designers, it is usually argued, are the ones who should both know and be able to realize the consumer's needs. John Heskett (2005), for example, acknowledges the conflicting imperatives between a company and the users of its products, and describes how the role of design needs to be understood as providing a bridge between them. Philip Kotler (1973) underscores the relevance of the designer's understanding of the consumer by drawing a distinction between intended and perceived atmosphere. Kotler defines the intended atmosphere as the set of sensory qualities that the designer of the store means to invoke, while the perceived atmosphere is the sensory qualities experienced by the consumer. As a further complication, perception can of course vary significantly from one consumer to the next. Further still, designers are employed by clients who typically bring their own perceptions and intentions to bear on the situation (Haug & Münster 2015; T. Kent & Stone 2007). Considering all these complicating factors and interests together, it becomes obvious that a reliable method for understanding how designs are experienced subjectively would be of indisputable value to decision makers at every level in the field of retail.

In order to delimit the study, we will focus our attention on the variables controlled by the designer: namely, layout, furniture, decoration, and display (Haug & Münster 2015). Using this method, we are able to investigate whether different store characteristics affect individual consumers' product preferences and determine the extent to which a highly rated store designs affects ratings of products inside the store. A strong correlation between store design preferences and merchandise preferences would indicate that interviews might in fact be a sufficient method of data collection; a weaker correlation would indicate, conversely, that perhaps this data is not as trustworthy as we'd like it to be.

Research Methodology

Experimental approach

The experiment was designed to investigate whether an interior, that a respondent has expressed a preference for, has a positive influence on the respondent's perception of the products in that interior. In order to determine this, various measurements from each participant were needed. The experiment was therefore designed to collect data indicating (1) each participant's preference for products rated in a neutral setting and (2) each participant's preference for products rated from within the different interiors, (3) each participant's preference for the interiors.

Ratings were measured for each individual. Preferences depend on individual factors like cultural and biological background, education, and personal experience (Kubovy 2000; Leder et al. 2004; Martindale & Moore 1988; Reber, Schwarz, & Winkielman 2004; Thurstone 1928), which makes aggregated data less useful. Each consumer is unique, in other words. Despite the fact that many marketing scholars study consumers by grouping them together at the aggregate or market-segment level, we contend that considering consumers as individuals will grant access to potentially latent information. The experiment was therefore designed first to take individual ratings, and then analyze this data to identify patterns and structures in the population (Krackhardt 1992; Wright 1997). The first part of the study was designed to measure the influence that the interior has on the product when presented in the store — the so-called spillover effect. The second part of the study was designed to measure an explicit preference, or lack thereof, for the store interiors. Comparing each respondent's expressed preference for a store with his or her highest rated product will tell us whether the product is indeed more highly rated in an interior that the respondent likes.

To measure the unconscious effects that interiors might have on products, it was deemed necessary to avoid drawing attention to the interior. To avoid undue reflection, respondents were asked to rate products while physically present in three different test stores. Respondents were therefore influenced by the interior

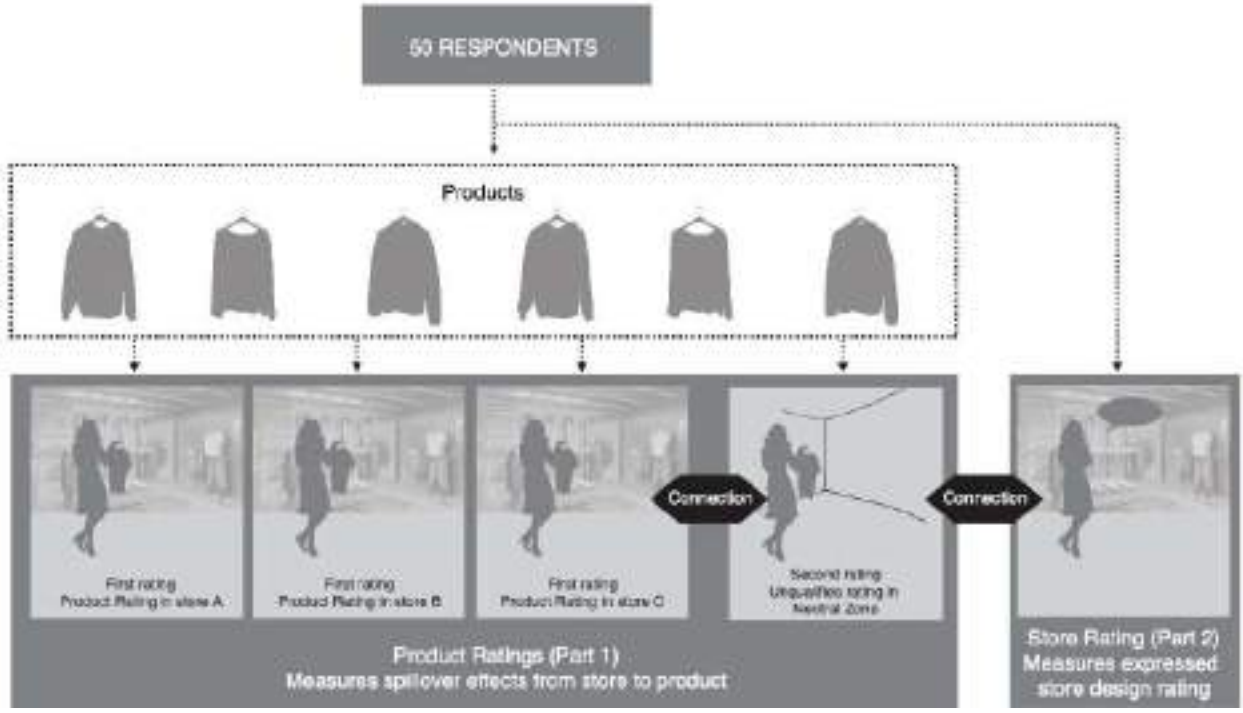
and its various cues, without knowing that the stores were the real subject of the questioning, and not the products.

Ratings were collected using a touch screen tablet which showed photos of the products taken in the respective environments, such that the hanger and background was visible in the photos (Photo 4). Preference for the products was indicated on a visual analogue scale (VAS) using rated, paired comparisons (Wright 1997). Moving the cursor left or right from center, the respondent indicates which of two products he or she prefers, and the relative strength of that preference.

Photo 4. For each pair of products, the respondent is asked to indicate his or her preference by moving the cursor on the visual analogue scale to a position that reflects the degree of preference to the products shown.

To add a control product rating, respondents were then taken to what we will call a neutral zone, outside the influence of the three test interiors. Here respondents were allowed to examine the products more closely, before rating each product again. Product ratings were again collected on a touch screen showing a photo of the product and a visual analogue scale running from 'I don't like at all', on the left, to 'I like very much', on the right. Respondents were asked to indicate a preference for the products by moving the cursor left or right of center. Any discrepancy between in-store product rating and product ratings given in the neutral zone is, we contend, attributable to the influence of the interior: the spillover effect (Model 1).

In the second part of the study, the same respondents were asked to observe the store interiors and rate them according to their personal taste. These ratings were once again collected on a touch screen tablet, which showed a photo of the store from the perspective where the respondent was standing with the researcher. Above the photo was the question: 'How much do you like this store?' and below, a visual analogue scale with 'I don't like at all' at the left endpoint and 'I like very much' on the right. Once again, the respondent was asked to indicate how much he or she liked the store design by moving the cursor left or right of center.



Model 1. In the first part of the study the products are rated inside three different test stores and in a neutral zone. In the second part of the study the design of the test stores is rated.

Comparison of results from part 1 and part 2 should indicate the level of correspondence between a respondent's expressed preference for an interior and that interior's spillover effect, if any, on the respondent's product preferences (Model 1).

Stimulus Selection

Before carrying out the experiment, field studies and interviews with retailers and retail designers were conducted in order to locate suitable test stores. The three test stores selected were in close proximity to one another, which was considered ideal. This would allow the researcher to guide respondents though the different environments without encountering additional, unintended atmospheres, which might influence respondents. The experiment was conducted in a European mall in 2015. The first 20 tests took place in February, the next 20 in March-April, and the last 10 in May. Respondents were actual customers who had entered the stores to view, try on, and potentially purchase the displayed fashion items, and were recruited upon leaving the store. The researcher explained that the experiment involved rating different products in the store.

Test Stores

Test environments were similar in size (between 31-39 m2), room height (4,5 meters), light intensity/quality, sound, and odor, in order to remove the influence of variables that are not always controlled by the retail designer (Haug & Münster 2015). Quantity of products displayed, and price level were also comparable between all three test stores. As mentioned above, it was deemed important to use test stores which were in close proximity to one another, in order to reduce the influence of external factors during the experiment. The test site was in fact a single men's store consisting of three separate in-shops, each specifically designed for three different men's fashion brands. Most importantly for our purposes, the design of each of the three in-shops was easily distinguishable from the other two. Furniture, wall coverings, floor materials, decoration items, brand images, hangers, and collections; each of these had its own separate identity in each of the shops. We will hereafter refer to the test environments as Shop A, Shop B and Shop C (Photos 1-3).

Shop A had a modern, industrial, bright appearance. All surfaces were white, and metal is a consistently used material. Shop B was characterized by a vintage look using different natural surfaces: brick-

walls, wood, and metal with a distressed or patinated look. Finally, shop C had a classical, elegant look resembling a formal men's wear department from previous decades.

The neutral zone was located in continuation of the fitting room area, which was shared by the three stores. While it is implicit in our premises that no interior space is completely neutral, what is meant by this is an interior whose atmosphere is outside the purview of this experiment. The interior of the area in question was, however, monochrome and dark, with no decorations or other products on display.



Photo 1 (left) shows Shop A, photo 2 (in the middle) shows Shop B, and photo 3 (right) shows Shop C.

Test products

Six men's tops were selected as test items. All items were priced from 40 to 55 Euros, which also corresponded to the mean price level for similar items in these stores. The same six products were presented in all three test stores and in the neutral zone, so it was necessary to use several copies of each product. Products were presented on front sticks on wall furniture, such that the front of the product faced the customer, and all six products were placed so that they could easily be seen from the center of the store, where the interview would take place. None of the test products were a part of the collections featured in the shops at the time of the experiment, but they were placed among the current collections as though they were. All items were presented on specially made hangers belonging the stores where they were displayed.

Participants

Of the 50 respondents, 31 were men and 19 were women, aged from 15 to 49 years.

Study

Pre-tests

Five pre-tests were conducted at the test site, in order to determine whether the test was comprehensible to participants, and to fine-tune the procedure. Evaluation of the pre-tests resulted in some slight adjustments to the procedure before proceeding to the 50 actual tests, which are included in this paper. In the pre-test, the six product combinations were presented in the same order in all three shops. Respondents understood the procedure easily enough but were confused by the realization that they were seeing the exact same products in each of the environments. In order to ameliorate this unsettling effect, we changed the order of the combination of products from store to store, to reduce this predictability. We also decided to inform participants at the outset of the interview that they would be presented with different fashion items, and that some of the items would be presented several times.

Procedure for Product Ratings (Part 1)

In-store Product Ratings

As a warm-up to the rating procedure, each respondent was shown a test sheet to familiarize them with the task. On a test screen, each respondent was asked to indicate his or her preference between two products on a visual analogue scale.

First, the researcher walked the respondent into shop A. While standing in the middle of the store, the researcher presented the respondent with two products at a time, asking the respondent to compare them (Photo 4). The researcher then presented the touch screen with photos of two products in the setting and asked the respondent to indicate his or her preference by moving the cursor to a position that reflected a degree of preference. The six paired comparisons were (product left, product right) ~ {(1,2), (2,3), (3,4), (4,5), (5,6), (6,1)}; this comprises the statistical design set. Next, the researcher escorted the respondent into shop B, where the procedure was repeated, this time with the products in a different order. The same procedure was then repeated a third time in shop C, with yet another ordering of products. The statistical design set was identical in all three shops; the comparisons were merely shown in a different order in each location. Data collected in this phase will be referred to hereafter as 'Product Ratings' or 'In-Store Ratings'.

Photo 4. In the stores, the research assistant presents the respondent with two products at a time and asks him to compare them.

Results and Discussion - In-store product ratings

The paired comparisons method allows us to determine not only how many respondents prefer, for example, product 6 over product 5, but also reveals the relative strength of the preference for each single respondent. Accordingly, separate preference structure for the six products and for the three stores, were calculated for each respondent. Product ratings were converted into numbers, one for each comparison, using the following method: The distance from the middle of the scale to the mark noted by the respondent was measured, positively to the right and negatively to the left. The observations are denoted $y_{i,j}$, $(i,j) \in D$. It is assumed that the numerical score will increase with the strength of preference for one product over the other product, and that equal but upper site preferences would correspond with equal but upper site ratings. For each subject and each room, the six comparison ratings, $y_{i,j}$, $(i, j) \in D$ were combined into a metric rating scale. Therefore, for each subject and for each room, there exists six γ's; $\gamma 1$, $\gamma 2$, $\gamma 3$, $\gamma 4$, $\gamma 5$ and $\gamma 6$, corresponding to the six products, so that the expected value, $E(y_{i,j})$, of $y_{i,j}$ has the form $E(y_{i,j}) = \gamma_j - \gamma_i$. The estimation of the γ's is performed using the least squares method. Preference-scores for the six products are calculated as: scores for product $i = \exp\{\gamma_i\}$.

Because respondents did not rate products individually, but as paired comparisons from within each space, the experiments and data from each of the test sites can be considered independent of the other two. It was therefore decided, that the importance of maintaining a natural flow from one space to the next outweighed the minimal risk of a mere-exposure effect, where a respondent might come to like a product or products more by being shown it multiple times.

Unqualified Product Ratings

In order to determine each respondent's product ratings when not influenced by the test atmospheres, respondents were then escorted to the neutral zone, where they rated each product individually. Chronologically, the neutral setting phase took place after the store ratings to allowed as much time as possible to pass between the two rating phases. In the neutral setting, ratings were collected using a VAS with the parameters 'I don't like at all' on the left, and 'I like very much' on the right. These ratings will be referred to in what follows as 'Unqualified Product Ratings.'

Results and Discussion - Unqualified Product Ratings

Each respondent's unqualified product ratings were converted into numbers by measuring the distance from the middle of the scale (0) to the mark noted by the participant. Positive scores from 1 to +50 to the right of zero and negative scores -1 to -50 to the left of zero. Products with high scores were considered to be products for which the respondent had a high degree of preference or liking.

Consumers buy products they like. To give focus to the results, it was decided to isolate the highest-rated product for each respondent. This was determined by locating each respondent's highest unqualified product rating. This product will hereafter be referred to as the respondent's 'Favorite Product'. Having established each respondent's favorite product, it was possible to compare the three in-store ratings for that product. Fig. 1 shows the ratings given for the favorite products in all three stores. The results show that favorite products on average were rated rater homogeneously in the three stores: The favorite products were rated highest in Store B (mean score 19.8), lowest in Store A (mean score 18.0), and slightly higher in Store C (mean score 18.3).

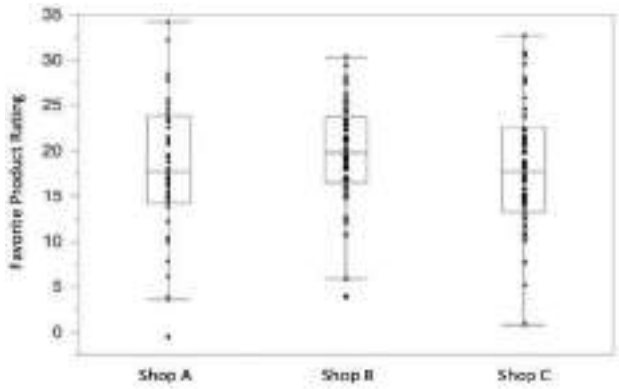


Figure 1. This Box-Plot covers each respondent's Favorite Product rating in store A, B and C.

However, when directing the focus on the one store where the very highest in-store rating of the favorite product was given, a more nuanced picture comes to view. Fig. 2. shows the highest in-store rating for each favorite product. Considering favorite product ratings in all three environments, shop A had the lowest impact on product ratings. In contrast, when isolating the store environment where the favorite products were rated the very highest, differences occurred: The mean score given in store A is now the highest (25.8) but is based on only 9 responses. The mean score in store C is almost as high (25.2), and is based on 13 responses, while the mean score in store B has gone from highest to lowest (21.7), but is based on a much larger sample size, namely 28 responses.

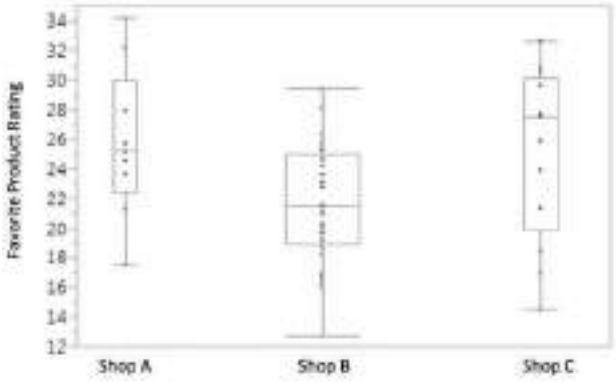


Fig. 2. This Box-Plot covers the highest in-store rating of each favorite product.

These two analyses show that we can in fact observe a measurable spillover effect from store design onto product ratings. We can see that the majority of favorite products (28 of 50) are rated most highly in store B, while relatively few respondents (9 of 50) rated their favorite product highest in store A. However, favorite product ratings given in store A are discernibly higher than those given in the other environments. This is a compelling observation, showing that the proposed method allows us to understand specific tendencies within a population, which might be of interest to retailers and design mangers. If, for example, the group of respondents who rated their favorite products highest in store A turned out to be trendsetters or very loyal customers, design managers could make a solid argument for paying more attention to the ratings given by this group of respondents in particular, and for paying more attention to design cues in this specific setting. Thus, data collected using this method can describe and differentiate tendencies that might otherwise be obscured by aggregate methods, and thereby form the basis of new design strategies.

Favorite products are now established, and it was indicated how the different store environments impacted the ratings. But in order to answer the question 'Do consumers rate products more highly when they are presented in stores which they find attractive?' we will need to compare product ratings with ratings of the interior spaces themselves.

Procedure for Store Ratings (Part 2)

After rating the products in the stores, but before rating the products in the neutral zone, each respondent was returned to the stores, one after the other. At the entrance of each store, the researcher asked the respondent to look into the store and describe the interior of the store in their own words. This task was intended to focus the respondent's attention on the environment, as opposed to the products. These responses were typed by the researcher on the touch screen. For example, one respondent gave the following description of store A: ‘white, cold, modern’; while another respondent used the words ‘industrial, factory, bright’. Next, respondents were asked to rate each interior according to his or her personal taste. These ratings were taken on a VAS where ‘I don’t like at all’ appeared on the left extreme, and ‘I like very much’ on the right. These ratings will be referred to in the following as ‘Store Ratings.’

At the end of the interview, respondents were asked to provide their gender and age, and finally asked whether they would ever consider buying clothes from any of the stores in focus. The purpose of the last question was to eliminate participants who might have been in the stores for reasons other than shopping. This information was also typed on the touch screen and stored along with the data for each individual.

Results and Discussion - Store Ratings

Store ratings were converted to numbers by measuring the distance from the middle of the scale (zero) to the mark noted by the respondent. Positive scores (to the right of zero) from 1 to 50 were marked to the right of the midpoint, and negative scores (to the left of zero) from -1 to -50 to marks placed on the left. A high score was interpreted as a high degree of preference or liking for that store. Fig. 3 shows store ratings for all respondents. Store B (mean score 30.1) and store C (mean score 30.8) were rated highest, while store A (mean

score 21.1) was rated lowest (fig. 3). Store C was not only rated highest, but respondents were more closely in agreement in their ratings of store C than store A.

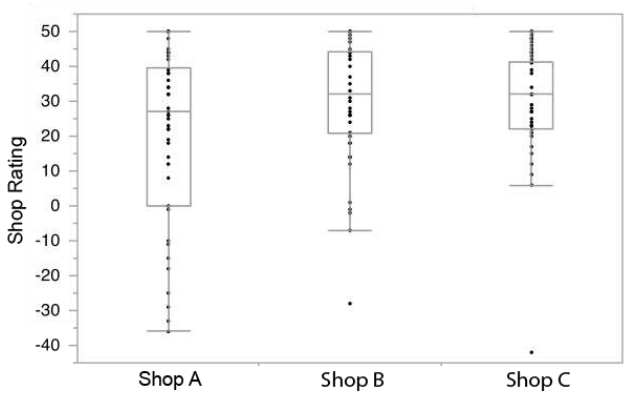
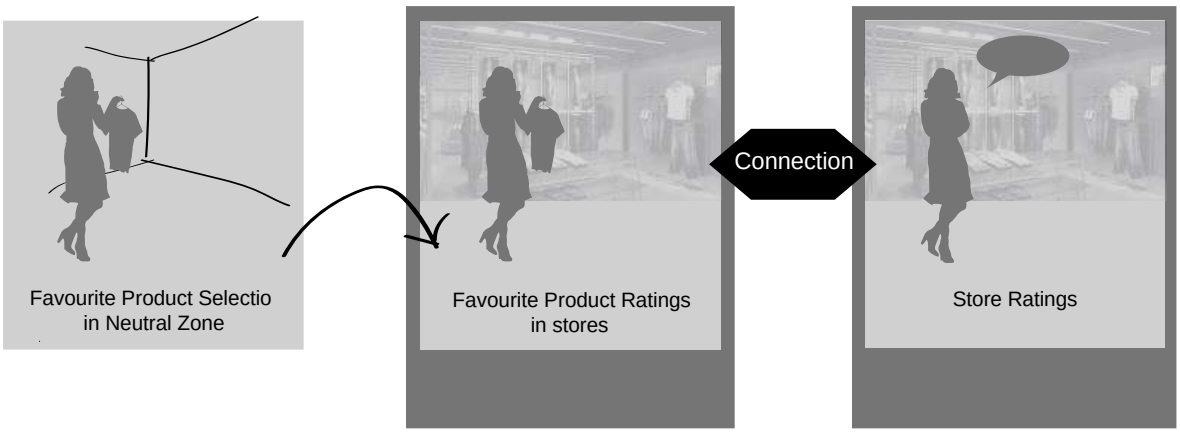


Fig 3. Box-Plot of the expressed store ratings for store A, B, and C.

Interestingly, store ratings fluctuated widely between the different periods of data collection. Notably, shop A's rating ranged from a mean rating of 11.7 in the first period to 30.8 in the second, and 21.5 in the third. The mean ratings of shop B and C were more consistent throughout. Since the only change in the stores from period to period was the product collections and their presentation, we surmise that these variations are the result of changes in product presentation. For example, during the first period shop A contained some discounted products, and the merchandise varied more than during the second period, where a professional merchandiser had just organized the collection, which might have left the store with a cleaner impression. This suggests that it is not advisable to evaluate store design in isolation, since stores atmospheres are always subject to some degree to the collection of products displayed within them. Products should therefore always be a part of any evaluation of a store atmosphere.

Comparing Product Ratings and Store Ratings

To find out whether a highly rated store design has a corresponding effect on product perception, the task remains to correlate favorite product ratings with store ratings (model 2).



Model 2. Favorite products were selected, and the study was delimited to focus on in-store ratings of favorite products and store ratings.

Each respondent reported three store ratings, and three favorite product ratings, one from each of the test environments. Linking store ratings with in-store ratings of favorite products in aggregate, we see a significant correlation (p = .001) (Fig. 5). However, if we consider the ratings given inside each store separately, differences occur. For example, comparison between favorite product rating and shop ratings from shop A for the same respondent reveals a positive correlation ($p < .001$) (Fig 6). But the same comparison for shop B shows a statistically insignificant correlation, $p = .206$ (fig. 7), and shop C also shows an insignificant correlation of $p = .708$ (fig. 8).

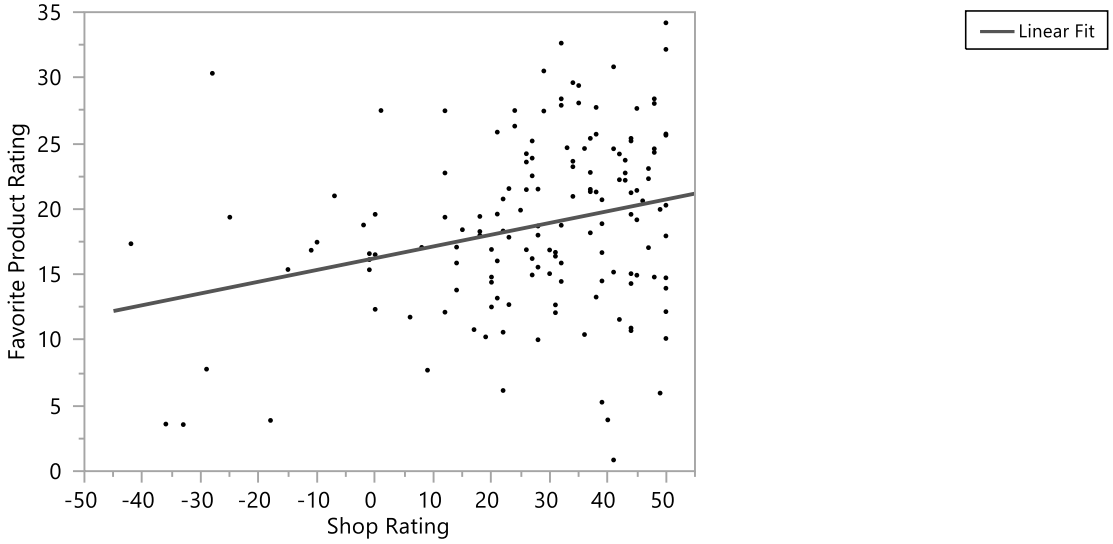


Fig 5. Correlation between Favorite Product Ratings in all stores against Shop Ratings. Linear Fit, Favorite Product Rating = 16,240478 + 0,0895712 x Shop Rating.

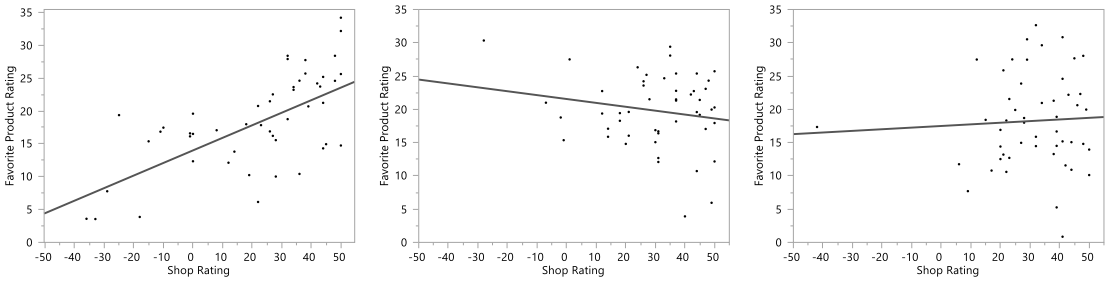


Fig. 6. Left. Significant correlation between Favorite Product Ratings against Shop Ratings in shop A (p < .001).
Fig. 7. Middle. Insignificant correlation between Favorite Product Ratings against Shop Ratings in shop B (p = .206).
Fig. 8. Right. Insignificant correlation between Favorite Product Ratings against Shop Ratings in shop C (p = .708).

In other words, taken in aggregate, a highly-rated store design seems to correspond with product ratings. But isolating the stores makes it clear that some designs influence product ratings more than others. In fact, only in the case of shop A a statistically significant correlation is found between favorite product rating and shop rating. Interestingly, shop A scored lowest among the three interiors in terms of its mean shop rating, (fig. 3), which seems to indicate a discrepancy between consumers' expressed preference for a store environment and that same environment's effect on their responses, at least measured in terms of product preference.

Conclusion and General Discussion

The review of the literature revealed a gap in scholarly understanding of whether a so-called spillover effect exists between store design and product preference. Given that interiors affect people in ways that they cannot necessarily articulate, this study's primary objective was to propose a method for determining whether store design preference spill over onto product preference in a measurable way, and to do this without bringing the respondent's conscious attention to the store interior. A field experiment was designed to

establish the extent to which a preference for three differently designed fashion stores affected the rating of fashion products from within those stores. Results from this project have theoretical, methodological, and managerial contributions to make. Each of these will be discussed separately below. Briefly: on the theoretical level, we expand theories dealing with the supportive aspect of retail design, and spillover effects; methodologically, we contribute to the study of the unconscious effects of interior spaces, and underscore the value of considering consumer data on the individual level as opposed to the aggregate; managerially, this project has implications for design managers and retailers, who can begin to understand the importance of how their designs are experienced by actual users, and how they might go about gathering this valuable information.

Theoretical Implications

The present study shows that individual consumers do indeed rate the same products differently in different contexts. From this we can conclude that there is a measurable spillover effect from context to merchandise, and that this effect has a relation to the design of the interior. Considering respondent data in aggregate, a significant correlation between preferred store design and product preference exists. But considering results from the individual test stores shows that store preference supported favorite products with statistical significance in only one of three stores. Thus, a well-matched interior design can have a supportive or enhancing effect on product preference. Results also indicate that the existence of a supporting effect from an interior is not something that the average consumer is aware of. The store that influenced the product ratings most positively, store A, was not the store that consumers rated the highest in aggregate; stores B and C were both rated higher, in fact. In other words, the enhancing effect does not necessarily go hand-in-hand with preferences that consumers express, which suggests that the practice of relying on consumer opinion, or on direct interrogation as a method of inquiry, should be viewed with circumspection.

Methodological Implications

Methodologically, the approach used in this study allowed us to investigate the extent to which atmospheric context and cues affected specific product ratings without directing the respondents' attention to the contexts themselves. Results showed a measurable effect. Repeated individual measurements enabled studying how each product's ratings were affected within various interiors, a methodological approach that made it possible to measure how much a particular store design influenced specific product ratings. This information cannot be gleaned from studying average or aggregated ratings. Focusing on favorite products revealed that most participants rated their favorite product highest in store B, but that the mean product rating in store B was lower than that in both store A and store C. In this way it is clear that our method of data collection and analysis allowed a more nuanced picture to emerge. Such information could enable decision-makers to define more specific consumer segments, allowing them to target these in productive ways.

Aggregated results indicated a positive correlation between store preference and product preference. On the surface, this seems to indicate that customers did in fact rate products higher in shops that they liked. But our individual measurements enabled the analysis of data from each store separately, which revealed that the effect was produced by only one of the three interiors, shop A. This observation underscores the risk of treating the average customer as representative of the market as a whole.

Managerial implications

The research presented here has several implications for retail and design managers. First and foremost is valuable information about how individual consumers experience retail environments, and how to access this information, which can be of obvious benefit in making strategic decisions about store design. For example, is it more profitable for a given brand to create a design that will appeal strongly to a smaller group of highly engaged customers, or is a broader, more lukewarm appeal to a larger consumer segment the better approach? In this regard, shop A was an interesting case: Individuals who preferred shop A also rated their favorite products higher in its interior. In fact, this effect was strong enough to have a significant effect on the average of all three stores. We can safely conclude that shop A's interior did indeed have a positive influence on product preference. Interestingly, shop A scored the lowest store rating of the three stores, which seems to indicate that managers should be very cautious about relying on consumer interviews to gather information about a store design. A qualitative study of the respondents who were most positively affected by shop A might reveal a small group of enthusiastic individuals, who lifted the average disproportionately. If these

specific consumers turned out to be just browsing and not willing to buy, an argument could be made for ignoring them. If, on the other hand, they turned out to be trendsetters, or loyal customers, a solid argument could be made for paying greater attention to their preferences.

Another observation that might be relevant for practitioners is the fact that the same stores were rated differently during the course of the data collection period. Since the store design was not changed during that period, this indicates that stores are perceived differently according to the products on display. In other words, the current collection and the presentation of the merchandise can significantly impact the overall impression of a store design. This is clearly relevant for design managers to bear in mind when evaluating store design concepts. The appearance of a store design cannot be considered in and of itself, as products themselves are an important part of the equation.

Limitations and further research

The method proposed and applied in this study has advantages and disadvantages. Advantages include the fact that real-life studies of store environments provide a more realistic assessment of their effects than artificial settings (Baker et al. 2002; Ballantine, Parsons, and Comeskey 2015; A. M. Kent & Kirby 2009; van Rompay et al. 2012; Spence et al. 2014). Disadvantages include the complications involved with performing research in actual stores, where control of all variables is difficult. Our research team faced challenges in controlling the location of the test products during the experiment; shoppers could—and did—walk away with test items when the researcher wasn't looking. Results also showed variations in store ratings among the different periods of data collection, which could indicate that the store environment as a whole is affected by changes in collections and displays. While this type of variation can be controlled in a laboratory setting, they are impossible to eliminate completely in a real-life, operating store environment. Furthermore, the possibility cannot be eliminated that respondents were distracted in one way or another during the experiment, and the possibility therefore exists that such distraction may have influenced the ratings to some extent. Having said these things, the state of mind present in an actual shopper in an actual store cannot be reproduced in an artificial setting, where the respondent will always know on some level that he or she is participating in an experiment.

Apart from these inherent complications, the following limitations deserve mention. First, the results are based on a field study with three stores, six products and 50 participants. The differences in the design between the three test stores were big enough that a difference was discernible, but it is conceivable—perhaps even likely—that bigger contrasts and wider stylistic variation would produce even bigger contrasts in the results. Next, none of the test products were part of the current collections; they were instead displayed as single items blended in among the collection itself. This somewhat artificial circumstance could also have had an influence, providing a clue for respondents that something was unnatural about the situation. We believe that possibility to be negligible for the results, however, since the same situation obtained in all test stores. But one possibility for making the experiment more realistic would be to select test products from the current collection in the test store(s). Doing so would also make it possible to record respondents' buying intentions in the different stores, which the present study did not address. It would certainly be relevant to know how many of the respondents actually purchased products from the study, with a view to finding out whether a threshold seems to exist where like equals buy. This data would be of obvious interest to retailers. Finally, the study was based on data from one mall, which introduces a geographic and cultural limitation; it was furthermore limited to respondents who were already in the stores, and therefore provides no information about potential customers.

With this background, we can suggest several directions for further research. First of all, it would be useful to establish a connection between highly rated stores and increased sales. Our study indicates that positively rated store atmospheres do in certain cases enhance product ratings but does not establish whether a highly rated store increases sales. Next, additional research on the particular environmental qualities or atmospheric cues that serve to amplify product evaluation is needed in order to determine whether other factors, apart from liking a store design, are at work. For example, it might prove interesting to employ our method to ascertain whether qualities like friendliness or exclusiveness have an influence, or whether specific interior styles affect preferences for specific products. It might be, for example, that specific kinds of atmospheric cues produce a feeling of well-being in consumers, that in turn creates a positive effect on their responses to products in that store, without giving them any explicit preference or liking for the interior itself. Additional research, including more complex, combinatorial studies, is needed in order to categorize the relevant influencing factors and their degree of influence.

The method applied in this study attempts to isolate unconscious effects that spill over from an environment onto objects within that environment and juxtaposes these results with evaluations of the interior gathered by direct interrogation. Combining this type of study with more detailed explicit responses from consumers might produce a more nuanced account of how specific design cues are interpreted, whether the effect is conscious or unconscious, and to what extent. In this way, the method used here can be applied to other variables in order to determine which, if any, variables are more important for consumers. With further development, the method could become an effective aid in choosing between different design solutions. Rapid developments in virtual reality technology make it easy to imagine applications of this method as a tool for choosing between highly detailed interior drafts. Use of methods like the one proposed here in a virtual setting would allow testing of interiors at a much earlier stage, which could save a great many resources.

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The Semantics of Design and Why They Matter

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Understanding the value of design in industry is a contemporary issue both in academia and industry. Many studies have been conducted using historical data, macro-level indicators, questionnaire-based tools, and abstracted post-hoc accounts of the value of design. However, very little research attempts to uncover direct insights from real-world practical experiences of designers in industry and how they negotiate the design-value space. This study uncovers rich qualitative, pragmatic considerations of how the value of design is operationalized in situ by design practitioners in industry through a series of 6 in-depth interviews. Initial results indicate that different designers undertake a series of different context-dependent strategies: these range from changing the narrative of the contribution of design based on the KPIs of the audience, to taking a non-action stance allowing for consequences and pressure from external stakeholders to help drive design in practice, as well as performing “designer-ly” activities under a different alias.

Keywords: Design, Value, Value of Design

Introduction

Over the years there have been several attempts to understand, measure and communicate the value of design to business in both industry and academia. Even though this is a contemporary topic, little progress has been made, as the mechanisms of operationalizing and mobilizing the value of design are still widely under-researched (Braga, 2016). Existing literature in this space comes from a variety of fragmented fields including design studies, design management research, economics, management, marketing, engineering, human computer interaction and information technology. A majority of the work that has been done in this space focuses on empirical studies that rely on questionnaire based tools, study macro-level indicators, and reflect on abstracted post hoc accounts of the value of design. To complicate matters further, there is no consensus on the semantics of design, its definition and how it manifests in organization (Heskett, 2005). Many design practitioners still struggle to explain their roles and justify their value within the organization (Heskett, 2005, 2017; Preece, Rogers, & Sharp, 2015) to corporate executives and management. There has been some shift in how design is perceived in organizations with even C-suite positions such as the Chief Design Officer, and design verticals being created. This focus however comes off as tokenistic to most wider organization audiences, who still do not fully understand the value of design and associate it with their own understanding of what design means to them, which can mean a multitude of things. Instead of evaluating the value of design by imposing a priori definitions and concepts of measurement as done in previous studies, this study aims to understand emergent behaviours and strategies adopted by design practitioners in situ to operationalize, mobilize and communicate the value of design to their daily work. We attempt to uncover deeper insight into how the design-value space is currently being negotiated and traversed, and how we as a community can look to learn from and rethink our approach to measuring and communicating the value design.

Attempts to measure and understand the value of design in academia date as far back as three decades (Dumas & Mintzberg, 1989; Hart, Service, & Baker, 1989; Walsh, Roy, & Bruce, 1988) but to this point have been unable to make a lasting impact on mainstream industry and practice. In industry leading business consultant firms today continue to publish reports that try to explain the business value of design (Warwick Business School & Design Council, 2014; PricewaterhouseCoopers, 2017; Accenture Strategy, 2016; Design Council, 2018; McKinsey Design, 2018). The widespread promotion of 'design thinking' as a strategic tool in industry has spearheaded a revival of the role of design in business (Dunne & Martin, 2006; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). This has gained significant traction through the help of evangelism of firms such as IDEO, and the establishment of institutions such as Stanford's d.school and Hasso Plattner Institute (Brown, 2009; Camacho, 2016; Johansson-Sköldberg et al., 2013; Kelley, 2001). Design has been widely acknowledged by its evangelists as a competitive instrument (D'Ippolito, 2014; Hertenstein, Platt, & Veryzer, 2013; Heskett, 2009, 2017; Roy & Riedel, 1997; Verganti, 2003). Design management literature primarily focuses on the role of designers within organizations (de Mozota, 2003; Verganti, 2003)and how design can drive radical innovation in industry (Norman & Verganti, 2014; Verganti, 2008; Verganti & Dell'Era, 2009). However even with all the positive sentiment attributed to design there are still many challenges faced when attempting to convince conservative business management of its value as a necessity and not merely a nice-to-have luxury.

Defining design

One of the biggest challenges with trying to measure and communicate the value of design is that there is no universal consensus on its definition. It means different things to different people in various contexts (Heskett, 2005; Love, 2002). Designers therefore seem to find it difficult to explain what it is that they do to people outside their field. There also seems to be an unspoken, unwritten expectation, that all designers understand design, therefore whenever someone is talking about design they should be talking about the same thing. So one could consider that designers never really have to explain to each other what design is, therefore they are not practiced enough to deal with the outside world when it comes to explaining themselves. Many competing attempts have been undertaken to define design (Ralph & Wand, 2009) but the field remains far from adopting any of these definitions with consensus. A persistent difficulty relates to the fact that no definition circumscribes all of ways that the term is employed in vernacular use. Heskett (2005) suggests that "*design sits uncomfortably between […] two extremes. As a word it is common enough, but full of incongruities, has innumerable manifestations, and lacks boundaries that give clarity and definition. As a practice, design generates vast quantities of material, much of it ephemeral, only a small proportion of which has enduring quality.*" As there are a multitude of manifestations of design, there will be many who are interested in the term but little agreement to what it actually may mean. So design may be defined by the very popular, almost canonical definition of "*Devising courses of action aimed at changing existing situations into preferred ones"* (Simon, 1968) or as abstractly as "*The performing of a very complicated act of faith*" (Jones, 1966). Studies exploring the definition of design cover over 42, very unique definitions of the term, all meaningful in their own way (Jones, 1992; Ralph & Wand, 2009).

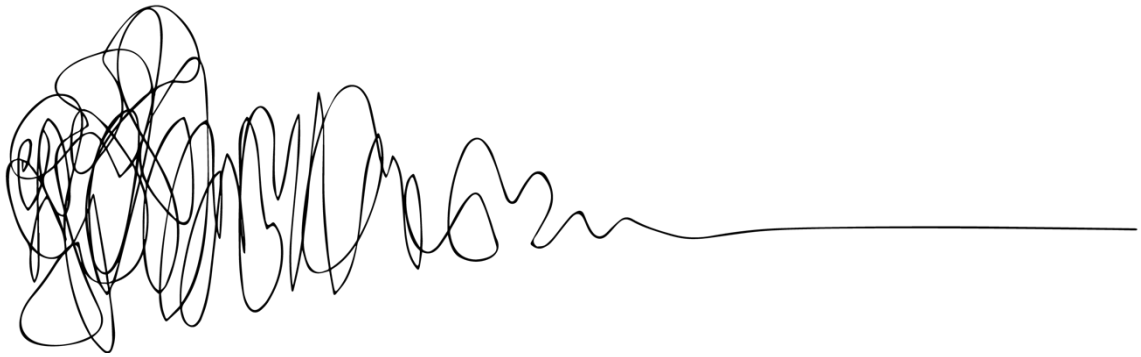

Figure 1 Design Process by Damien Newman (https://thedesignsquiggle.com/)

The semantics of design

There are a number of related difficulties with design as a subject matter for research that we can discern.

Basic Semantics

A unique challenge that comes with the word design is how it can be used as so many different parts of speech, all grammatically correct, yet conceptually distinct. Heskett, (2005) illustrates this complexity with his very famously quoted, seemingly non-sensical but grammatically sound sentence "*Design is to design a design to produce a design.*" Design (noun), the concept or field, is to design (verb) the action or process, to design (another noun) the concept or proposal, to produce a design (yet another noun), the final product or realized output. In order to know what in particular is being called out by use of the word "design", we need to be mindful of the many ways it can appear in parts of speech, and to which of those senses it is currently being employed.

Family resemblance | process variance

There is also variance in manifestations of design as a process, which is similar to the notion of 'family resemblance' concept discussed in '*Philosophical Investigations*' (Wittgenstein, 1968). While any two design processes may share one or more manifestations, there is no single or determinate set of manifestations that would be common to all design processes (Walker, 1989). Our ordinary language criteria for applying the word "design" to any particular case is not predicated on there being a particular characteristic of that case that demands (or licenses) our use of that term (see Figure 2). If design is a family resemblance concept, this means that every attempt that has been made to define, or draw a sharp boundary around, our use of the term cannot both include all cases in which design would ordinarily apply, and exclude all cases where it would not. Definitions such as Simon's (1968) while clear, appear to include any human conceptual problem solving activity (including e.g. solving maths puzzles), and appear to exclude any design project in which designers do not have to deliberate new "courses of action" in order to bring about a new product or system.

Qualifiers

Similarly adding an adjective to design i.e. a prefix, a moderator – significantly changes what the term design might be doing or referring to. So while Industrial design is very different from textile design or interaction design, each of which may still have some semblance of commonality on some specific aspects, but wide divergences in other respects. Beyond different disciplines or domains of design, though, design has innumerable other modifiers as well. For instance, many different kinds of things can be designed: physical design, process design, service design, experience design, application design, event design etc. While some disciplines have particular emphases on some of these "objects" (in the grammatical sense) of design, e.g. industrial design traditionally emphasizes the physical, material, or tactile, there is no doubt that industrial designers are also engaged in designing experiences through products and systems.

Output variance

Additionally, there is further complexity even within the same sense of design on account of the fact that no two iterations of design processes which have been run following the exact the same procedures will result in the same output. Nelson & Stolterman, (2003) have discussed this aspect of design as the "ultimate particular"—that in many cases the point of design approaches, and one of their distinguishing characteristics, is that they result in novelty, not the reproduction of identical results. Furthermore, the outcome of one design process may result in more innovative solutions that can lead to an increase in user satisfaction; or on the flip side it may lead to cost savings. However both conditions may be mutually exclusive, and do not always intersect. The point is that we cannot use any predetermined outcomes of a design process as a means of identifying that process as design.

Popular culture

There are often certain narrow characteristics of design that as a result of popular culture or media have become more widely attributed to design such as aesthetics or graphics, which somewhat permeates what the concept as a whole entails, particularly when it is being discussed with those who are not very familiar with the field of design. This is something we encountered in our study.

Abject breadth of design

Heskett, (2005) comments on how it is interesting that design can operate as something very inconsequential and banal, but at the same time be very profound and meaningful. He sees this as an inherent characteristic of design, unlike many other concepts.

Needless to say, for reasons such as these design is challenging to study systematically, and it can be difficult or ill-advised to extrapolate measures or "findings" from one study to another. This is because simply any particular aspects of the multi-faceted phenomena of design that have been chosen to be brought into focus in any one study are selective, and rarely consistent across studies. While this study is not intended to act as a semantic analysis of how design is used in language, nor a genealogical exploration of the term over the years, it is important to understand how practitioners and industry understand it, to trace some of the many ways the value of design has been understood. Therefore it is argued that the semantics of design are important to understand, in order to comprehend how the design-value question has been addressed and answered in practice and research.

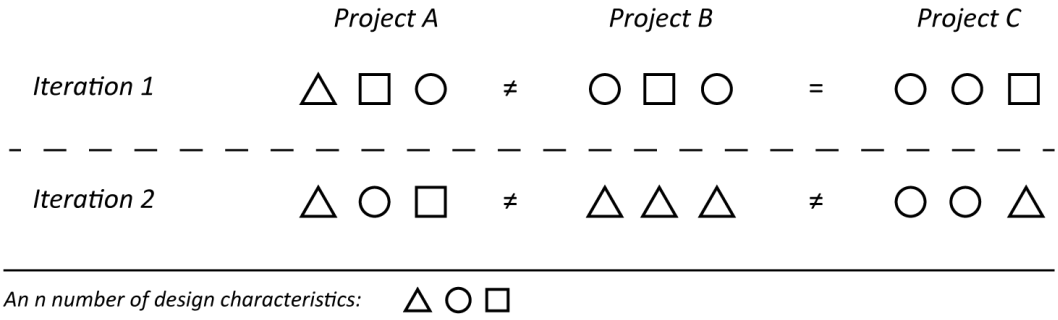

Figure 2 An illustration of the family resemblance concept w.r.t. the manifestations of design characteristics over multiple iterations of the same projects

Measuring design

Existing studies have attempted to create a wide range of measures of the value of design, but the range of these approaches is evidence of the disputed nature of the phenomenon. Practitioners themselves also struggle to explain what it is that they do, and what value that they bring to most of the organization. This raises a number of questions. Were the efforts in the previous studies made to explain and understand the value of design both in academia and industry insufficient? Is the impact that design makes to organizational performance not evident / visible? Is there something unique and distinct about design as a function, area of expertise that requires for it to find new and more convincing arguments for existence? Are design skills so overtly generic and non-specialized that just about anyone can be a 'designer', therefore there is no need to have a title ascribed to the practitioner of the field? Are the indicators used to measure design not representative of its presence? Or is it that designers are just terrible at communicating what it is that they do, and so are unable to convince anyone of what value they bring?

The value of design often manifests in ways that are tacit, intangible, and subjective – in turn making it difficult to measure (Dorst & Cross, 2001). Concepts such as gross value added (GVA), triple-bottom line, as well as service usability index have all been used to measure the design in action (Løvlie, Downs, & Reason, 2008) with the argument that as there is no direct financial metric relationship to quantify design, the context and actors dictate what is meaningful for measurement. Other studies have attempted to develop scorecards that can be used to gauge the value of design (Beltagui et al., 2008; Moultrie & Livesey, 2009; Westcott et al., 2013). That said the transient nature of design and its complexities are unable to be meaningfully positioned and captured in studies that analyse macro-level indicators and industry trends which are distilled into simple abstractions of value, such as for every "*£1 invested in design you get £4 profit"* (Design Council, 2007). If we look at design through the lens of the family resemblance concept (Wittgenstein, 1968), where any two design processes may share one or more manifestations, there is no single or determinate set of manifestations that would be common to all design processes; using the same tools (metrics, questionnaire-based instruments, pre-populated categorizations etc.) would be inadequate to measure the complexity of design. Good design of

physical artefacts is generally invisible to us, in that we mainly notice breaches in our expectations of how things should work as highlighted by Heidegger via Winograd, Flores, & Flores, (1986). The same holds true for intangible aspects of designer-ly actions such as well considered design processes, practices and actions. In the same light, if good executions of design become harder for us to locate and observe, they also become harder to measure. It is therefore asserted that the identification of design as a phenomenon is a problem of a wicked nature (Rittel & Webber, 1973).

Design disclaimers

When studying the value of design, there are two very important caveats to be cognizant of: i) Not all designers are the same, there are different types of designers, who understand and practice design differently. Having the label of the designer does not necessarily entail that one is in essence performative of designer-ly actions. This can be attributed to a multitude of reasons, ranging from everything from formal education in this space, practical experience, to others just adopting the label and taking on the mantle of a 'designer' for political expediency. ii) not all design is equal. Just because a thorough design process has been conducted does not mean that anything has necessarily improved, or value has been added. Naturally, there is a great deal of 'bad design' in existence. Design as a practice, even with all the potential benefits it may bring to organizations, is not the be all end all of improving business performance. Design is messy, it is practical, and it resides outside of the polished models and frameworks that project it as a simple process with predictable (and guaranteed) outcomes.

The social construction of the value of design

Design is seen as a social phenomenon (Bucciarelli, 1994; D'Ippolito, 2014; Suchman, 1987), that is situated within a given context and whose meanings are derived from the interaction with the space and actors – it thrives through social interactions (Petroski, 1985)

.Therefore it is imperative for us to explore how the value of design is constructed within the political, practical, and social landscape, between design practitioners and other actors in the workplace, and not just reduce the value to purely quantitative indicators. Therefore this study takes a slightly different approach to current attempts, and tries to uncover social conventions, behaviours and actions of designers in practice as evidence of how the value of their contributions to design are articulated and understood. This is based on the idea that if we as researchers have access to the rich and full complexity of design in action, why rely on historical data to attempt to explain what we can be observed in the present? i.e. the present is the best representation of itself (Dreyfus, 2002); and can provide us with a surfeit of rich contextual data that can help us construct meaning. This approach does not in any way attempt to take away from the body of work in existing literature that looks at understanding the value of design using historical, post-hoc data, but instead tries to further it, by trying to uncover the rich layer of contextual, social, practical considerations that are in place in situ by real world practitioners. Adopting this approach to study the value of design gives insight into previously unexplored spaces, and may help further extend our understanding in ways previous models were unable to.

Study Design

This study takes an empirical approach to understand how the design-value space is negotiated by practitioners - exploring how the value of design is understood, communicated and operationalized in industry. This orientation to the study design as a socially situated construct borrows from Mills's (1940) treatment of *motive* in his paper "Situated actions and vocabularies of motive." We consciously move away from the a priori understanding of constructs of design, instead focus on a socially situated, practiced, and observable design that may be interpreted and analyzed in light of the conditions it exists in. A series of 6 semi-structured, one-to-one interviews was conducted, with a purposeful convenience sample of participants who self-identify as design practitioners. On average the interviews lasted 37 minutes, with an open-ended discussion between the researcher and participants. There was no particular order to the discussion but guiding questions were asked to scaffold the discussion and prompt discussion. Questions started by trying to explore how the participants associated to design itself, *What kind of design title if any do you associate with yourself?* This was followed by exploring aspects of *How is design generally understood within the organization?* Leading into some of the more interesting probing questions of how the value proposition of design is operationalized based on audience, asking *How do you describe design to another designer?* and *How*

do you describe design to a non-designer? This then circled back into *how the value of design is communicated within the organization and what challenges if any are faced in doing so?* The idea behind the questions as a whole was to provoke discussion on how the value of design is understood, defined and communicated by participants within industry and explore what is the prevalent contemporary role of design within an organizational setting. This would also provide a window into how practitioners negotiate this discussion in their daily practice, as well as give insight into any emergent behaviour, actions and strategies that are used.

Table 1: Participant Information

#	*Self-identified design title*	*Response to "Describe design to a non-designer"*	*Years in industry*
A	User Experience Designer	*Design is what make makes [the best] sense of things*	0.5
B	Graphic / User Experience Designer	*Well what kind of design do you mean?...I think of it as something was designed a certain way so someone found a problem and created a solution for it and that is what design is I guess*	4
C	Product Designer	*I make products easy for people to use… that's easy for them. So I don't tell them it's graphic.. I just say if you use an app, I make it easy for you to use, more relevant for you, more easy for you to use. So I just make it simpler. I know it covers the usability part of it but that's the easiest way I could find to explain to them because if I go in more detail they assume its graphic related. So I really struggle at that point. So in layman terms I am unable to describe what I do…*	2.5
D	Front-end Web Designer	*[design is] …making things look pretty but not just for the sake of looking pretty… it's like usable - I read a quote the other day "don't make something unless it is both necessary and useful, but if it is both necessary and useful don't hesitate to make it pretty."*	5
E	User Experience Designer	*To me it's more just solving problems. Users have a problem with their application and it's your job to bring them a solution. It's a very abstract way of thinking about it, [but] it's the only way you can capture what design is.*	1
F	User Experience Designer	*Design to a non-designer… I think design is always misunderstood as just making things look nice but design is how sort of how things work how a product feels in somebody else's hand and just everything that comes with a product or an idea and experiences around that I think.*	3

Findings

This section presents results from the interview sessions, covering how designers adopt different strategies to position themselves and situate their work in relation to the organizational context. The findings are clustered into broad themes and excerpts from the participant responses are used to supplement the discussion.

You say it best, when you say nothing at all.

There are quite a few varied positions on how design value is mobilized for different participants. Participant A comments that there is no need to communicate the value of design, as no matter what effort is put into design work, at the end of the day it is the decision maker's prerogative of whether integration of the design

recommendations will make sense for the organization. Participant A comments "*Well to be honest, I won't [communicate the value of design], heh. They can listen to you but they won't agree with you…[imitating the decision-maker: 'This is what I want! I want - what I want.. [pause] Okay I have listened to you.. You have good recommendations and all that - but no. Thanks, but no thanks' Heh... So I learnt… there is no point in communicating the value of design"* It is instead argued that customers or clients can act as external actors who advocate the value of design – as more often than not the requests made by the customers are in line with the recommendations of the design team. This adds additional pressure on management to take design seriously – whereas design and designers are able to establish value through a passive positioning. This seemingly non-confrontational approach stems from the belief that "*Design is a creative process.. It's a creative spontaneous process.. Just like making a painting. So and if someone is calling [the] shots on your painting then it is not art anymore."* So it dislocates itself from the actual control of the bureaucratic environment it is situated in – and creates pockets of freedom following an unconstrained design process, in the hopes that influence from outside the organization can nudge decision makers to take notice of their contribution and suggestions. It is a very passive position for the designers.

~~*Design*~~ *is still design*

Another interesting finding was how buzzword-compliance may be used as a strategic tool when used in line with the organizational lexicon. Participant C used the term 'UX' interchangeably with the word 'design' during the interview discussion. When probed as to why, it was indicated that when design was introduced to their organization it was done so from a top-down approach i.e. management had come across the idea and wanted capabilities built within the organization. This participant was part of the first recruits that were hired into the organization to form the design team, and was trained by a third party design consultancy for six months in order to become equipped with the knowledge of design and thereby become the so called 'design' expert within the organization. This however meant that their team was the sole propagator and advocate of design within the organization from an informed, trained perspective. However given the rest of the organization was not privy to the perceived benefits of using design within the organization setting, wrote it off being as arbitrary based on their own limited understanding and exposure to it. Participant C says "*We didn't pitch it as design, we pitched it as UX. we didn't even say UX design, because the way they were thinking of design was different. Y'know design is more graphical related, but when we pitched it as UX - user experience they didn't see the design, they saw it as improving the whole product portfolio, getting more customer retention and improving the customer experience."* This approach had two consequences – it disassociated design from all the baggage that comes with the term itself, and at the same time allowed the type of work it performs to become relevant, in-fashion, contemporary expertise for the organization. This decision was not planned but the benefits of taking this approach were soon realized "*It was initially not conscious because it was supposed to be UX design and then people started to talk about UX! UX! UX! UX!… later [at] some point [we] realized that it makes sense to talk to people who did not understand what design is.. Because ...at that point the buzzword UX was spreading throughout the company so we were supposed to be the advocates for UX and the buzzword of UX was spreading so we wanted to ride that wagon - that hype wagon. At that point we realized that if we add design that it would lead to confusion and people would think what is UX what is design and we would start from scratch"* Dropping the alias of 'design' and adopting UX instead allowed the team to cash in on the opportunity of taking advantage of the popularity of UX, which had been making rounds as a buzzword within the industry and the organization. Disassociating from design also allowed for the team to be taken more seriously across the organization.

It's not [about] me, it's [about] you!

When communicating the value of design to stakeholders, it was also seen imperative for design to be positioned in terms of the key performance indicators (KPIs) of the stakeholder that was being addressed. This is seen as being cognizant of the transient nature of the value of design and how it is able to take on different output manifestations such as act as a 'cost-saver' or 'complaint-reducer' to 'sales driver' based on the project, context and stakeholder.

Participant B highlights how communicating the value of design is very difficult to peers who are unaware of the ethos behind it. They further add that they took a top-down approach to circumvent existing hurdles and barriers to adoption within the organization, based on cultures with high power distance e.g. convincing the boss/management of the value in terms of their KPIs and having that order being mandated on all staff in lower branches of the organizational structure. "*[the organization] was very hierarchical - so I didn't have to*

[convince my peers] I just had to go to the top person and they just tell the people what to do - so I didn't try to tell [my peers].“ This again is seen as an active position / stance on how the value of design is communicated and dealt with within an organizational setting. Whenever the discussion of the value of the work of design within the organization was brought up, it was done so in the terms of the KPIs of who was being spoken to within the organization.

There are a few assumptions that were seen from the interviews as well. Most participants assumed that if they were talking about design to a designer – they were talking about the same thing; or that they shifted the type of design based on what the designer they thought they were talking to was referring to e.g. a UX designer would talk to a graphic designer in more visual aesthetic terms than to another UX designer. The above examples are placed to showcase the varied rich contextual nature of how the design-value paradox is negotiated by designers within industry.

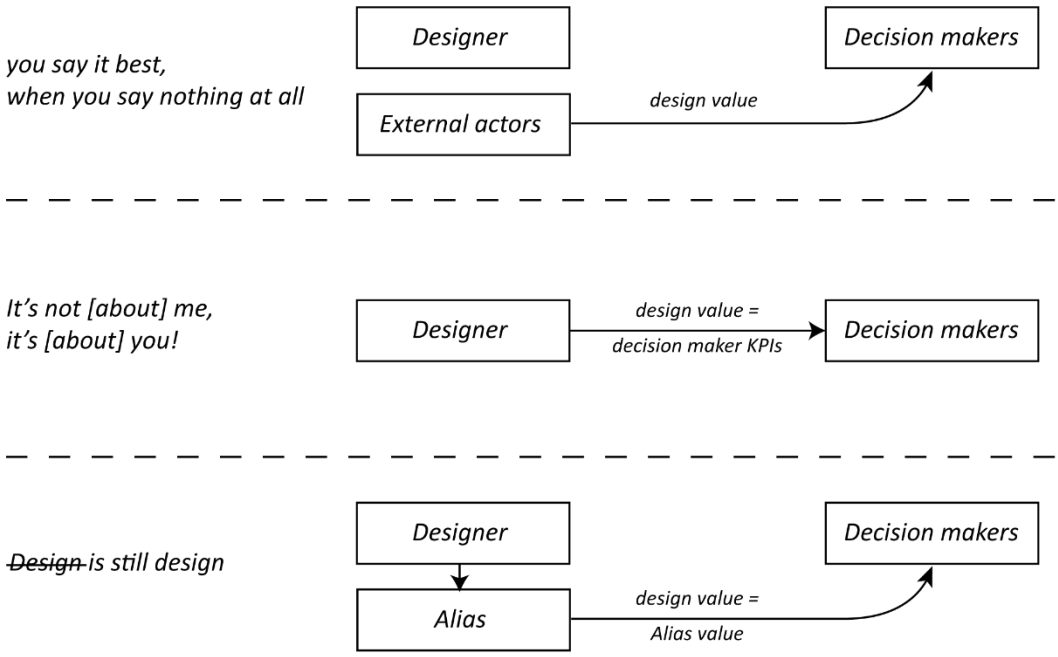

Figure 3: Different social conventions and strategies to operationalize design value by practitioners in industry

Discussion

The patterns of behaviour and emergent practices of designers that have been uncovered through this study are intended to act as exemplars of the possibility of a variety of different actions that design practitioners take as part of their daily work-lives. These are clearly not an exhaustive set of strategies or social conventions that are in place in the workplace today, but give insight into how different practices have emerged as a result of trying to address the design value question. Even with the limited scope of this study, We already start to uncover a window into the disparity in practical approaches to valuing design within organisations to what is conventionally being studied in literature. We hope this allows us to spur discussion and reflexive practice into what this means in terms of how we can re-evaluate and position our efforts in trying to negotiate the design-value space. We are also able to see how the multitude of strategies through which design value can be operationalized. This shows us the diversity of forms and roles that design is able take on to create an impact within the organisation. This highlights the transient, transferrable nature of design – where it permeates and transcends pre-prescribed functional boundaries.

Further work needs to be done in this space to fully appreciate the complexity of design in action. It can be asserted that we can advance in this work more meaningfully if we take a more anthropological approach, using ethnographic studies, or designing self-documenting tools that allow for design to be traced within the organization. Another consideration to think of is that there is a distinction between work that is labelled as

design in contrast to that which is 'designer-ly'. This distinction may not matter in most cases, where there is significant intersection, but at the same time there may be instances where designer-ly activities reside outside of the design-labelled boundaries of the workplace. Using immersive study techniques and tools will help bridge our understanding of how design can be meaningfully positioned, operationalized and mobilized to make greater impact to the industry. The three strategies that are presented in the findings embody the idea of design being a social construct, and here we see that it in essence is very dependent on the context (Bucciarelli, 1994; D'Ippolito, 2014; Suchman, 1987). Similarly taking on actions such as deciding to take on an alias in lieu of design, or re-appropriating the benefits of the work performed by design to another's KPIs as well as the political position of relying on external actors to influence propagation of design are all derivatives of interactions within the space and actors (Petroski, 1985).

Further investigation into different types of design fields may result in different strategies; organizations that have design as the core competency such as a design consultancy might have different permutations of strategies in place, versus ones where appreciation for design is still in a nascent state. Furthermore the duration of the experience of designers in industry may also act as a contributing factor to the strategies that are adopted. This study merely scratches the surface of what possible strategies and social conventions are in place in regards to understanding and communicating the value of design. There is scope for a lot more research to be conducted in this space.

Conclusion

The findings of this study present three distinct approaches to channeling the value of design from a practitioner's point of view to the wider organization. They touch upon some very distinct and interesting behaviours that are a product of the environment and context. Even with all the challenges that come with the semantics of design, as well as its nature, we see that from a practical perspective, designers are making decisions daily of how to best represent their work. The indisputable identification of design as a phenomenon, is only the first wicked problem in the thesis of this paper: this is a practical problem that today's practitioners are constantly attempting to resolve in the course of their work. Similarly the measurement of its value, however value is ultimately defined based on future studies, is also a distinct but cognate wicked problem in its own right. To this point we have begun to uncover some of the ways in which design is being operationalized and how its corresponding value is being articulated. Further explorations in this regard will help design practitioners explain and communicate the utility of design on an organizational front, and allow us to better trace how design lives within an organization. Design has often been portrayed as a strategic tool, a competitive instrument, a way of problem solving – but understanding how it is used by practitioners in industry, and how they use different arguments to socially construct the value it offers is of great benefit. This will open up a secondary stream of work exploring the value of design to industry, and uncovering rich, contextual, pragmatic ways to understand the value of design in organisations. This may also allow researchers to obviate methodological approaches that rely on a priori definitions of phenomena as a means of encapsulating something as dynamic and malleable as design.

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Communicating the Value of Design: Design Considerations to Assist Practitioner Rationale in FMCG Packaging Development

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Product packaging design is often produced through the practical application of tacit knowledge, rule of thumb and professional connoisseurship. Stakeholders are becoming increasingly demanding that design practitioners provide clarity of reasoning and accountability for their design proposals. Therefore, a better framework for the design of fast-moving consumer goods (FMCG) is required. This paper proposes a comprehensive taxonomy of *'design considerations'* to assist the development of low involvement FMCG packaging and aid in rationale communication for design solutions. 302 academic sources were reviewed, inductive content analysis performed to code topics and output validation with academic and industry experts (n=9) through a modified-Delphi card sorting method. The research provides movement towards a comprehensive framework and common dialogue between stakeholders, practitioners and managers to assist in more effectively communicating the value that design can offer to FMCGs. The constructed taxonomy provides a set of 156 '*design considerations'* to support in objective and informed design decision-making.

Keywords: Design Practice Management, Design Value, Packaging Design, FMCG, Taxonomy

Introduction

Within the FMCG industry, packaging design has the potential to influence consumers' perceptions of product and its value. The literature explores the nature of design activity but does not appear to take into consideration the broader contextual influences affecting the design of packaging. Packaging design practitioners have been characterised within the literature for poor rationale application in their decision-making process, potentially leading to the reduced market success of products (Barnes, Childs, Henson, & Lillford, 2008; Ryynänen & Hakatie, 2013). It is suggested that greater discussion between design practitioners and academics may further the understanding of design activity and benefit the design profession (Swann, 2002 p61). This paper aims to provide a more holistic perspective and understanding of the value that design can offer to FMCG products. This could lead to improved objectivity and rationalisation in design decision-making of practitioners and design managers by providing improved dialogue and understanding; In turn, improving the communication of design decisions and design value to stakeholders. Due to an emphasis on consumer-led research, packaging literature fails to fully explore packaging management and packaging designs important role as a core part of FMCG product development (Simms & Trott, 2010). Improved frameworks for the design of FMCGs is needed (Clement, Kristensen, & Grønhaug, 2013). Current frameworks

such as Ampuero and Vila (2006); Silayoi and Speece (2007) and Ryynänen and Hakatie (2013) provide some valuable insight into the consumer manipulation techniques design practitioners can and should apply. However, Clement, Kristensen, & Grønhaug (2013) suggest that research into a better framework for the design of FMCGs is required along with a taxonomy of design features. At current, the area of design management in FMCG packaging development is under researched (Simms & Trott, 2014b).

This paper which forms part of an ongoing PhD research project into UK FMCG packaging design and its design management discusses a more comprehensive description of influences affecting the visual appearance design of FMCG product packaging. The paper provides a preliminary framework, a taxonomy, that may be used in the future to support conceptual packaging design activity, in the generation and selection of concepts and to help emphasise to stakeholders the value of design through informed decision-making. The taxonomy, defined later in this paper, proposes a more complex ecosystem of *'design considerations'* for the development of FMCG packaging design. This study aims to provide a symbiotic interdisciplinary review of *'design considerations'* and presents them in a useable format for design practitioners, marketing and design managers.

The Value of the FMCG Industry in the United Kingdom (UK)

FMCGs can be defined as *"…inexpensive products that people usually buy on a regular basis, such as supermarket foods or toiletries."* (Collins English Dictionary, 2018). These types of products are low involvement, carry little emotional value, require low cognitive engagement and are considered low-risk purchases (Clement, Aastrup, & Forsberg, 2015; Holmes & Crocker, 1987). The UK FMCG industry is a significant sector within the UK economy and contributes to approximately £125 billion in consumer spending, around 8% of the country's GDP (Francis, Dorrington, & Hines, 2008). UK retailers alone have product portfolios of approximately 40,000 product lines, producing thousands of New Product Developments (NPD) requiring substantial amounts of design effort (Nancarrow, Wright, & Brace, 1998; Vazquez, Bruce, & Studd, 2003). Thousands of new FMCGs are launched each year, and large quantities of these will almost certainly fail at market (Rudder, Ainsworth, & Holgate, 2001). Consumers will approximately purchase only 0.7% of products available to them yearly (Simmonds & Spence, 2017). This increased competition between products at the point of sale has required companies to devise strategies to compete; hence, the modification of visual appeal and communication of brand intent through packaging design. This is seen as critical for consumer brand preference and essential for sales success (Karjalainen and Honkaniemi, 2009; Wang, 2013). Not only can packaging enhance commercial success for FMCGs; but, the influence packaging has on consumer cognitive processes is of great interest to corporations such as the Food and Drug Administration and public policy establishments (Underwood & Ozanne, 1998). More effective communication of nutritional information and health claims (Bialkova, Grunert, & van Trijp, 2013; Bialkova & van Trijp, 2011); or, highlighting product risks through packaging can potentially influence purchase habits and affect public health (Hammond et al.,2014; McNeill et al., 2017).

The Value of Design to FMCG New Product Development

NPD in the FMCG industry is considered vital. Incorporating the activity of design into packaging development is possibly the most significant factor for success (Wansink & Huffman, 2001). Developing or changing a product can be a risky activity to an organisation (Ryynänen & Hakatie, 2014); and, as a result, design offers opportunities as a valuable success factor for FMCGs in these complex markets (Rundh, 2009). Retailers are extremely competitive, and thus design is exploited as a strategic tool to develop value, differentiate products and increase brand equity (Vazquez et al., 2003). Products purchased in these retail environments are heavily characterised by a variety of different visual stimuli available to the consumer (Clement et al., 2013). Approximately 68% of FMCG retail purchases are unplanned, with 90% of consumers only observing the front of a package before making a choice (Stahlberg & Maila, 2012; Urbany et al., 1996). Furthermore, around 85% of FMCGs are chosen by a consumer while shelf facing (Clement et al., 2015). It has been consistently reported in literature that consumers frequently make purchase decisions influenced by a product's visual appearance (Bloch, 1995; Crilly et al., 2004; Fenko et al., 2010). Thus, the manipulation of the visual appearance attributes of packaging has become an increasingly effective method of creating differentiation amongst competing products; creating opportunities for more effective information communication and marketing strategies (Rettie & Brewer, 2000; Underwood & Klein, 2002; Young, 2004). This is key as consumer decisions are made in quick succession. Approximately less than eight seconds are spent in evaluating, analysing, and determining

a purchase (De Chernatony & McDonald, 1992). Hence, why the design of packaging has been found to be one of the most reliable forms of marketing for influencing consumer choice (Underwood & Klein, 2002). Inferences of product value are made from the first point of interaction between the product display and the consumer (Rundh, 2013). FMCGs, specifically those of low involvement, rely on these symbolic, aesthetic, semantic and visual informational cues to communicate and market product value (Becker et al., 2011; Clement et al., 2015; Creusen & Schoormans, 2005).

Understanding the importance and value design offers to exploit this marketing medium is crucial; but, in some incidents, companies do not consider the design or innovation of packaging until the later stages of NPD due to its low regard within the product development process (Francis et al., 2008; Simms & Trott, 2014b). Limited research and development budgets and cost savings are normally the focus of dialogue during the consideration of product packaging (Ryynänen & Hakatie, 2014). However, the expense of launching a new product that is ultimately unsuccessful will undoubtedly incur high costs for the company involved (Rudder et al., 2001). Only a small amount of FMCG launches will succeed (Rudolph, 1995). It is estimated that 70% to 95% of products are failing yearly across a range of consumer markets (Spence, 2016; Wells et al., 2007). Spence (2016b) proposes that the large proportion of failures could be due to current methods of consumer research and product validation working ineffectively. Reduced success at market has also been accredited to poor packaging design decision-making (Rudder et al., 2001). Spence (2016a) suggests visual attributes of the packaging can conceivably be the most critical cue affecting the success or failure of FMCGs. Even minor features of product packaging have been shown to have a substantial impact on consumer behaviour (Parise & Spence, 2012). Thus, basic design choices influence the consumer's first impression, often before physical interaction with the product (Noble & Kumar, 2010).

Stakeholders (for example brand, category and marketing managers) are increasingly demanding that designers gain more explicit understanding of the impact of design on consumer decision-making (Young, 2002). Practitioners can be referred to as *"gatekeepers"* who can change their industry (Ryynänen & Rusko, 2015); Yet, packaging solutions developed by professional designers may often be based on tacit knowledge; rule of thumb; and, professional connoisseurship rather than knowledge provided by research (Barnes et al., 2008; Ryynänen & Hakatie, 2013). Despite this, it still seems that the practice of design continues to rely on a designer's intuition, guesswork and self-expression (Swann, 2002; Taura & Nagai, 2017). A designer being able to explain their practice coherently and the rationale for decisions may bring greater credibility to their design outcomes (McNiff & Whitehead, 2011).

A significant body of consumer research exists to help inform designers, and many phenomena and principles that can be found in the literature could be utilised for product packaging design, however, much of the current knowledge on packaging has been described as *"…theoretical and remote"* from a design practice perspective (Ryynänen & Hakatie, 2013). Potentially a better understanding of consumer-design interactions could lead to greater use of design as a strategic marketing tool (Ryynänen & Rusko, 2015); and, in turn, bring greater respect and appreciation to design as a discipline (Veryzer, 2000). Clement et al. (2013) suggest there is a need for further research towards a better framework for designing FMCGs. The following study describes the development of a taxonomy of *'design considerations'* that progresses towards an informed design process and common dialogue to assist in FMCG packaging development.

Methodology

Research aims to identify a comprehensive set of *'design considerations'* for low involvement FMCG packaging design. The intentions will be to begin the process of making existing research knowledge in this area more accessible and useful to packaging designers and managers. Additional content was gathered to expand the finding from the literature via an expert consensus seeking technique.

The following study was designed within the Loughborough University Ethics policy, following the data protection guidelines and authorised through an ethical approval process (Loughborough University, 2018). This study was designed to understand the key criteria and considerations for developing, evaluating and communicating the value of design in FMCG packaging. The research procedure was divided into four key phases to identify, define and validate a classification for the categories and topics extracted from literature. Inductive content analysis was applied to extract the key themes. The research design began with a structured literature review of packaging design and related disciplines. An expert panel of reviewers and a modified-Delphi card sorting study aimed to validate the terms gathered; and, provide a consensus of expert opinion and validation to cross compare academic research with expert insight. The additional content was added by

experts to expand on the current knowledge discovered in literature. For the purpose of this study, modified-Delphi Card sorting was selected over other qualitative, more traditional techniques to exploit the strengths of expert group decision-making. This was opposed to gathering accounts using methods such as interview to reduce bias where individual practitioners may try to render themselves more intelligible in their recall of accounts (Crilly, Moultrie, & Clarkson, 2009).

Phase 1: Structured Literature Review

The formal review aimed to extract possible topics of discussion including design elements, principles, interventions and considerations from a wide range of associated topic literature that would be useful to recognise and apply to the design process of low involvement FMCG packaging. The review process identified sources including journal articles, book chapters, PhD theses and other additional online sources deemed appropriate. Searching for these resources was bound using the variations on the key specific terms and phrases as well as wider search terms: '*visual appearance design', 'product packaging', 'packaging design', 'FMCG', 'low involvement', 'visual perception', 'visual attention', 'consumer response', 'consumer behaviour' and 'decision making'*. A bounding period ran from one of the first, notable consumer research study on consumer choice and visual attention to low involvement FMCG products by Russo and Leclerc (1994) to recent papers published in 2018. Figure 1 outlines the research strategy for the collection of data. This followed a structure adapted from Torrens (2017).

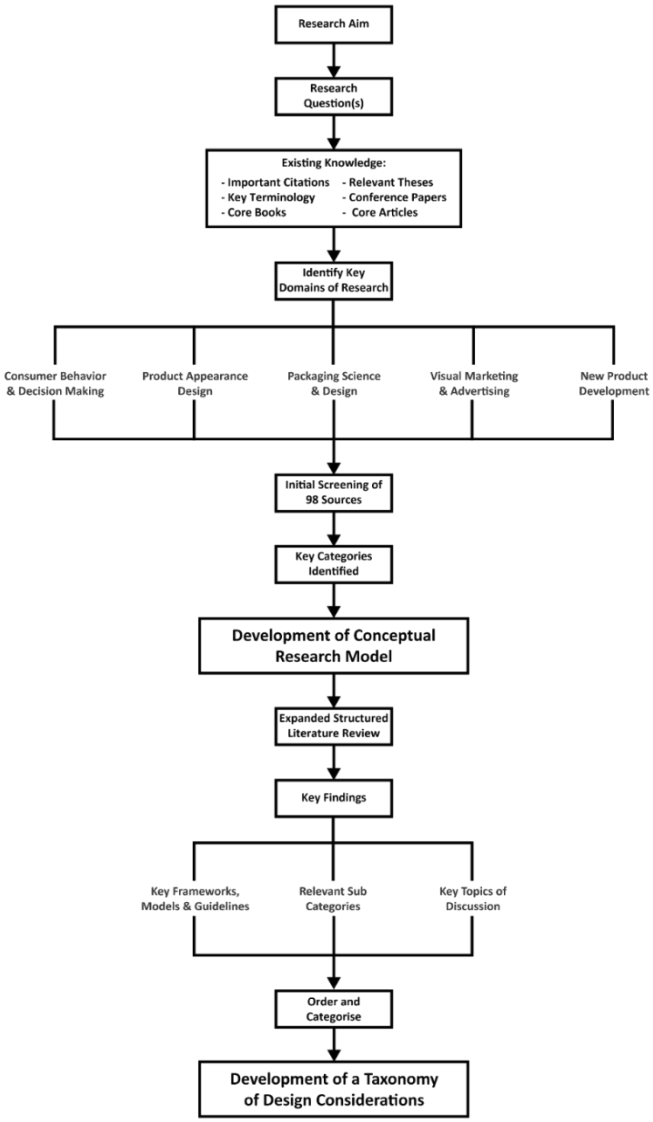

Figure 1. Adapted Research Strategy Model

A preliminary screening of resources was conducted before selection to identify topic categories. This was undertaken in advance to aid in the construction of a conceptual research model to identify key topic and content categories. Similar models can be identified in papers conducting summaries of research over an allocated period (see Luchs & Swan (2011)). This conceptual research model (Figure 2) was developed from frameworks, models and guidelines that utilised visual perception and information processing theories gathered from the review process (Bialkova & van Trijp, 2010; Clement, 2007; Husić-Mehmedović, Omeragić, Batagelj, & Kolar, 2017; Wedel & Pieters, 2008) and placed into an adapted cognitive-based consumer decision-making model by Schiffman, Kanuk, & Wisenblit (2010).

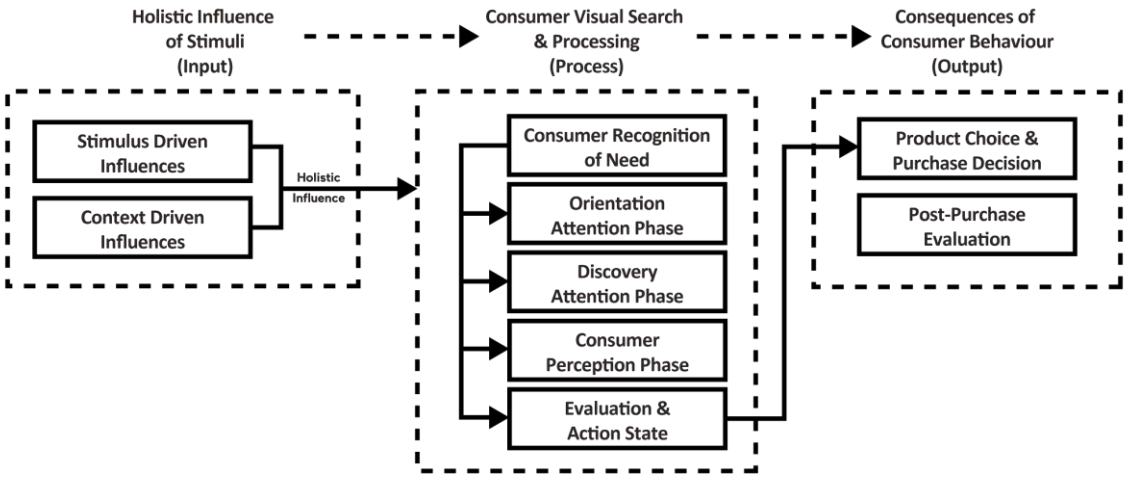

Figure 2: Conceptual Model of Research & Classification for Low Involvement FMCG Packaging Design Considerations

This model aided the appropriate topic clustering and organisation amongst categories identified. The consideration set for source selection for the expanded structured literature review included: date of publishing, journal type, research aim, relevant keywords/topics of discussion, research methods used, relevant findings and proposition of topic relevant frameworks. An inclusion and exclusion criteria were established to assist selection. All sources had to be in English and relating to the topics of product appearance design, new product development, consumer decision-making, visual marketing, fast-moving consumer goods or packaging design. Additionally, the number of citations and the perceived reputation of the author of the source was also considered. Priority was given to articles from high-quality journals that were open to a range of interdisciplinary topic fields and double-blind peer-reviewed. All papers titles, keywords and abstracts were reviewed before the resource was considered. However, if a paper provided valuable insights in addition to this criterion, these were included subject to critical analysis by the informed researcher.

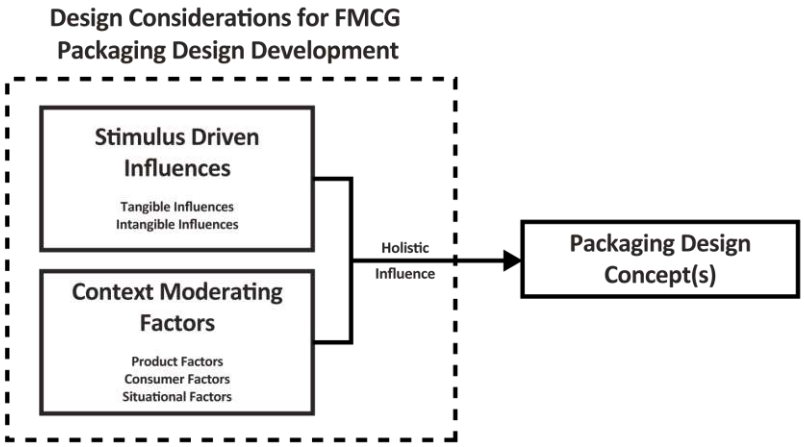

Figure 3: Conceptual Framework of Design Considerations for FMCG Packaging

Throughout the process, the researcher continued to reflect on the material being reviewed as new sources were discovered. The reference lists of the journal articles were also examined to identify any new sources that may be of interest that may not have been identified in the meta-search. For this study, precedence was given to the *'input'* section of the conceptual research model (Figure 2), and the development of a *'Conceptual Framework of Design Considerations for FMCG Packaging'* (Figure 3) resulted from the meta-search. The review process was concluded once a point had been reached where the articles selected from review represented a consensus of the body of research, reflecting the topics of discussion within literature and no new topics were being discovered.

Phase 2: Defining and Categorising Topics

Qualitative inductive content analysis was undertaken as a method to evaluate the resources, adapted from the method described by Elo & Kyngäs (2008). Content analysis can be defined as the systematic description of written, spoken or visual material to express themes, patterns; and occurrence of words, phrases, images or concepts. This allowed for the identification of common themes or patterns that emerge from data and indicate an order of priority. Units of terms could also the be clustered and reordered into a themed category (Hsieh & Shannon, 2005; Martin & Hanington, 2012). Investigation of the articles in this manner provides a systematic and objective method of analysis (Krippendorff, 2004). The process allows the researcher to distil words or phrases into fewer content-related categories when they share the same meaning (Cavanagh, 1997). The process identified duplicates or similar terms and phrases that could be categorised together under one term. Qualitative data was extracted in the form of words, phrases and quotes which were then recorded and referenced. These were then coded and clustered into themes to create more manageable topics. The process of coding and clustering is a conventional method for analysing qualitative data enabling researchers to collate meaning from a data set to develop theory (Robson, 2002). Through this process, greater validity may be given to any inferences made from the data (Krippendorff, 2004). Content analysis is a means to deliver concepts or categories to build up a model or conceptual map (Elo & Kyngäs, 2008). The data collected from this study was organised, categorised and recorded into a spreadsheet. The data provided justifications for each topic as well as an assigned description, examples of contextual quotes from literature and citations to link to relevant research papers. An initial taxonomy and nomenclature was produced by the researchers based on the outcomes of this structured review to be later compared, critiqued and developed against the outcome of the modified-Delphi Card Sorting exercise.

Phase 3: Expert Participant Panel Selection

A panel of expert participants was selected to review and validate the topics and content categories extracted from literature through modified-Delphi card sorting. The resulting outcome provided information structures based on the participants' collective interpretation of the identified topics and categories. Acknowledged by Paul (2008a p8) there is no strict consensus of participant numbers. Suggestions range from six to over thirty participants to gain a meaningful consensus. Soranzo and Cooksey (2015) suggested 8 to 10 participants are

needed to gain a meaningful information architecture for modified-Delphi card sorting studies. Experts were chosen from fields where they have *"…a personal stake in the resulted knowledge [sic]"* (Paul, 2008a p10). For this study, an eight-expert participant panel was formed. Participants ranged in professional disciplines but all with relevant experience and significant knowledge of the FMCG industry. These included academics, packaging development specialists, product design consultancy practitioners, POS designers, packaging designers and FMCG marketing specialists. The participants all had experience of the design of physical artefacts as this is the current focus of the research. These experts were asked to evaluate the set of topic cards and categories extracted as well as to provide professional insight. Before the card sorting exercise, participants were asked to complete a short questionnaire. This included taking details on their gender, age, positions held, previous experience, specialisms and education. The information gathered aided the interpretation of their commentaries and to qualify their responses against their professional backgrounds (Soranzo & Cooksey, 2015).

Phase 4: Modified-Delphi Card Sorting

Card sorting was selected as a method as it can be used when comprehension and meaningful categorisation is critical. As a participatory design technique, card sorting explores how concepts or topics are categorised. The method was used as a technique to draw out mental models about a set of information and aid in the design or validation of information architectures (Paul, 2008a p8). Cards were printed with a topic or category on them, which participants were asked to sort. This aspect of card sorting can be used to highlight terminology that can easily be misunderstood or has multiple meanings associated with it. It can be used to create structures for information such as taxonomies (Martin & Hanington, 2012 p26). Participants organise the cards into groups that may be compared against a given predicted model produced by the researcher (Paul, 2008 p8).

Two approaches are usually taken; an open or closed card sort, as described by Spencer and Garrett (2009). Open card sorts are used in the pre-design stages of information structure development. This allows the participants to produce their own categories and identify where categories are not fully defined. The method can be used to *"…add new content to an existing information architecture or to test an information architecture by scoring participant results with the existing structure. [sic]"* (Paul, 2008a p8). In contrast, a closed card sort can be used to place cards into pre-existing categories that have been set by the researcher, which is a post-design method to validate or amend an information architecture (Spencer & Garrett, 2009). For this study, a modified-Delphi card sorting method was adopted from Paul (2008a p12-14), which utilises the principles and strengths of expert group decision-making from the Delphi method (see Okoli & Pawlowski (2004) for an explanation and key features of the research method) combined with conventional card sorting. These additional features of the Delphi method enable communication within a group while reducing the adverse effects of group work interactions (Geist, 2010).

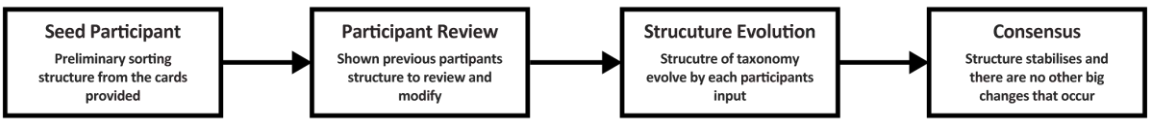

Figure 4: Steps for Conducting Modified-Delphi Card Sorting

Modified-Delphi card sorting may be compared to that of open card sorting as it provides the freedom for participants to modify, add or remove categories that fit their own interpretation of the model. This modified method allows participants to build upon each other's structures, giving a holistic result from all participants work combined. This is particularly useful when, as in this study, data sets are complex and more extensive; and, where there are high cognitive costs to the participants when undertaking the study (Paul, 2008b p12). There are four steps taken during the card sorting exercise (Figure 4). This method aims to improve the quality of results from each participant, reducing the time to conduct the study and analyse the results. The modified-Delphi method is ideal for measuring how people interact with the *"articulation of a taxonomy"* (Soranzo & Cooksey, 2015).

For the seeding of the deck Paul (2008b) suggests multiple methods of opening the card sorting study. A single participant working alone; or, the pairing of participants for the initial categorisation. Alternatively, the assistance of an initial structure can be used where the information is new to the participants, and there may

be some difficulty producing an initial structure. Because some predefined categories had already been extracted by the researcher and the nature of the card sorting topics was relatively complex, category titles were provided to the seed participant. However, each participant was encouraged to evaluate the categories and add, remove or modify them. Participants were asked to distribute the topic cards amongst categories. Each card contained a topic name, associated terms and an assigned description gained from the initial phases of research (Figure 5).

Card sorting also enables the physical use of cards or a digital based card sorting option. For this study, physical cards were used as the range of topics were large, and a screen could limit the amount of information available. This allowed participants to physically interact and organise the cards and make notes. Participants were provided with an introductory script adapted from Paul (2008b p4). They were asked to add, remove or amend topics or categories using the blank index cards on previous participants structures. Participants were also allowed to distribute the cards into multiple categories by adding an index card to an alternative category. After each card sorting exercise, experts were asked to reflect on and refine their final structure. Towards the end of the card sorting study, fewer changes should be made; and, participants would only need to reflect on higher-level issues. Throughout both sections of the card sorting exercise, participants were encouraged to verbalise the decision-making process.

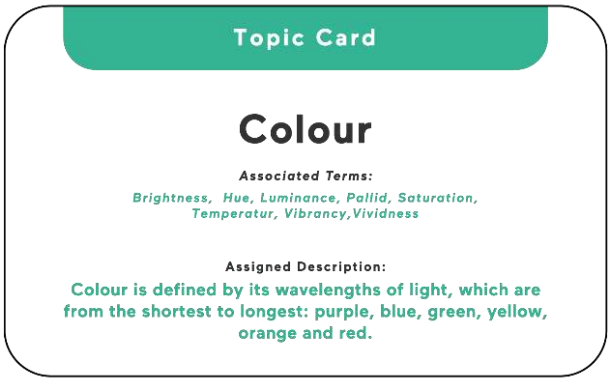

Figure 5: Exemplar Topic Card Design

Results

Except for the seed participant, no other participants knew the order in which they contributed or other *'experts'* who undertook the study. After each participant, structure data was recorded via photographs and transferred into a spreadsheet for analysis. Spreadsheets contained the topic categories with cards organised and distributed in each. If a new topic or category was added the text was recorded and highlighted to determine modifications (Paul, 2008b p4-5). Digital representations of each structure were produced to help further interpret data and compare the relationships between the topics and categories. Detailed analysis is only required if it is necessary to help in the description of mental models and evaluate the optimum term as the cards themselves provide enough data for information architecture construction (Soranzo & Cooksey, 2015). The first participant seeded the deck, and two new categories were proposed. Some category names and topic structures were challenged by participants 2 and 4, but a consensus was achieved by participant 5, with categories remaining agreed between participants 5 to 9. Throughout categorisation, the removal of only one original category occurred. Topics from this category were distributed into other categories. Overall, 9 categories were established in the final taxonomy. Participants 1 through to 3 focused primarily on the category design with minimal contribution to the contents of the topic deck. Greater changes occurred once the categories settled with the most additional topics introduced between participants 4 and 5. Participants 4 to 9 focused primarily on topic organisation as considerable changes were made at this point. Results suggest that significant changes were seen during participants 5 through to 7. However, changes were predominantly of topics derived from other topic cards. These participants produced cards to extend existing topics and add to additional categories. An example of this can be seen by specific variations of the term *"Technologies"* which was introduced as part of the original topic set. This was split into more specific topics associated such as *"Accessibility to Technology"* and *"Use of Technology".* Some new topics were introduced that were not discovered during initial content analysis such as *"Zeitgeist"*, *"Giftability"* or "*Influence from NPOs*" introduced

throughout the expert review. During the review of participants 5 and 7, this was where most of the changes were made. It seemed that participant 8 accepted most of these changes as almost none were made at this stage. To conclude, participant 9 made smaller refinements to the final taxonomy.

Agreement Weighting Analysis

This method, as recommended by Paul (2008b), is a way of understanding card importance and relationships agreed between participants. Data collected was distributed into a topic-by-participant category matrix to calculate agreement weighting. Percentages determined were then distributed into a topic-by- category matrix. Because participants could create their own category titles and add, remove or change topics with no restrictions, exact agreements across all participants can be minimal. Categories were then further grouped based on the criterium specified by Righi et al. (2013). Category titles were amended and final titles allocated. A second topic-by-category matrix was then produced with agreement weighting percentages recalculated. However, not all participants contributed to the agreement weighting of 32 topics. Additional analysis would be required to confirm these results and their validity. From the original 119 initial topics extracted from the 302 sources studied and reviewed by experts (n=9), an additional 34 (+21.5%) new, variations or repeated topics were added to the taxonomy. This brought the total topic count to 156 *'design considerations*.' An agreement consensus was determined if the topics received >50% in a category from all participants. If the topics gain a higher agreement percentage, the stronger the determination for the categorisation of that topic within the information structure (Paul, 2008a). If topic cards received ≤50%, these were arranged based on their highest agreement. If there were <50% or stalemates occurred, categories were then determined from analysis of the participant commentaries. From the original 119 topics, a consensus was not reached on 9.8% of topics. 32 topics (20.9%) did not gain a consensus from all participant due to these topics being added during the study. These would require additional evolution analysis. Although the nature of the modified-Delphi card sorting study allows for iterative development of the taxonomy, additional evolution analysis will be conducted to help understand why they were added and their relevance to the taxonomy based on comments noted during the study and reflection period post sort. Overall, based on the results of the final participant, the taxonomy saw an agreement of 86.27%, 10.12% disagreement with 3.27% of the cards being removed or combined with other topics. Further evolution analysis was conducted to understand participant decisions in greater detail.

Evolution Analysis

Areas of discrepancy were recognised throughout initial data analysis. Because of this, a heuristic approach to evolution analysis was employed as a secondary analysis technique. This method utilises data collected during the observations of the card sorting studies in the form of written notes and voice recordings. This identifies disagreements and weak points allowing the researcher to pay more specific consideration when analysing data. This additional strategy prioritises the final participants work relative to that of the previous, supported by any low or stalemated agreement weighting discovered from the previous analysis technique. Prioritising the final participant's design can help us understand why some cards were added, removed or merged throughout the development process of the taxonomy (Paul, 2008b).

In the case of low agreement weightings that did not meet the >50% threshold, for example, *"Consumer Research Involvement",* prioritisation was given to the highest category weighting of agreement from participants. However, in the specific case such as *"Memory"* and *"Memory Association"* prioritisation was given to the location of the final participant. Participants 6 through to 9 had placed these within the *"Consumer Factors"* category. As observed in earlier analysis, greater consideration was given to the location of topics once the category labels had been determined, only then was more focus given to topic location. As these topics remained in the same category from participant 6 to 9, reverting them to the previous category did not seem logical. Although they did not hold the highest weighting agreement, on examination of the taxonomy's development taking into consideration these other factors must be considered to understand why their location had changed. The same rationale was given to the topic *"Product Semantics"*. In cases such as stalemates between agreement weighting results, for example: *"Affordances"*, *"Cognitive Capacity"* and *"Cognitive Bias"*, arrangement in the taxonomy was based to the position given by the final participant. In one circumstance, a card was removed and then reintroduced in a later structure of the deck. *"Coordination"* was removed during the participants 2 to 6; however, participant 7 argued the reintroduction of the topic. Although the topic only received 33% in agreement weighting, the argument exhibited by participant 7 and inclusion by participants 8 and 9 determined that the topic should remain in the deck in the location

determined by participants 7 to 9. In certain incidences, topics were introduced by participants and then later merged or combined into other or new topics. *"Brand Ethos"* was introduced by participant 4, then later removed by participant 7 and combined into the topic *"Story*". On analysis of these topics once more, the topic *"Story"* did contain sub-terms such as *"Brand Story"* which could be deemed similar. For this reason, the decision proposed by participant 7 will remain in the final taxonomy. Introduced by the final participant, *"Shopping Habits"* combined multiple consumer specific topics that had been introduced throughout the study. From the discussion in the reflective section of the study with participant 9, this was introduced as a more generic term to encompass conscious/subconscious habits of consumers and lowers the complexity of the taxonomy. For these reasons the decision made by participant 9 shall remain. At one point *"Marketing Strategy"* was removed and combined with *"Organisational Factors"*. On review of their rational, the evidence collected from the analysis of literature and previous appointments of participants, this decision was omitted. The topic was reintroduced into its previous location allocated. Overall, the card sorting exercise performed in the structure proposed by Paul (2008b) can be deemed as successful, and the researcher's feel confident with the results. The study aroused healthy debate, conflict and agreement to provide a set of validated considerations for the design and development of low involvement FMCG packaging. A revised conceptual framework can be seen in Figure 6. Although the final participant's taxonomy differed significantly from the researcher's original proposal, the addition of new categories and topics from the development and evolution from 9 participants have provided not only validation for the original deck, but additional knowledge and expertise that could not be gained from the researcher's alone. The final taxonomy is established in Figure 7.

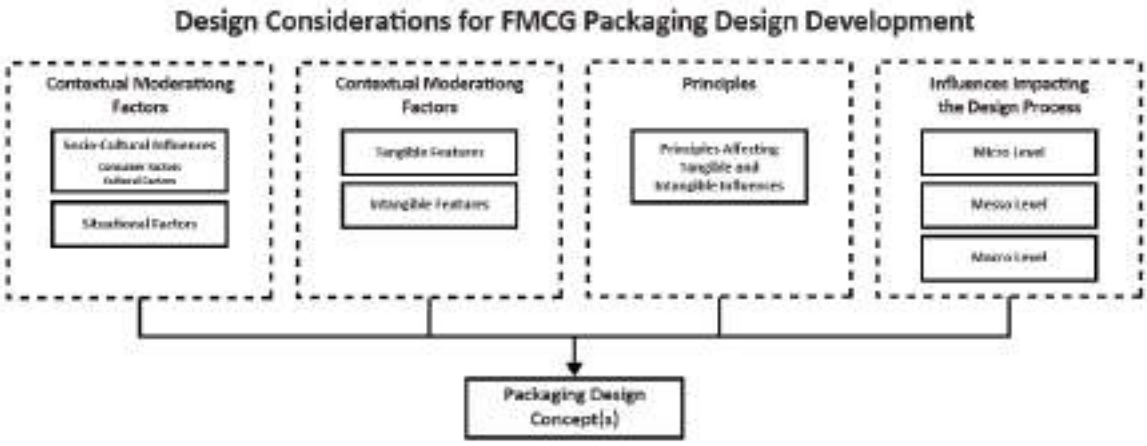

Figure 6: Revised Conceptual Framework of Design Considerations for FMCG Packaging

Figure 7: An Interim Taxonomy of Design Considerations to Support Low Involvement FMCG Packaging Design

Discussion

This summarised account is leading towards a resource to provide practitioners, marketing and design managers with a detailed understanding of *'design considerations'* needed to communicate the value of their designs to stakeholders. It aims to provide terminology and understanding to open up dialogue for the rationale behind decision-making. A much more complex ecosystem of variables that effect the design process was discovered compared to what is presently considered. Although consumers can encounter packaged products in isolation, packaging pre-purchase is viewed almost always in the context of other products packages on store shelves in a retail environment (Deng & Kahn, 2009). This study has provided a comprehensive understanding of the holistic influences that can or should be considered in the design of low involvement FMCG packaging. This included a classification of the "*Artefact Driven Influences"* that provide the *"…actionable dimensions, features, and general product attributes a design team can manipulate in creating a product that attempts to meet design goals."* (Noble & Kumar, 2010); and, the *"Contextual Moderating Factors"* that can affect the perception of the artefact and the latter perceptual processing on post-purchase evaluation of a product. Identification of *"Principles Affecting Tangible and Intangible Influences"* and *"Influences Impacting the Design Process"* was also established. Existing frameworks for packaging design, as identified earlier, do not include such a comprehensive list of *'design considerations'*. This taxonomy represents a means towards creating better frameworks for the design of low involvement FMCG packaging.

The taxonomy produced begins to develop a framework aiding design practitioners to begin to understand, evaluate and assess the designs they produce as well as begin to aid in communicating their decision-making by providing the understanding and terminology. The main purpose of this research was to identify a core set of elements and demonstrate their validity through expert review. This paper is a starting point in the conversation to bridge the difficulties between practitioners, researchers, managers and stakeholders through a set of key topics (terminologies) which provide a clear understanding of the considerations needed when executing new design development or redesigns for FMCG product packaging. Furthermore, this taxonomy could be utilised as a tool to be adopted by industry to assist with self-reflection on internal processes; and, communication in the design process to potentially help improve organisational knowledge management and skill auditing. It may also help facilitate communication with stakeholders to understand each other in the design development process by providing a more common dialogue; and, help effectively communicate with design practitioners internally or externally. The interim taxonomy presented is in an incomplete stage and requires improvement but offers an emerging insight into the final structure. Further work should be addressed to validate the 32 additional terms offered by expert insight.

Research Limitations

The dataset grew significantly from the original set provided by the researcher, based on a review of literature. Using more than 100 topic cards increased session times and fatigue of participants. Although more cards may be used if the participants are familiar with the content, large datasets often lead to confusion, tiredness and possible misinterpretation from participants (Paul, 2008a). Additional terms that were given by participants throughout the taxonomy development and validation significantly increase the data set. However, if not enough information had been provided to participants, this would have reduced the opportunity for a well-rounded and rich model. As participants were continuingly improving the taxonomy, lower cognitive costs were incurred; an advantage of the modified-Delphi card sort method. The selection of *'experts'* could be deemed as a factor that may have affected the results of the final taxonomy and terminology produced. Alternatively, more specific groups of 'experts' could potentially deliver a different outcome as these are less generalist to the group used in this study. For example, just marketing, design or academic professionals rather than a representative body from multiple disciplines. How might this affect the terminology categories and additional topics to the taxonomy? However, the researcher attempted to use a range of experts from a variety of relevant backgrounds to provide a more comprehensive and holistic contribution to the taxonomy terminology; and, capture a range of expertise in the field of FMCG design. The use of a multidisciplinary group was aimed to help reduce the bias of any one discipline. The topics introduced by the participants in the later stages of the taxonomy were not validated by all members of the expert panel. Although the nature of the study allowed this to occur, further validation of the completed taxonomy is required. Cultural context must also be addressed as a potential limiting factor. This study represents an insight from a UK perspective. However, this may differ if conducted in other countries where terminology and processes vary. Although bound to a selection of domains of research in the literature section including: packaging design, product

design and marketing/design management; this study may be improved with some more lateral thinking to gain further insight. This could be in areas such as user experience or service design. How might this affect the final outcome of the taxonomy? However, to gain an in-depth and focused investigation; and, due to time restrictions, additional insight gathering was restricted.

Future Research

There have been great efforts made within marketing management and consumer science research to understand the effect packaging elements have on consumer response and product perception in FMCG product categories. A baseline common dialogue, taxonomy and nomenclature, has now been established; and, validated as a set of *'design considerations'* for FMCG design practice. Future research should focus on the validation of the 32 additional topics identified by experts to authenticate their place in the taxonomy through further deductive content analysis of the resources gathered and through additional literature search. Future research should also look to understand how FMCG design practitioners implement, rationalise and validate design decisions in their design practice. Some emerging research has already looked to try to unravel and explore more in-depth FMCG packaging management with industry bodies (Simms & Trott, 2014a, 2014b) and individual FMCG design practitioners (Ryynänen & Rusko, 2015) through qualitative research methods and narrative report. Further investigations through the use of qualitative investigation methods such as case study, practitioner/key informant interviews, observations, document analysis or surveys to explore FMCG packaging design practice and management at a UK level. This could look to help the understanding from a personal account how packaging designers rationalise and validate their decision-making in real-world application; and, understand in more depth design management of FMCG packaging design development through industry-led research. This will contribute to the ongoing development of better frameworks for FMCG designers and support packaging design development.

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Track 3.d Introduction: How does design express value?

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A general view, often presented in a political context, suggests investment in design may create societal benefits, like economic growth, employment, competitiveness, and convenience. Conducted at a general level with aggregate variables, such measurements provide very limited insights and can even be misleading. A different approach takes a particular view of a designed artefact, object, system or service. Addressing the benefactors, users and consumers, we may be able to reach an individual value, which in turn may be aggregated to assess a market, KPI or similar.

How does design express value? And how can we measure the value?

To design is to create value for somebody. However, the value depends on who judges it and their and their personal values.

According to John Heskett;

> *"Design, stripped to its essence, can be defined as the human capacity to shape and make our environment in ways without precedent in nature that serves our needs and gives meaning to our lives". (Heskett, 2005).*

This suggests that artefacts, objects, systems and services, which are available to us, may influence and serve us in different ways depending on our position within a particular environment. Any artefact may affect our physical well-being. This reflects preferences and other values may essentially be emotions and feelings.

The four presentations represent a comprehensive view on how design create value, ranging from the more conceptual issues to the applications and applied situations where design is valuable.

Design capabilities for the evolution of value creation by Nicola Morelli, Amalia de Götzen, Luca Simeone Aalborg University, Denmark deals with the fundamentals of design as creation of value:

The process of value creation is not an exclusive preserve of designers, but the result of a diffuse problem solving capability. The creation of new value connected to the concept of innovation and can happen in different logical contexts, from limited and confined contexts (niches) to consolidated structures (regimes) and to wider sociotechnical contexts (landscapes). In all those contexts, design has a different role and whoever designs use different capabilities and tools. Furthermore, design capabilities are useful when aligning value creation and change in different levels, thus contributing to understand the relationships between small-scale interactions and wider scale transformation of sociotechnical landscapes. This paper proposes a framework to understand the contribution of design to the value creation process at the three levels, focusing on design capabilities and tools to work across different logical contexts.

Voorberg, van Buuren & Brinkman locate design thinking in connection with public services:

Design thinking is increasingly expected to create value by including service users in the fundamental aspects of services. In order to create value, the design approach needs to be 'translated' into an applicable framework, appropriate for the public domain. Therefore, we first explore what kind of value is generated within the public domain. Subsequently, by focusing on well-known contributions from the design literature, they review what can be learned from design approaches for value creation with users. They examine what kind of specific characteristics of the public domain needs to be taken into consideration, when one aims to apply a design-oriented approach in the public domain. Ultimately, we conclude how the design approach, can be made applicable within the public domain. In doing so, this paper aims to formulate stepping-stones for both academics and policy makers.

Wang and other locate design with branding: Emergent trends of co-branding strategies are increasingly being utilized in fashion marketing and retailing; as such, the role of design is becoming paramount in collaborative partnerships when devising co-branding strategies. In particular, designers are central to the process of collaborative partnerships when developing highly novel products more that are attractive to demanding consumers. This paper critically examines the role of cobranding strategies as a source of innovation in fashion marketing; and to understand how organizations draw upon co-branding to inform the development of new products, services and brands. Branding strategies, new product development, design, innovation, and fashion marketing are discussed and critically analyzed.

Cardall and Howell discuss design in a particular context of the Dutch design week:

Trends in design manifest in many ways. To identify meta-trends in contemporary design culture, we worked with nine student researchers to gather data seen during an academic trip to Dutch Design Week in 2017. The results indicated growing interest in four central themes: identity, globalization, technology, and production. From these themes, nine trends were outlined; social engagement, production consciousness, design for agency, material innovation, humanist design, humanity and technology, re-interrogating history, speculative design, and questioning the role of design practice itself. We noted a shift from narrative-driven to experiential designed objects and a change from individual expression toward communal experience. We also observed a discipline in flux as designers struggle with these large themes, object hood, and the role of the designer.

Discussion

The contribution demonstrate a wide variety of what design discourses on value creation offers today. Design is not isolated to particular people, but is cooperative and takes place within complex contexts of private and public spheres. It is also connected with business elements such as branding and the issue of design may serve as co-branding.

One critical issue concerns how we may measure the value of design. This is not a major issue in the value of design discourse yet. However, it is likely to become one in the future. However, there a several challenges to this. One is that designers and similar experts are doers more than analyzers and those who analyze like sociologists, marketing people and economists have severe challenges understanding and delimiting design in particular contexts.

A suggestion may rest on the following principles: Standard measurements in economics, sociology and marketing are quantitative and builds on aggregate data, referring to a population, a market, and a segment or similar. When referring to persons or individuals the reference is an average individual and there is usually no way to consider individual variation. The individual variation may be substantial, as our experiment below will show.

In design, we may want to measure values, experiences, expectations, adherence and preferences

It may be is based on a bipolar scale. Such a scale represents data collection in practical situations, like a person using her computer or smartphone to search information, a shopping experience where the person is located in a shop (or particular section of a shop) comparing a pair of items. These represent the comparisons by moving the cursor between the two items indicting which is preferred and even how much one preferred compared to the other. The scale has no number and each particular comparison is representing the values of the particular situation. The researcher may later use a numeric measure to indicate the numbers. Such a measure may become qualitative, but using statistical methods. It will take embodiments into serious consideration.

Further developments will take place and published in the near future.

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Design capabilities for the evolution of value creation

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The process of value creation cannot be an exclusive preserve of designers, but it is rather the result of a diffuse problem solving capability. The creation of new value is also connected to the concept of innovation and can happen in different logical contexts, from limited and confined contexts (niches) to consolidated structures (regimes) and to wider sociotechnical contexts (landscapes). In all those contexts, design can have a different role and whoever designs should use different capabilities and tools. Furthermore, design capabilities can also be useful when aligning value creation and change in different levels, thus contributing to understand the relationships between small scale interactions and wider scale transformation of sociotechnical landscapes. This paper proposes a framework to understand the contribution of design to the value creation process at the three levels, focusing on design capabilities and tools to work across different logical contexts.

Keywords: value co-creation, multilevel perspective, design capabilities

Introduction: design and value creation

The concepts of ‘value’ and ‘value creation’ have been discussed since Aristotle (Johnson, 1939). In the last centuries, such concept became the founding element of economic theories. The definition of such concept in economic terms would go beyond the scope of this paper, but two interesting paths can be followed, which make the concept of value creation relevant to reframe the activity of design.

On the one hand, some studies have spot a light on the logical difference between considering the value as a unit of market exchange or as something related to what happens in the phase of use (Lusch & Vargo, 2014; Vargo et al., 2008). On the other, a design perspective would focus on value not only in relation to the creation of the tangible reality of goods and services, but also on the role they play in practice and in the context of people’s life (den Ouden, 2012; Heskett, 2017).

Following those paths, it is possible to move the centre of the value creation activity from the chain of production of products and services, to the moment and context of use. This is a fundamental shift in the way to interpret both economic processes and design actions. Furthermore, given the critical role design has in innovation process, it is possible to consider the role of design not only in radical innovation processes, but also in incremental innovation actions that everybody performs in everyday life.

This perspective shift would not exclude the relevance of design as a support to manufacturing or service systems, but would refocus such activity around the centre of value production and articulate it on different layers. Therefore, starting from this perspective shift, this paper will explore the activity of design at different logical levels of intervention, highlighting the abilities required to design at each level.

Changing views on the value creation process

The application of knowledge and skills for the creation of value is the fundamental basis in economic exchange. With this concept Vargo and Lusch (2004), later refined in other works (Lusch & Vargo, 2014; Lusch & Vargo, 2006; Vargo & Lusch, 2008) refuted the dominant view that material goods where the primary unit of exchange, to propose a view in which services, seen as exchange processes and relationships, are dominant (Vargo & Lusch, 2004). In Vargo and Lusch' view, goods are only resources for a process in an exchange of competences, that is the core of value creation.

This simple and plain ascertainment is in fact a substantial revolution in the way of interpreting the value creation process, because it changes the role of the actors and elements of this process. Goods are just part of an *infrastructure* that organisations create to offer a *value proposition* to service beneficiaries. Such infrastructure integrates resources (services, expert knowledge, products) to be used in the value creation process, but it does not constitute value *per se.*

The functional change of the elements in value creation leads to rethink the role and capabilities of the actors in this process. The customers (beneficiaries[1]) of the service are no longer passive, as they have the key role to co-creating value within a constellation of actors (Normann & Ramirez, 1994; Ramirez, 1999). Value is cocreated by integrating the infrastructure proposed by the enterprise and the beneficiaries' personal resources (personal knowledge, preferences, habits, problem solving strategies). This integration capability basically represents the natural problem solving attitude that is common to every individual; this is an attitude that depends on the capability to *device courses of actions aimed to change existing situations to preferred ones*, which according to Simon (1969, p. 55) is a characteristic of the design activity. The value co-creation process happens within a broader ecosystem (Vink et al., 2017), which includes values, implicit rules, regulations and knowledge, that is what Vargo and Lusch (2016) define as *Institutions* (Figure 1)

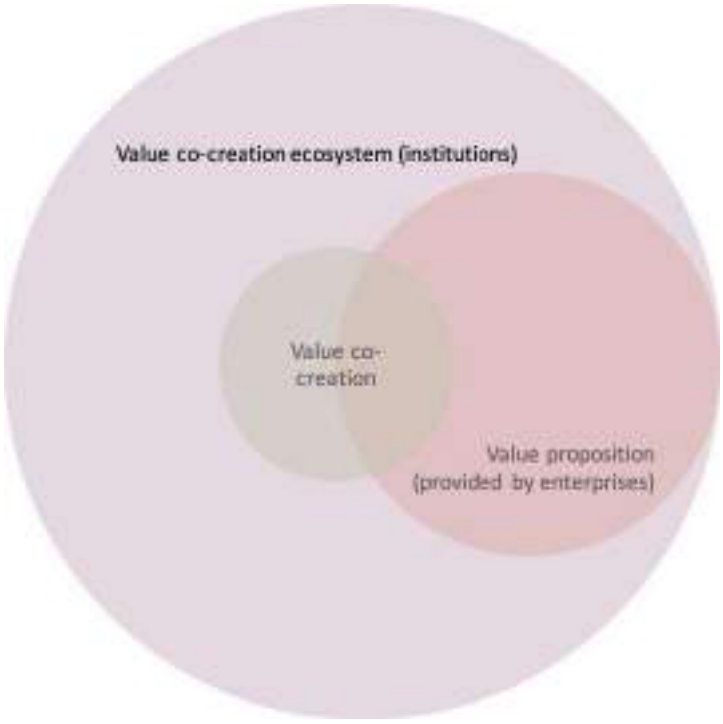

Figure 1 Value co-creation and its ecosystem

[1] Vargo and Lush highlight the inadequacy of the terms *customer* or *user*, in respect to a process of value co-creation (because the customer/user is in fact also value creator). They prefer to use the term beneficiary, instead. This paper will therefore use the term *beneficiary* to indicate those who participate to the value-creation process by aggregating resources provided by other stakeholders (service providers, resource providers).

Redefining the design action

The recognition of the beneficiary's active role in service delivery and the revision of value creation as a design process within a network of relationships (Vargo & Lusch, 2016) poses the problem of redefining the characteristics of the design action and the role of design in a logical context in which the typical competence of designers - to envision possible desirable futures and to take action towards them - is no longer an exclusive capability of trained experts, but a diffuse one (Manzini, 2015).

The design perspective can be useful to link the process of value creation with some considerations about innovation in services. Design has often been considered as a crucial component in innovation processes (Brown & Katz, 2009), and as a driver of a specific kind of innovation, that works at the same time on radical innovation in technology and in the system of meanings (Verganti, 2009). Focusing on design as a diffuse capability however, makes it possible to zoom in, to the individual act of value creation - the everyday actions rather than the radical innovation – and back out, to analyse the systemic context of such actions. According to this approach, design is an attitude that informs the process of value creation at the microscopic level, but at the same time such innovation may imply change and evolution in the infrastructure that supports value creation, in the relationship between the actors that integrate resources for value creation, and even in the quality and modes of resource integration.

Every action of value creation is in fact producing new value, because it is producing something that was not there before, whatever the relevance of the novelty is (incremental or radical). In some instances, the value creation process is generating novelty not only in the value that is created, but also in the structure of the value creation ecosystem. Such change is often part of an evolutionary process, or the result of a process of social construction – i.e. a process of negotiation between social, cultural and technological instances of different social groups (Bijker et al., 1987) - which changes the structure of the value co-creation ecosystem at different levels. Unlike other evolutionary processes in nature, though, the changes produced by this process are deriving – though they are not the direct result of - from the ability of human beings to act through purposeful action, in other words, from design actions.

Innovation processes, a multilevel perspective

The evolutionary mechanisms described in the previous session refer to change and innovation at different scales. It is therefore interesting to analyse innovation processes in value creation systems in relation to the magnitude of change and to the design capability that comes to play, when working on different levels of innovation

Studies of innovation have provided useful conceptual structures to understand the mechanisms of change in complex systems. They have explained, for instance, the paths from invention to innovation (Nelson & Winter, 1982), the action of technological paradigms in selecting and directing innovation towards preferred trajectories (Dosi, 1982) and the relevance of large or incremental changes in scientific knowledge (Kuhn, 1962) The analysis and comparison of such contributions goes far beyond the scope of this paper, but a common characteristic of such studies is to focus on the tension between elements of change and elements of resistance to change, mainly embedded in infrastructures (services, organizations, rules, policies or institutions).

Such tension is the engine of a transition process that provokes different types of innovation, from incremental changes to technological revolutions (Freeman & Perez, 1988). This tention has also been studied at different scales, identifying different levels of heuristic analytical concepts: a frequent definition of such levels distinguishes between niches, socio-technical regimes and sociotechnical landscapes (Geels, 2010, 2012; Geels & Schot, 2007; Smith et al., 2005). Such levels are very useful to understand the insurgence, diffusion or consolidation of innovation.

According to Geels, and Schot (2007), ***niches*** are protected environments, like incubator rooms, in which innovation emerges, and is developed by a network of dedicated actors. Novelties, and especially radical novelties, originated by the action of outsiders and fringe actors can mature in such niches, protected from the adverse action of conservative forces, which tend to preserve the existing status and routines.

Socio-technical regimes refer to consolidated infrastructure and recognizable communities of experts, which stabilize existing trajectories through cognitive routines, regulations and standards. The solidity of such trajectories is essential for attracting investments in machines infrastructures and competences.

Finally, ***sociotechnical landscapes*** form an exogenous environment beyond the direct influence of regimes and niches actors, they represent the ecosystem of values, rules, regulations, cultural frameworks and institutions that shape innovation. The three levels also define different speed in innovation processes, with rapid and unstable changes in niches, solid and slower changes in sociotechnical regimes and very slow changes in sociotechnical landscapes. Change, however, does not simply happen within those logical levels, but also across them: niche changes create pressures towards regimes, landscape changes press for regime transitions and destabilization of regimes creates opportunities for niche innovation.

Niches and socio-technical regimes have similar kinds of structure as both are driven by the purposeful action of a community of actors, although the interaction among them is regulated by explicit rules in regimes, whereas it is unstable and depending on implicit structures in niches. Niches innovation is based on unstable aggregations of actors, whereas regimes have a consolidated aggregation, where mutual motivations and interests are binding the actors. The rules that govern the interaction at both levels have different nature: regulative (regulations, standards, laws), normative (relationships, values, behavioral norms) and cognitive (belief systems, pragmatic knowledge, problem definition, search heuristics). Such rules are essential for enabling actions - thus empowering and amplifying their effect - and legitimating them or delimiting their action, when their impact tends to be disruptive. Innovation, however, is often depending on how such rules are interpreted and possibly broken to generate new rules.

The socio-technical landscape instead does not influence change directly, but rather by providing *gradients of force*, i.e. the substrate of values, policies, knowledge, on which niches and regimes are based. Change at this level is much slower, but it can indirectly determine turbulence, shocks, disruptive phenomena or support *avalanche* changes (i.e. a number of uncoordinated changes of multiple dimensions at the niche level) (Geels & Schot, 2007).

Multilevel innovation perspective and the structure of value creations systems

The multilevel perspective proposed in the previous section is providing an operative framework to understand innovation processes, but how can this structure be used to read and understand concrete changes in the value creation processes? How is purposeful action (or design action) working at the three levels?

The service- dominant logic, proposed in the first sections of this paper, considers value creation as uniquely and phenomenologically created by the beneficiary, although such process happens through the interaction of multiple actors, and is coordinated through actors' generated institutions and institutional arrangements (Vargo & Lusch, 2016). Every instance of value creation is by definition creating something new, however most of the value creation actions are clearly framed in a system of normative, regulative and cognitive rules. For the scope of this paper, the focus is on the mechanisms of innovation, that is, on those novelties that bring about changes in the structure of value creation (i.e. the network of actors that contribute in the value creation process) or in the way resources are integrated.

Every time individuals or groups use a product (e.g. a car) or a service (e.g. public transport) they create value by integrating their personal knowledge (e.g. how to drive a car, where to sit or when to step out of the bus), knowledge deriving from rules and standards (e.g. driving rules, rules to access to the bus service) and knowledge embedded in their products or services (e.g. the car, the bus, the bus driver). Innovation in the way knowledge is integrated could consist in the change of the interaction between those different kinds of knowledge, e.g. assisted driving, or a different way of paying the bus ticket. Within a niche of a specific service, this change could be integrated into a more complex interaction structure (e.g. new interaction systems for a car or a new app for paying the ticket in the bus). This structure could be limited to a specific context, e.g. a neighbourhood in which specific infrastructures have been installed, to support autonomous or assisted driving, or a bus line in which the new ticket system is implemented. The confined environment of the niche creates an error friendly environment in which it is possible to create small experiments, that could eventually produce larger changes. The persistence of an element of novelty within a niche may encourage the definition of a more solid organization (e.g. a local service) which can be built by codifying the interaction among the actors in the niche or formally organizing the resources available in the context (for example organizing a network of charging spots for electric cars in a town, or creating protected lanes for self-driving vehicles).

The pressure for broader regime change comes when innovation structures in the niche reach a level of maturity that allows replicability and scalability. The regime includes large organizational structures, such as service organizations, public service systems or infrastructure. Such infrastructure has been designed and codified, in order to support *routine* procedures, which in fact facilitate any form of value creation that is compatible with them. The resistance of this infrastructure to the pressure from niche innovation derives not only from the conservative behaviour of the communities within those structures (organizations, administrations) but also by the solid framework they derive from, which privileges compatible forms of value creation. The resistance also depends on the solidity of such framework, where moments of weakness, frictions between regime structures and the sociotechnical landscape, can reduce the resistance to niche innovation. This is happening for instance, when increasing pressure of environmental concerns on the existing production systems, require a substantial infrastructural change (such as a shift in the energy production systems); in those cases, niche innovation can wedge into the regime weaknesses, to propose a new infrastructure. Unlike the experimentation activity of niches, the creation of novelties at the regime level requires a purposive and codified behaviour that justifies the new structure and aligns it with the sociotechnical landscape and with other existing structure at the regime level.

Unlike niche and regime changes, landscape changes are not directly depending from purposeful actions of communities or individuals. They are slow, evolutionary changes, often triggered by shocks, turbulence, or disruptive phenomena (Geels, & Schot, 2007). The sociotechnical landscape is the logical level of institutions, as described by Vargo & Lusch, (2015). Institutional change consists of cultural change, or change in large political trends or broad geo-political patterns. The disruption can come from traumatic political issues, large and rapid migrations or evidences of environmental changes. Changes in sociotechnical landscapes are obviously influencing niches or regimes, as the rules and knowledge at this level may gradually come to collision with regime structures that are no longer adequate (e.g. the progressive inadequacy of existing public administrations in respect to the growing pervasiveness of social networking) and can support or hinder experimentations and multidimensional innovations in niches. Even at this level, purposeful action could have an effect, in defining policies or governance structures, that trigger new political and governmental landscape.

Design and value creation in a multilevel perspective

The previous section highlighted the opportunities for purposeful action to generate innovation at different levels of the value-creation structure. This section is instead zooming-in the purposeful action at each level to describe its design specificities.

Design and the value creation in niche contexts

The very moment of value creation is the result of an interaction between beneficiaries, other stakeholders (enterprises, institutional actors, service providers) and other resources (objects, technologies, services) (Vargo & Lusch, 2004; Vargo & Lusch, 2008). Value creation happens in the local context of the beneficiary, i.e. in the logical and geographical niche in which s/he operates. Beneficiaries are the centre of the value co-creation process and their design action is based on their own experience, knowledge, problem solving capabilities. However, the interaction in this moment can be facilitated by more specific design abilities, to create interfaces, control systems, engaging rules (such as games), competition or cooperation mechanisms or creativity tools, such as cards to support the dialogue between citizens and experts (Cottam & Leadbeater, 2004a). The attention of several design studies has been focused on the process of *infrastructuring*, that is the process that supports, triggers or empowers customer creativity or creates the *agonistic* ground for interaction (Björgvinsson et al., 2010; Manzini & Staszowski, 2013). In some instances, the effect this kind of design intervention can have is to provoke *avalanche* changes around specific innovation areas. Such avalanche consists of multidimensional and multidirectional innovation flows, that increase the innovation tension in a niche, with the expectation that such tension will find preferred paths to create more pressure over the regime structures or even on the sociotechnical landscape (Figure 2).

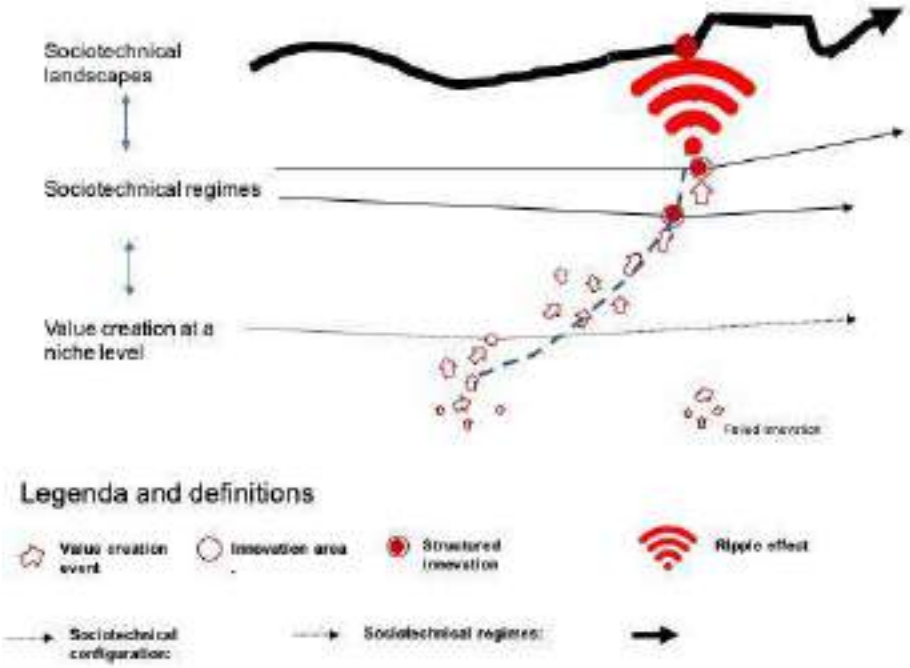

Figure 2 design in the value creation context and pressure on sociotechnical regimes and landscapes

It is however important to point out that design may also have a role of creating frameworks that address such flows towards preferred paths, as exemplified by Manzini and Rizzo (2011). The *Design of The Time* (DoTT07) program, for instance, was a program that enhanced a number of innovation initiatives in a northern England region. Such initiatives were touching different dimensions (from school reform to sustainability, from local food production to health issues) (Thackara, 2007). The framework program is not yet an organized infrastructure, but rather a way to align a number of initiatives to scenarios about desirable landscape changes (framework programs will be analysed later in this paper).

Purposeful action at the niche level can also aim at aggregating resources or actors (and therefore relevant knowledge) around local niches, thus creating proof of concepts for possible reproduction of local innovation in further niches or possibly to scale up innovation created in local communities. This was the case of some EU-funded project, such as Life 2.0 and My Neighborhood, which created innovation in a small network of actors, but also highlighted skills and competences that would consolidate a reproducible ecosystem (Morelli, 2015).

More generally, the organization and integration of resources at the niche level corresponds to the activity of designing a single instance of a service - a local fast food concept, a car pooling group or a solidarity purchasing group - where any innovative element is organized in a way that makes business, social and cultural sense. Even some experiments of migrants' integration in local communities, where any available resource, from empty apartments to migration regulations are organized to create meaningful reconfiguration of a local community, may represent an example of organized resource integration (Elia, 2013). It is worth noticing that the purposeful action at this level does not imply the intervention of an expert designer, as in the case of migrant integration in Riace, Italy, promoted by the major of the city (Elia, 2013) or the initiative of Social Streets invented by a citizen living in Bologna (Ecchia & Maria, 2016)[2]. The design skills involved in the action at this level concern problem solving, conflict management, prototyping and visualisation of meaningful opportunities. Although sometimes complex, those skills are very close to the natural capability to organize change and to integrate the available resources.

[2] The mayor of Riace re-vived a depopulated town in the South of Italy by opening empty apartments to migrant families, who created new activities and new needs for schools and civic infrastructure. The social street movement was initiated by a citizen in Bologna who used a Facebook group to create new physical interaction with his neighbours

Design at the regime level

The institutional arrangements, that support the value creation system at the regime level are service organizations (e.g. fast food chains, franchising systems), public administrations (taxation systems, municipalservices, healthcare systems), or interaction platforms (created by private initiatives or cooperative movements, such as social networks, mutual help platforms, or share-based transport or residential solutions). Those arrangements organize the value creation ecosystem, by specifying rules of engagement, interaction modalities, actors' motivation, business purposes and motivation systems. This is typically the activity of service design. It concerns the visualization and organization of service interaction in a coherent architecture, the visualization of interaction mechanisms, motivations, business opportunities and social ecosystems. These competences are more specific of expert designers, because they require the capability to recognize value and embed it into the structure of the institutional arrangement, the capability of linking each element of detailed interaction to the systemic whole, and the capability to figure out, and possibly visualize scenarios of possible use of services or deployment of resources (Conley, 2004). New competences are recently being highlighted, in relation to the construction of service platforms, which represent a substantial transition in the concept of service organization, in which the traditional roles of producer/consumer is declining, in favour of a complex interaction system, based on value integration for mutual purpose, information exchange and filtering, relationship management, accessibility and redefinition of new exchange currencies (Choudary, 2015).

Design in landscapes

As mentioned in a previous section, the purposeful intervention at the landscape level does not produce direct changes in the landscape, but can actually trigger change processes. This is the logical level of institutions, which facilitate and regulate value creation by representing shared systems of values, social, cultural and political premises. Innovation in institutions depends on the aggregation of a number of factors, including, but not limited to human action. Design action is therefore unlikely to produce direct and controllable institutional changes. Nevertheless, several examples are evident, of purposeful social constructions aimed at influencing this level. This is the case of healthcare reforms, the Australia tax reform (Terrey, 2012), the construction of the American electricity system (Bijker, 1995), or the psychiatric reform in Italy (Manzini, 2015). The role of design at this level is still being discussed. What are the most successful strategies to amplify the impact of design action on institutions? Can we recognize more effective methods or tools to influence this level? What are the interactions between policy instruments (I.e. the institutional arrangements that actualize values and principles) and institutions? Are there tools to align design actions to institutional change, in order to link operational design aspects, even at the niche level with *desired* directions for institutional evolution?

Summarising design skills at different logical levels

The previous sections identify different levels for design action and some specific skills that lead to change in each of them. Table 1 synthesizes such skills, from everyday problem solving (at the bottom of the table) to major landscape changes.

Everyday problem solving refers to everybody's attitude to solve recursive or trivial problems - like driving a car, cooking, going to work - which usually do not represent any particular challenges to individual problem solving capability. This routinized type of behaviour has been described and studied as *practice*. Practices represent behaviors that depends on the interconnectedness of contextual elements, such as "things" and their use, background knowledge, know-how and emotional states. (Reckwitz, 2002, pp. 49-50). Practices are constantly repeating sequences of actions, although they may tolerate changes which may exercise higher or lower pressure on the practice framework.

Designing (i.e. generating purposeful change) at the **niche** level require different capabilities to interact with other actors or to organize or *infrastructure* such interaction, as for the organization of a web page or a service activity. Building upon Conley's definitions (Conley, 2004) the design capabilities required at this level concern:

- **Contextualization skills,** i.e. the ability to identify and respond to relationships between a solution and its context.
- **Experiential control,** i.e. the ability to use form to embody ideas and communicate their value and
- **Modeling skills,** i.e. the ability to model and visualize solutions before all the information is available (as in prototypes).

The activity of design at this level may use tools, such as visualization (Journeys, storyboards, dramas), analytical tools (personas, experience-, context- or technical- analysis) and models (such as prototypes, or role playing). Such tools describe the change that is intended to propose, simulate and experiment on such change and make sure that all the stakeholders in the value co-creation context be able to figure out and interpret their role in the perspective change. The literature about such tools and their use in design disciplines has been widely studied, especially in the disciplinary areas of service design, interaction design and industrial design. A number of projects, in the previous decade (Meroni, 2007; Parker & Heapy, 2006; Thackara, 2007) paved the way to the construction of a rich framework of competencies and skills. It is also worth mentioning the influence of schools and academic courses on service design, interaction design and more recently on social innovation in defining strategies and tools for design action at this level.

Changes at the **regime** level consists in designing and organizing services and platforms, the design skills at this level concern:

- **Architecture building skills,** i.e. the ability to add or maintain value as elements are integrated into a whole.
- **Vision skills,** i.e. the ability to recognize a broad range of potential in a given problem statement and
- **Open Problem solving skills,** i.e. an approach to problem solving that involves the creation and evaluation of multiple alternatives.

The activity of design at this level may use tools that help recognizing the element of a value co-creation ecosystem (such as stakeholders' maps, business model canvasses), and organizing complex interactions (such as blueprints, system maps, platform canvasses). Those skills are consistent with a vision of design as part of a production process, thus using the contiguity with management and marketing studies to borrow methods, tools and problem solving strategies. At the same time the skills related to this logical level aim at generating structured architectures and visions that can define subdivision of work (stakeholders' maps, motivation matrix) codification of knowledge (blueprinting) and opportunities for economy of scale (system maps) (Morelli, 2009). While the competences at the niche level may also refer to existing social practice or personal experience, this level obviously requires *expert* competences. Like the competences at the niche level however, the design competences at this level are quite well known and familiar to the design discipline, also because of the growing relevance of the design profession in new areas, such as service design and innovation.

Finally, the design skills related to changes at the **landscape** level concern the ability to influence and direct change in governance - in particular in policies - and in the principles and values that are eventually expressed into institutions. The design capabilities to impact on this level are:

- **Modeling skills,** i.e. the ability to model and visualize solutions before all the information is available
- **Intra-level design ability,** i.e. the ability to work at varying levels of abstraction.

Unlike the previous levels, the role of design in supporting landscape changes has not been systematically studied in the design discipline. This is probably due to the infrequent involvement of designers in governance and policy making bodies. The debate on design for policies has been quite active in the last decade, and the blossoming of government innovation labs connected to public administration and policy design[3] has highlighted the relevance of this issue. The debate however, has been limited to the role of design in delivering concrete results, rather than to the alignment of such results – and the strategies to achieve them – to the ongoing or desirable cultural, social or policy related horizon.

The next section will therefore consider some relevant contributions for a more systematic analysis of design approaches and tools to support purposeful changes of the sociotechnical landscape

[3] On this matter, it is worth mentioning NESTA, in UK; MindLab and Innovationshuset in Denmark (both closed now); la 27me Région in France, Public Polcy Lab in New York, Helsinki Design Lab and the Design Policy Lab (at Politecnico di Milano), also recent projects, such as Design for Europe (designforeurope.eu/) and Designscapes (designscapes.eu) are contributing to this debate.

Table 1 Design skills and their relevance at the different logical levels. The value creation facilitators are the resources (people, technologies, organizational forms) that support value creation. The last column also includes some of the common tools used in relation to the various capabilities

	Resource integrators	Value creation facilitators	Example	Design Skills needed
Value creation in Sociotecnical Landscapes	Principles/values Governance (Policies)	Institutions	• Long-medium term Sustainability plans • Healthcare reforms • Tax reforms (Terrey, 2012) • Policy labs • Urban Health (Geels 2010) • Edison's electricity system (Bijker 1995) • Psychiatric reform (Manzini 2015) • Gas stove systems (Shwartz Cowan 1987) • DoTT 07 (Manzini-Rizzo 2011)	**Modeling skills** **Intra-level design ability** • Framework design programs • Design orienting scenarios • Theory of Change
Value creation at regime level	Services, service platforms Policy instruments	Service organizations Public administration	• Taxation services, Healthcare services, Fast food chains • Franchising • City Labs	**Architecture-building skills.** **Vision skills.** • System mapping tools • Alignment tools (to align services to policies or corporate values) • Business modelling
			Cooperative platforms Commercial platform (like AirBnB, Uber, Facebook)	**Architecture-building skills.** **Open problem solving skills** Platform building, HCI, Business modelling canvas
Value creation in niche contexts	Local Organization	Local service providers, expert designer, citizens	Solidarity purchasing groups, urban gardening groups	**Contextualization skills** **Architecture-building skills** • System tools • blueprint • system maps • business modelling
	Local Interaction	interaction structure	Mobile/web application, interaction cards, games.	**Modeling skills** **Experiential control** • Service journey/touchpoints. • User-driven methods
		Social practice	Restaurant	Professional experience
Everyday problem solving			Driving a car	Personal problem solving strategies

Aligning design at the three levels

The focus of the early experiments on design in public administration (Cottam & Leadbeater, 2004a, 2004b; Leadbeater & Cottam, 2008) highlighted the need to focus on citizens and enhancing their participation, thus proposing strategies for social innovation and practical tools (e.g. card games, prototypes) with the direct involvement of citizens in projects that were mostly developed at the niche level (Murray et al., 2010; Thackara, 2007). The need to develop design capability and strategies for policy change was more explicitly framed by the *Design for Europe* project (VV.AA, 2013). The focus of the contribution on this matter, however, has often been on the *policy delivery* process, that means on the process of developing policy instruments to solve concrete and specific cases, or to create proofs of concept (again, at the niche level), or to reframe the administrative structure of specific services (e.g. healthcare or taxation services) focusing on citizens' need, rather than organizational efficiency (Nesta, 2016).

The open question remains: can design – and designers - have a role in the process of change that concern the larger frameworks of principles and values that inspire policies and government action? This question can be translated into practical and operative terms: are there tools or strategies that allow designers to align interventions at niche or regime levels to larger actions that purposefully contribute to change the sociotechnical landscape?

Changes in sociotechnical landscapes, as mentioned above, are not directly deriving from purposeful action, but rather from small movements of the system of values and knowledge and social practices.

Manzini and Rizzo (2011) propose an alignment between small experiments at the local level and large sociotechnical changes. Such alignment would be possible through the definition of *framework design programs*. Those programs are generated as a result of different kinds of actions: they could be the result of scenarios proposed by design teams (as in DoTT07) or of negotiation among different stakeholders, or could be triggered by inspirational exhibitions or local living labs.

The intermediate steps between the small-scale experiments and the larger scenario changes is however seldom explored. Scale-out or scale-up processes[4] are supposed to support larger changes starting from local phenomena. Scalability happens according to different processes: *wild fire diffusion* (the most common case of diffusion phenomena, such as the take-up of social media) or *diffusion by nodes* or by *circles* (Morelli, 2015), which is based on the reproduction of small scale value-creation ecosystems. Scalability and diffusion, however, describe the expansion of a small-scale phenomenon, but still do not provide indications on *purposeful value creation* at the level of socio-technical landscape. That means they give no insights on how change can be addressed towards desirable landscape configurations.

Scenarios are a frequently used approach to the definition of large and long term changes, because they create the ground to generate strategic insights to align present actions to future desirable sociotechnical landscapes. This approach has been particularly relevant in studies on sustainability, where *backcasting* was used to imagine and select possible future scenarios and project them back into the present. (Holmberg, 1998).

Working with scenarios has always been implicitly or explicitly part of design activity. "Scenarios are images of possible, probable, or preferable futures or futures to be avoided, and sometimes comprise the steps to achieve them"(Jonas, 2001, p. 76). The organization of design work on the basis of scenarios implies a work of analysis, projection and synthesis (Ibid), which in operational terms has inspired Manzini et al. (2009), when proposing *design orienting scenarios,* a tool to align a framework of desired values.

- The analytical phase in this approach consists on mapping the current system of actors and negotiating and define a set of common goals and intentions at the systemic level.
- The scenarios (the projection phase) are built on the basis of hypotheses about the changes of the most critical factors (values, lifestyles, technological issues, social and ethical issues)
- The synthesis consists in plans for concrete solutions (services or infrastructure for local interaction), that use a kit of descriptive tools, including system maps, storyboard, and motivation matrix).

[4] Scaling out has been defined as a horizontal process of scaling up (diffusion) whereas scaling up has been defined as a vertical process (institutionalisation)(Concilio et al., 2013; Morelli, 2015; Uvin et al., 2000)

A more systematic alignment between large scale changes and local/present design solutions can be facilitated by the use of *theory of change*.

A Theory of Change is a structured way to map a journey towards an expected change, starting from some assumptions about the causes of a present problem. It is therefore a useful planning tool, which shows the 'intervention logic' of a project, showing the actions that need to be taken to realize a desired goal or impact, the output, the outcomes and the expected changes deriving from the action. By figuring out this "causal pathway" between action and their impact, the theory of change proves to be a good evaluation tool, that can be used to align short term value creation with larger sociotechnical changes.

The Theory of Change can be used to boost innovation pathways in environments, such as urban contexts, where a number of small innovation ecosystems, composed by the alliance of different stakeholders, are proposing promising solutions to relevant or emerging urban issues. This is the case, for instance, of the Designscapes project[5] (Simeone et al., 2019)(Figure 3).

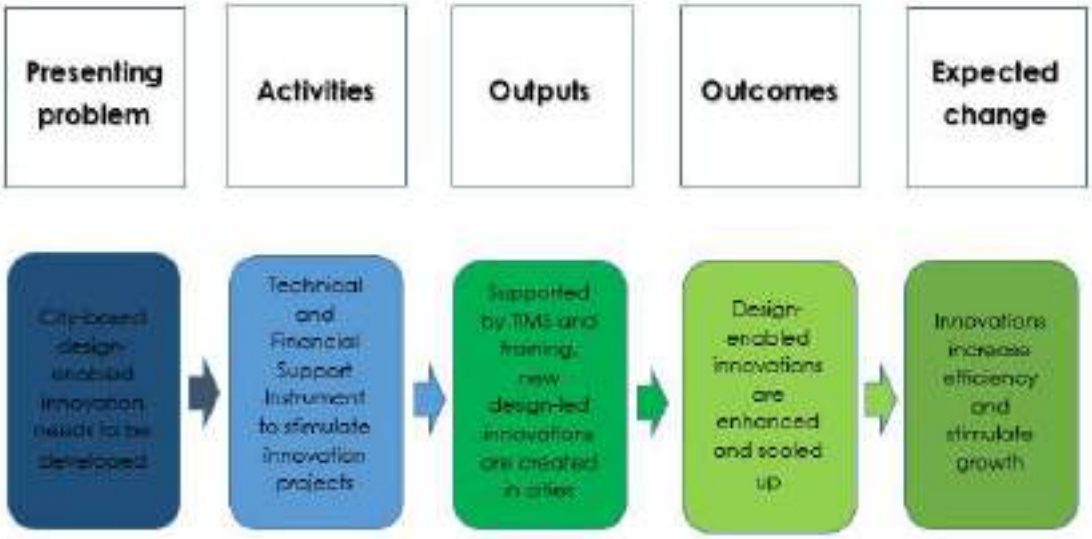

Figure 3 The Theory of Change, as used in the DESIGNSCAPES project. The the project aims at providing design-driven tools to leverage niche and regime oriented projects towards landscape changes (Source Designscapes project).

Conclusion

This paper starts from the assumption that the process of value creation depends on the human attitude to aggregate resources of different kinds (knowledge, services, technical infrastructure) to devise solutions that change the human beings' conditions. Design, intended as a purposeful change to an existing situation, is therefore a diffuse capability. The co-creation of new value, however, is also linked to a process of change, that can have different levels of definition, different structures and speed. When seen as a purposeful action, the ability of design consists of *infrastructuring* such change with different capabilities and different tools: capabilities and tools to support interaction and value co-creation at the niche level, to consolidate and codify innovation into solid regime structures and to align such changes to wider perspectives of transformations in the sociotechnical regime. The debate about value co-creation and the role of design has often focused on the niche level - how to engage people in design activities, how to design the interaction at the front desk, how to design experiences - or at the regime level – how to create service systems, how to manage change in organizations or administrations or in a production system. In recent years, new projects and studies are focusing the attention on the sociotechnical landscape and the contribution of design to this higher level, where design was hardly considered as a relevant attitude. This is the level in which design can contribute to policy making or to change the system of values, rules and regulations. Defining design as an attitude to generate purposeful change means investigating on how design capabilities can support and organize those

[5] Designscapes is a EU-H2020 funded project that aims at promoting Design-Driven innovation in urban contexts. More information about the project is available at designscapes.eu.

changes and align change along different levels. From the perspective of expert designers this implies a better overview of the implications of design action on wider contexts and even on the most general system of values, believes, culture, policy and government-related issues. From the perspective of whoever is actively involved in innovation and change -managers, policy makers, organizations or single citizens - the framework proposed in this paper can help building up new value-creation capabilities.

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How to create value in a public sector context? Exploring the co-design approach

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In the public domain, design thinking is increasingly expected to create value by including service users in the fundamental aspects of these services. However, in order to create value, the design approach needs to be 'translated' into an applicable framework, appropriate for the public domain. Therefore, we first explore what kind of value is supposed to be generated within the public domain. Subsequently, by focusing on well-known contributions from the design literature, we review what can be learned from design approaches for value creation with users. Then, we examine what kind of specific characteristics of the public domain needs to be taken into consideration, when one aims to apply a design-oriented approach in the public domain. Ultimately, we conclude how the design approach, can be made applicable within the public domain. In doing so, this paper aims to formulate stepping stones for both academics and policy makers alike.

Keywords: Value creation; co-design; service-dominant logic; heuristic framework

Introduction

As a response to the 'flawed' governance mode of New Public Management (NPM), many authors have argued that a new mode is required to effectively address the needs of citizens (Rhodes, 1996; O'Flynn, 2007; Bryson et al. 2014; Osborne et al. 2015). This 'new' mode is coined as New Public Governance (NPG). Within NPG, value is considered less tangible and much more related to legitimacy (i.e. supported by all involved actors), rather than effectiveness. Consequently, in NPG value creation is encapsulated in the *process* of service or product delivery, rather than in the product itself (Gronroos, 2006). One might argue that because of this processual orientation, within NPG, a 'service-logic' may fit much better than a 'goods-logic', since in a service-logic, the interaction between provider and user as the key-determinant for value creation is emphasized. Key-aspect within NPG is that value of public goods and services is *co-created* with citizens.

To address these co-created efforts, various concepts have been introduced (Bovaird, 2007; Ansell and Gash, 2008; Bason, 2010; Emerson et al. 2012; Torfing, 2012; Brandsen and Honigh, 2015; Voorberg et al. 2015). These literature bodies have all grown substantially in order to address (specific parts of) this renewed attention for organizing public services and policy as a collective effort. Our starting point in this paper is that, although vast and rich, these bodies of literature only limitedly provide stepping stones to *how* value creation for efforts in the public domain can be achieved. Lessons from *co-design*, might help us to understand how value creation in public service delivery can be organized. In the field of public policy and management, we can witness a rise of interest from both academics and practitioners for co-design in public service and public policy delivery (Buchanan, 1992; Cross et al. 1992; Howlett, 2014). Examples include policy labs where actors from different backgrounds develop policy advice in collaboration (Bason, 2016); as well as social innovation

and living labs where innovative solutions for problems are formulated together with citizens (Gascó, 2016; Tonurist, Kattel, & Lember, 2015). Given the enfant phase of our understanding of co-design, this paper aims to offer a heuristic framework accomplishing value creation for Public Organisations. This paper therefore answers the question: *How is co-design to be organized to create value in a public sector context?*

Value creation within a Service-Dominant Logic

By means of a starting point, to understand the conception of value creation within a service-dominant logic, we refer back to the work of Vargo and Lusch (2004; 2008; Lusch and Vargo 2006). Their argument was that in order to develop competitive advantages, a company should invest heavily in relationships with (potential) customers and make sure that as many feedback opportunities are created in order to fully adapt a product to the desires of these customers (Vargo and Lusch, 2004). They proposed a framework, consisting of 10 foundational premises (FPs) about what they argue to be the 'Service-Dominant' logic (S-D logic). Within this logic, value creation is the result of the interactions during the production process with consumers. To further elaborate on this notion of value creation, Lusch and Vargo (2006) have stressed the orientation on *interaction* as elementary for value creation. I.e. by stressing that the customer is always a co-creator of value (FP 6) and that a service-centered view is inherently customer oriented and relational (FP 8). Created value is relational and the result of a fertile collaboration, during the design and production process. Therefore, in order to create economic competitiveness, for every company it is fundamental to incorporate interaction with end-user/beneficiaries/customers in every step of the design and production process of a product (Payne et al. 2008). Doing so, allows producers to relate to the preferences of their potential customers in every step of the production process. Hence, the production process becomes a *co-creation* process with end-users, in which an organization creates as much channels for feedback and dialogue between (potential) customers and the organization as possible (Prahalad and Ramaswamy, 2004; Payne et al. 2008; Vargo and Lusch, 2008). These channels can be considered the *services* that enable the exchange between different parties.

However, applying the S-D logic to the public domain, requires some altering. For instance, where in the private domain companies can focus on the target group who is most profitable to them, public organizations have to take into account different user groups and sometimes even incompatible service groups (Gronroos, 2008). In our next section we elaborate on this alteration.

Applying the S-D logic to the public domain – a matter of co-creation with citizens

First, we need to establish what value implies, as the result of co-creation between service-users and public organizations in a public context implies, if not competitive benefits. To prevent the discussion on value creation to become too abstract we propose to conceptualize this in line with Osborne (2018) who argues that *public organizations do not create value for citizens – they can only make a public service offering. It is how the citizen uses this offering and how it interacts with his/her own life experiences that creates value* (p. 228). For instance, in the healthcare sector, doctors can subscribe a remedy (service offering), but it is up to the patient how to deal with this subscription and whether it makes sense for him in his particular context (value creation) (Edvardsson et al. 2011; Elg et al. 2012). Hence, value creation for public organizations is always the result of a form of collaboration between service users and service provider. Therefore, it is *always* a co-created effort. The literature on (value) co-creation, offers some illustrations of how value as a co-created effort may be achieved in a public context. For instance, Gebauer et al. (2010) showed how by applying the S-D logic the Swiss Railroad Services changed into an integrated system, where customers are motivated to become active participants in improving the services. Hardyman et al. (2015) argued how a lack of S-D orientation in the British National Health Care policy disables health care institutions to actively engage with patients to improve health care services. Within the S-D logic, these services are to be co-created *with* people, thereby including the needs of these end-users much sooner in the design process of the service. The notion of value as a co-created effort is appealing for public organizations, since it not only allows for innovation in technical services (like railway services), it also creates collective responsibility for that services. Hence, co-creation involves a transfer of risk for public organizations to a network of actors, involved in the service delivery(Payne et al. 2008).However, how one could actually organize such a collaboration, *so* that value in use is the result of this collaboration is still a question left to answer.

One of the more promising answers to this 'how' question seems to lie in the literature on design and co-design. Co-design consist of a collaborative effort between customer and service provider to create a service

or product (Prahalad and Ramaswamy, 2004) and a "*collective creativity as it is applied across the whole span of a design process"* (Steen et al. 2011; p. 53). Co-design as a strategy for public service delivery is not new (see Bovaird and Loeffler, 2012; Farr, 2013, 2016), but the literature lacks conceptual and methodological focus. However, as the interest for design approaches as a strategy for value creation in the public sector grows, the need for an enhanced understanding of how co-design works and how it can be applied to a public sector context also increases (Bason, 2016; Howlett, 2014).

Learning from Design approaches

In order to understand what authoritative principles and practices are for co-design, we consulted the literature on design. To conduct our analysis in a more systematic way, and not just consult the records we found most interesting, we have analysed the twenty most cited contributions from the journals *Design Issues* and the journal *Design Studies* (see for an overview, the appendix I and II), resulting in a review of 40 records of two leading journals in design sciences. In our analysis we asked ourselves with each record two questions.

1) *How is design defined, in terms of user involvement?*
2) *How can the design process be discerned in terms of user involvement?*

How is design defined, in terms of user involvement?

Our selected articles showed a variety of how design can be conceptualized, in terms of user involvement. Various authors define design as a sense-making process (Schön & Rein, 1995) which is based on various discourses (Blizzard & Klotz, 2012; Dorst & Cross, 2001; Norman & Verganti, 2014) by deliberation and reasoning (Kolko, 2010a; Norman & Verganti, 2014; Xenakis & Arnellos, 2013). Other aspects of this social character involve, design as a learning process (Gerber & Carroll, 2012), linking technical aspects to social aspects (Morelli, 2002) or consensus building (Manzini, 2014). In a similar vein, Bjorklund (2013) approaches design as a social construction of what accounts as a problem. Her point of departure is that what accounts as solution is based on what the perceived problem is. As such, finding a useful solution to a problem is depending on how the problem is framed and how many people can be convinced about this frame. Mentioning the element of social construction brings us to Moreno et al (2014) and Ozkan and Dogan (2013). They consider designing as a process of association. This is what they call *analogical reasoning.* Analogical reasoning is the process of association between situations from one domain to another, made possible through the establishment of relations or representations. In short: problem solving is about recognizing the problem situation what the potential solution is to that problem. Ozkan and Dogan (2013) consider this as the fundamental cognitive process in design.

Other authors have approached this social notion of design from a more abstract level. Defining it as a systematic inquiry to define shared goal, purpose, value and meaning in products developed by humans (Bayazit, 2004; Cross, 2001; Kolko, 2010b). This inquiry should be considered as a circular process of deconstructing, deviating, design, integrating and deliberation (Scott, Bakker, & Quist, 2012).

Others have specifically stressed the relationship between consumer and producer. Both Sangelkar et al (2012) and Wilkinson and De Angeli (2014) speak in that regard of *universal design.* Universal design implies looking for products that can be used by all users without any adaptation or stigmatization. An example of such a product is the gradual ramp to access buildings. The fact that it is a *gradual* ramp, allows both pedestrians and wheelchairs to use it. Wilkinson and de Angeli (2014) speak in that regard about how design can be *mainstreamed* to be accessible to everyone. Participatory aspects in design are in this regard attempts to involve and better understand product users. This is a necessary element to come to appropriate user friendly products.

If we attempt to bundle these conceptualizations and to come up with a specific definition of design, we argue that design can be defined as: *An interactive process between at least provider and consumer/user; in which the design process is an analogical learning process; that leads to products aimed at serving the needs of its users in terms of outcomes.*

How can the design process be discerned in terms of user involvement?

When we try to distill what phases can be distinguished in a design process, in a general sense we can identify the elements as reflected in table I. Below we elaborate on each phase.

Table 1 Phases and characteristics of design process

Phase	Conditions/characteristics
Problem framing	- Led by the needs of customers/users - Collaborative process with all stakeholders - Empathizing with the issue and the stakes
Development of prototypes	- Contains multiple sub-phases - Goal-oriented - Aimed to serve multiple target groups - Aesthetically appealing - Low-fidelity
Testing of prototype	- Information is shared with everyone - Test in multiple contexts - Consumer friendly - Give consumers tools to measure it's effect
Reflection	- Part of every phase of the design process - Essential to come to product refinement - Initiates the start of a new cycle

Problem framing

The design process starts with the formulation of a problem or need to initiate the design process. This process is predominantly led by the needs of the client or customer. As Farrell and Hooker (2013) mention, the design process starts with a brief from a client, or employer i.e. someone who formulates a question or demand. Fundamentally this phase is primarily a collaborative process in which, to Blizzard and Klotz (2012), stakeholders and members of the design team should define commonly shared visions and aims (p.467). Scott et al (2012) therefore mention that the identification of user needs are a function of *involvement in practices*. Bjorklund (2013) assesses that problem framing is the key asset of designer's expertise, i.e. specifying what should be designed in order to serve the needs of the user.

Empathizing is then important to relate the design to the people the problem affects. A technical understanding of the issue is not enough; we have to understand the feelings and emotions of involved actors to understand what the problem actually means for them, in order to find a solution that suffices (Bayazit, 2004; Kolko, 2010c; Norman & Verganti, 2014). This process of problem framing is a process of continuous exploration and demarcation.

Developing a prototype

In the second phase, in order to solve or confront the problem a *possible* solution needs to be found. In order to do that a prototype is developed. To Ranscombe et al. (2011) this development process is characterized by four different stages: 1) ideation, in which a hand sketch is made with low levels of details; 2) realization, in which more details are offered and maybe displayed in a digital model; 3) refinement, digital models with a high level of detail; 4) scale modelling, the actual producing of the prototype.

Other authors have revealed other conditions. For starters, the prototype should be goal-oriented. Blizzard & Klotz (2012) argue that the design should be based on the principle of the fundamental desired outcome. This

implies that the prototype should be designed with the end-user in mind and then worked upstream. In order to do that, Vallet et al (2013) highlight that this development contains the same creativity techniques - e.g. brainstorming, brain writing or using morphological boxes – as during the phase of problem orientation.

To make the prototype as valuable as possible, Sangelkar et al. (2012) advocate to pursue universal design whereby the prototype is designed in such a way that it can serve multiple target groups. In additions, some authors have stressed that the prototype have to *look* attractive as well (H. Wilkinson, Gallagher, & Smith, 2012; Xenakis & Arnellos, 2013). Especially when it comes to products with a not so popular image, such as a wheel chair. However at the same time, Gerber and Caroll (2011) argue that *low-fidelity* prototyping is a key practice for design practitioners to construct critical knowledge about design, ideas and how to make decisions (p. 67). Low-fidelity implies that the prototype is clearly a try-out, which will be used to gather information and not the definitive product. All involved stakeholders should feel the liberty to comment on the prototype in order to establish a mutual learning effect. As such, various authors have stressed that if this is not the case that in the first phase consumers or users can express their wishes and that subsequently the designer comes up with the prototype. In addition, the development of the prototype should be conducted in collaboration with the user as well (e.g. Scott et al., 2012; H. Wilkinson et al., 2012; Xenakis & Arnellos, 2013).

Testing of prototypes

Our record selection revealed a small number of grab-holds. In the first place, Blizzard and Klotz (2013) argued how it is evidential that all information should be shared with every stakeholder. To them this aspect should be characteristic for the entire design process. However, we argue that sharing of information is of particular importance for the phase of prototype testing. Reason is that when a prototype is tested in multiple contexts (which is preferable if it is to serve multiple target groups), much can be learned from sharing the results with members from those different target groups. Therefore, it is important to exchange the results. In that regard, Wilkinson and DeAngeli (2014) stress the importance of appropriateness of such a prototype, saying that "*design must not only consider how usable or user-friendly a product is but also how people feel when using that product or how that product, in turn makes them feel when using it"* (p. 623).

In a similar vein, Gerber and Carroll (2011) highlight that also in this phase, designers should make it as easy as possible for test subjects to test the prototype. They mention, that individuals are more likely to experience mastery experiences when large tasks are broken down into moderate size tasks.

Reflection

This phase is not so much the end of the design trajectory, but the start of multiple iterations, aimed at repeating previous phases. That is why Scott et al. (2012) mention that design is a *circular* process of deconstructing, deviating, designing, integrating and deliberation. In this phase, the prototype is reflected upon and lessons are drawn for the refinement of the prototype. To Wilkinson and DeAngeli (2014) reflection is not so much a separate phase, but is inherently related to every aspect of the design process. They emphasize that it is important to capture user information and feedback at every stage, while there is input from all involved stakeholders. Either, implementing at the end of the production stage or making it an inherent part of all the design phases, reflection is considered essential in order to come to product or service refinement (Cascini, Fantoni, & Montagna, 2013).

We argue that transferring these ideas and principles may be inspiring for the public domain, but cannot be 'copied and pasted' without any translation/adaptation. Main reason is that product/service design in the private domain serves a competitive goal, which is usually absent in the public realm. In our next section we elaborate on this argument and we propose a way forward to overcome these issues.

Challenge of implementing design for public organizations

The first challenge lies in the public nature of public organizations themselves. Andrews et al. (2011) talk in that regard about the level of 'publicness'. They distinguish three key dimensions of publicness. First, there is the dimension of *ownership*. While in the private sector, ownership is in the hands of entrepreneurs or shareholders, in the public domain, property rights are vague and diffuse (Boyne, 2002). As a consequence, it is expected that in public organizations there is less urgency for innovation (what a co-design approach essentially is), due to the lack of direct financial benefits and the ambition to gain competitive advantage. Second, there is the dimension of *funding*. Based on public choice theory (Niskanen, 1971) the basic idea is that organizations that receive their revenues from a political sponsor are inherently unresponsive to service

and product users. As a result, effectiveness and consumer satisfaction are likely to be lower if these consumers not directly pay for these goods and services. Third, public organizations are *politically controlled.* In general, this implies that the duty to be accountable does not lie first and foremost with the end-users but to politically elected officials. This results in audits, inspections, performance reports and of course limits to budgetary autonomy.

The second challenge, refers to the organizational environment in which public organizations operate. Boyne (2002) argues that this environment is *complex;* with a variety of stakeholders; operating within networks of interdependent organizations; rather than independent organizations; which simply can pursue their own objectives. Consequently, public organizations are *permeable,* meaning that they are easily influenced by external pressures, due to their duty to be responsive to public needs. In contrast, private organizations can act relatively independent in terms of policy formulation and their implementation process. Furthermore, due to the political climate in which public organizations operate, their environment is much more *instable* than private organizations. Political will may change overnight, creating sometimes a much more short time-horizon. Last, due to the absence of competitors, there is an *absence of competitive pressure.*

The third challenge concerns the organizational goals and the values that public organizations pursue (ibid p. 100-102). Public organizations are to pursue distinctive goals, such as equity and accountability that are less dominant in the private domain. Furthermore, it is also believed that public organizations are less materialistic than private organizations. Instead of aiming to meet the demands of individual customers, public organizations have a mission, a vocation aimed at enhancing public welfare. However, on the other hand it is also believed that there is lack organizational commitment in the public domain, due to the inflexibility of personal procedures and a weak link between performance and rewards.

The last challenge relates to the nature of the user in the public domain. During the high-tide days of New Public Management, it was a popular idea to consider citizens as customers of public organizations. However, with the shift to the New Public Governance paradigm (Rhodes, 1996; Dunleavy et al. 2006; Osborne, 2006), the role of citizens is reinterpreted from consumer to that of a problem-solver and co-creator, "who is actively engaged in creating what is valued by the public and is good for the public" (Bryson et al. 2014; p. 446). Consequently, end-users are in the public domain by definition part of collaboration structures to produce those goods and services (Bovaird et al. 2015).

When looking at the design process, as identified in section 4, with these issues in mind, we argue that there are four important considerations to keep in mind when one wishes to apply a design approach in the public domain.

Consideration 1: Involvement of target group vs. involvement of end-users

As argued in section 4, the design process is a process, led by the needs of clients and customers. In the public domain, this implies that an as large variety of stakeholders as possible is involved in the design process. That is different from the private sector, where organizations can focus on their specific target group. Given the complex environment and the duty of public organizations to be permeable, having a legitimate problem definition goes beyond the specific target group of a public organization. Legitimacy is granted by a larger network of stakeholders.

In addition, our four identified issues reveal a potential paradox for public organizations when adopting a design approach. Just as the design process in the private domain, the inclusion of end-users is the key element in the design process, in order to effectively address their needs. But in the public domain, public policy and services are initiated that supersede the interests of individual end-users (e.g. climate adaptation policy; legal detention services; or rules regarding the use of public spaces). Sometimes in practice this may imply that the individual needs may contradict collective needs. In the public domain, public organizations are not allowed to focus on the target group that will give them the highest turnover, but are obliged to serve other groups as well. Therefore, characteristic in the public domain is that in some policy areas needs of target groups may contradict the wishes of individual end-users.

Consideration 2: Demands of target group vs. demands of external environment

Another consideration for public organizations involves their organizational structure i.e. based on funding and politically control. The fact that public organizations are part of public accountability (Bovens, 2005) as the hallmark of democratic governance, may very much determine the room for exploration and experimentation.

Especially when it comes to prototype testing and the number of iterations that may follow to refine the prototype, the required space to organize this process may be very much determined by factors, such as the wishes of an alderman or political pressure in general. The hierarchical nature of the relationship between political institutions and the public sector, may complicate for public organizations the desire to let the needs of end-users determine the goods and services. For instance in social security, political considerations can very well influence the choice whether services are more punitive or prevention oriented.

Consideration 3: The bureaucratic nature of public organizations vs. the need for innovation

Public organizations are not known for their ability to innovate. One of the explanations for this, may be encapsulated in the legal culture in which the public organization is embedded (Damanpour, 1991; Kelman, 2008). The willingness to share resources and knowledge is often frustrated by the boundaries (or the absence) of legal mandates. Innovation that cross these jurisdictions are particularly difficult to get adopted (Feller and Feller, 1981). Hence, policies are path dependent, i.e. policy formulation is like a tree. From the same trunk, many different branches occur, but they all build forth on that one trunk (Pierson, 2000).

Consideration 4: Inclusion for competitive advantage vs. inclusion for legitimacy

The last consideration we can synthesize is the reason why end-users are included in the design process. For private organizations, this is essentially the only way to enhance competitive advantages (Lusch and Vargo, 2006). However, for public organizations, within the NPG-paradigm, involving end-users has become an 'appropriate' way (March and Olsen, 2004) to develop public goods and services.

The way forward: co-design in the public sector

Although still following the principles of 'regular' design (e.g. divergence and convergence during phases of problem framing, development and testing of prototypes), co-design requires a 'participatory mindset' (Sanders, 2008). The participatory mindset finds it fundament in the conviction that 'all people are creative' and are to be considered 'experts in their own experiences,' (Naranjo-Bock 2012). Hence, they should be involved in designing products, services and policies that relate to those experiences (Cabinet Office 2016). The usual role of external experts in policy and public service delivery is challenged (Blomkamp, 2018; Howlett and Migone, 2013). However, our argument here is not that in order to come to value in in a public sector context, the voice of experts should be overruled by the voices of end-users, but that they should be both actively involved in the iterative phases of design process. Thereby, adding another dimension to co-creating value in co-design processes. To illustrate, Coleman et al (2014) showed how the Delphi-method allowed them to bring together experts, governmental officials and locals to collectively address the issue of water quality in Lake Champlain Basin. Our argument is that in co-design lived experience is to be treated as *a* type of expertise in co-design, *next* to expert knowledge.

Therefore, given the considerations as identified in section 5, our reinterpretation of the definition of co-design by Prahalad and Ramaswamy (2004) for co-design in the public domain leads to the following definition: *Co-design in the public domain refers to the collaborative effort between end-user and provider to create value of new services or products that is appropriate to the needs of the end-users.*

Based on this participatory mindset and the considerations as presented in section 5, we propose an adaptation of the design phases as presented in section 4, for co-design in the public domain. These adaptions are schematically shown in figure II, as opposed or added to the conditions/characteristics as shown in table 3. The quadrant at the front schematically displays the characteristics as we derived from the design literature. The quadrant at the back depicts the adaptations required for implementation in the public domain.

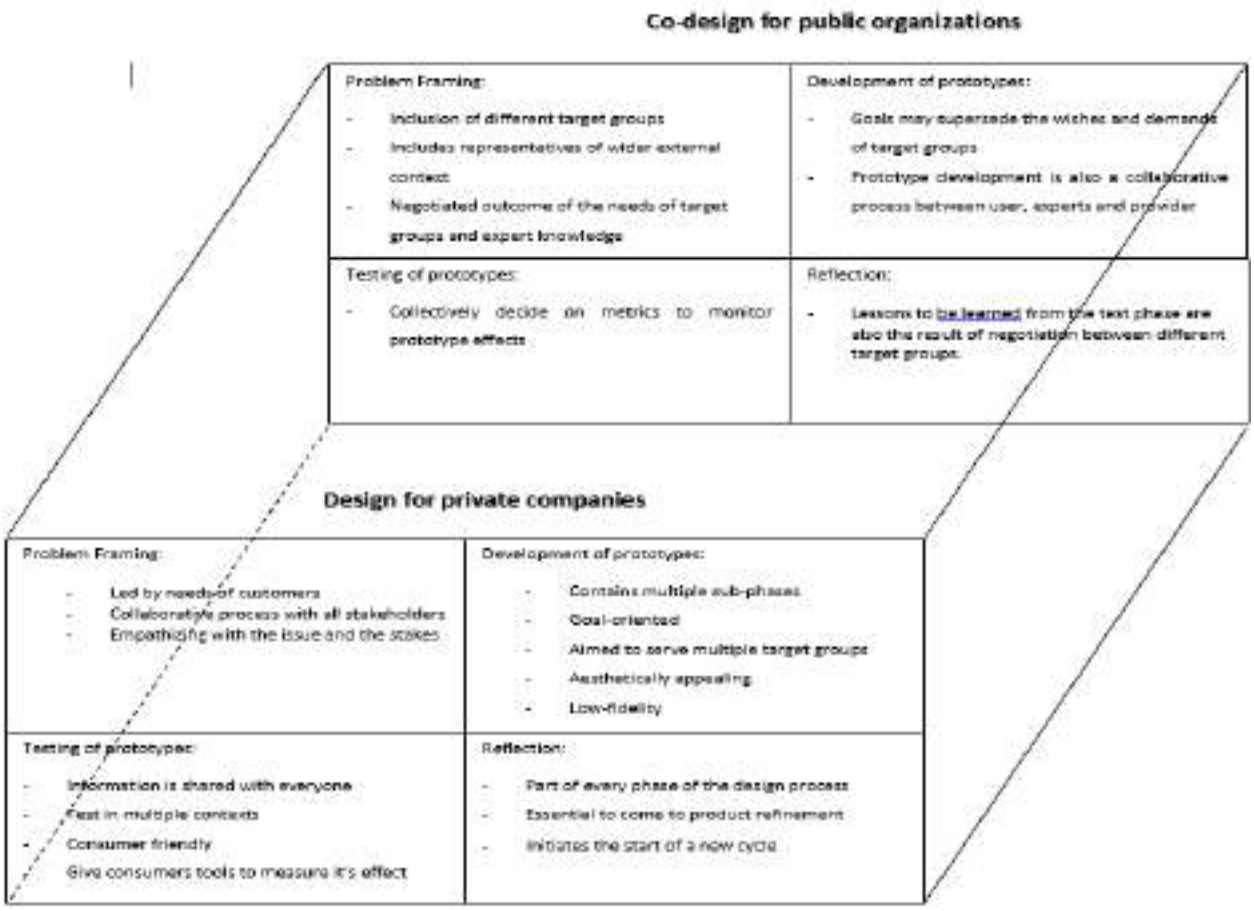

Figure 1 adapted co-design framework public organizations

Problem framing in co-design

In co-design in the public domain, the initial phase is the most important phase, since it sets the tone for the rest of the co-design process. The ultimate goal here is to empathize with the different stakeholders and their experiences with the problem at hand (Bayazit, 2004; Norman & Verganti, 2014). However, the argument here is that for public organizations the responsibility for empathizing goes beyond the first line of end-users. Therefore, preferably, all possibly affected target groups should be involved in this stage. The diversity of people's needs, perspectives and desires as the root of design is addressed by various authors (Margolin & Margolin, 2002; Oosterlaken, 2009; Scott et al., 2012; Secomandi & Snelders, 2011). As a consequence, the potential value-in-use is substantial, since not only direct users are involved, but ideally also target groups affected by the design and experts on the matter at hand. However, since public organizations cannot just rely on the preferences of the end-users, this phase requires tact and a lot of social skills, especially when participants are not necessarily interested in the design approach. This was shown by Askew et al. (2010), who illustrated the challenge of co-designing with drug addicts. That is why Evan Hirsch – industrial designer for PopCap Games, Microsoft and Walt Disney Studios – argued that the process of problem framing in the public context is the most challenging aspect of design. Given the political environment in which this process takes place, it might be very helpful to involve politicians and political officials into this process as well. When the process of problem definition is finalized and subscribed as well by political officials, the definition is 'democratically anchoraged' (Sorensen and Torfing, 2005), which can be a major element for the continuation of the co-design process.

Development of prototypes

In order to develop prototypes, techniques and measures used for 'regular' product and service design are very useful for the public domain as well. In fact, the earlier mentioned aim for *universal* design might even be of bigger importance in the public domain, since every effort of a public body is aimed at serving as many citizens possible. However, in line with the problem framing phase, it is important to keep in mind that public

organizations may be confronted with goals that may supersede the interests of individual citizens. For instance, with an issue like soil subsidence, the interests of local farmers probably contradict the interests of inhabitants living in the area. Therefore, having a goal-oriented prototype as Blizzard & Klotz (2012) argued, means something different for public organizations. However, we also believe that a design approach may form a way out, out of these potential deadlock situations. Waardenburg et al (forthcoming) show an example how this was a successful approach for developing a coaching program for public professionals dealing with crime-fighting.

Furthermore, in the public domain, we argue that one should take notice of the available design space and – more importantly - the boundaries that have to be taken into account (Howlett et al. 2015). Issues like policy legacies, the administrative tradition, existing rules and regulations can seriously limit the existing design space. Therefore, design in the public domain very often involves institutional redesign i.e. creating the space that is necessary for design to be effective (Peters, forthcoming).

Testing of prototypes

During this phase, for public organizations on the one hand we can stay closer to the design literature. For instance, as shown in section 4 also here it is stressed that, prototypes should be stressed in multiple target groups (Blizzard and Klotz, 2013). The user friendliness of the prototype, as argued by Geber and Carroll (2011) and Ranscombe et al. (2011) may even be more important in the public sector, since the prototypes are to be tested within more target groups than just the first line of end-users. By using prototypes that are characterized by *low-fidelity* (Gerber and Caroll, 2011) it is clear to involved actors that this involves a pilot or try-out. By labelling it as such, it may create the room to experiment and therefore to manoeuvre between different interests. Based on our considerations, we add to this phase, specifically for public organizations that it is important to collectively decide on the metric system, used to analyse the results of the prototypes. Also it is important to conclude together when a prototype is successful or not. These two conditions are to make sure that the results of the prototype are considered legitimate, which is the entire point of using a co-design approach.

On the other hand prototyping in a public context can be really problematic because of characteristic public principles like equality and legality, which public organizations have to take into account. Testing out an intervention in real-life is quite problematic in a relationship between governments and citizens that is surrounded by all kinds of guarantees and prescriptions. That implies that we need tailor-made principles when it comes to prototyping in a public context (e.g. the principle of informed consent). This point is illustrated by Bridge (2012), showing how co-design can be a way to successfully address the desire for personalisation and tailoring in Australian health and welfare programs.

Reflection

“Critique is oxygen for design” (Evan Hirsch 17-11-2018). That is no different for co-design in the public domain (for instance Drake and Washeck, 1998). However, given the multiplicity in context of public organizations (Boyne, 2002), organizing feedback loops can be more challenging to organize, since this might involve political confirmation or support from other institutional bodies. Furthermore, it is important to acknowledge that since every crucial aspect of the co-design phase involves consultation and negotiation with the design-group, this is not different for the reflection phases. I.e. what lessons should be drawn from the test phases and in which direction the prototype should be further developed is a collective decision. Also here, organizing that many feedback loops can be quite challenging. As Wilson (2009) showed in co-design in Child Protection in Australia, it required specific meetings and mentoring efforts to facilitate this feedback. However, since from the start of the design process, a network of stakeholders are represented in the design group, strategic decisions are legitimate.

Conclusion: value creation in co-design

In this paper, our goal was to explore how value creation in public sector context can be enhanced by adopting a design perspective. In doing so, this paper sought an answer to the question: *How is co-design to be organized to create value in a public sector context?*

To answer this question, we concluded that co-design in the public domain refers to: *the collaborative effort between user and provider to create value of new services or products that is appropriate to the needs of end-users.* Based on the literature on design we identified four key-aspects of the design process, i.e. 1) problem

framing; 2) development of prototypes; 3) testing of prototypes; 4) reflection. Considering 4 major issues for applying these aspects in the public domain, we have translated this framework into a heuristic framework applicable in the public domain. In general terms, we argue that since co-design involves the involvement of many more stakeholders than 'just' end-users, much more emphasis is placed on legitimizing each step and each decision by a broad network of actors. By no means have this makes co-designed an easy approach for innovation in the public domain, but it may help to enhance the legitimacy of public services and goods and thereby set the stage for allowing value-in-use (Gronroos, 2008) to be an integral part of goods and service delivery in the public sector. Although this paper only brings together several literature streams, we hope that it allows other academics to apply it in concrete empirical settings. Hopefully, this paper is a first step to create a more elaborate understanding of how co-design as a manifestation of the S-D logic may come to being in the public domain.

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Appendix I: Articles included in review – Design studies

	Author(s)	Title	Focus of study
1.	Bjorklund	Initial mental representations of design problems: differences between experts and novices	Product design
2.	Blizzard & Klotz	A framework for sustainable whole systems design	System design
3.	Cash et al.	Methodological Insights from a rigorous small scale design experiment	Design research
4.	Chai et al.	Understanding Design Research: A bibliometric analysis of design studies	Design process
5.	Demirkan & Afacan	Assessing creativity in design education: analysis of creativity factors in the first-year design studio	Design education
6.	Dong et al.	Investigating design cognition in the construction and enactment of team mental models	Collaboration design
7.	Farrell & Hooker	Design, science and wicked problems	Design research
8.	Gascini et al.	Situating needs and requirements in the FBS Framework	Product design
9.	Gerber & Carroll	The psychological experience of prototyping	Job design
10.	Hsiao et al.	An Online Affordance evaluation model for product design	Product design
11.	Koutsabis et al.	On the value of virtual worlds for collaborative design	Collaboration design
12.	Moreno et al.	Fundamental studies in design-by-analogy: a focus on domain-knowledge experts and applications to transactional design problems	Design methods
13.	Nikander and Liikanen	The preference effect in design concept evaluation	Design research
14.	Ozkan & Dogan	Cognitive strategies of analogical reasoning in design: differences between expert and novice designers	Architectural design
15.	Pucillo and Gascini	A Framework for user experience needs and affordances	Product design
16.	Ranscombe et al.	Visually decomposing vehicle images: Exploring the influence of different aesthetic features on consumer perception of brand	Product design
17.	Sangelkar et al.	User activity - product function association based design rules for universal products	Product design
18.	Scot et al.	Designing change by living change	Behavior-based design for sustainability
19.	Valet et al.	Using eco-design tools: an overview of experts practices	Eco-design
20.	Verhaegen et al.	Refinements to the variety metric for idea evaluation	Product design
21.	Wilkinson & DeAngeli	Applying user centred and participatory design approaches to commercial product development	Product design
22.	Wiltschnig & Ball	Collaborative problem - solution co-evoluation in creative design	Collaboration design
23.	Xenakos & Arnellos	The relation between interaction aesthetics and affordances	Product design

Appendix II: Included in review – Design Issues

	Author(s)	Title	Focus of study
1.	Bayazit	Investigating Design: A Review of Forty Years of Design Research	Design Research
2.	Buchanan	Design Research and the New Learning	Design Research
3.	Chapman	Design for (Emotional) Durability	Behavior-based design for sustainability
4.	Dorst	Design Problems and Design Paradoxes	Design Research
5.	Cross	Designerly Ways of Knowing: Design Discipline Versus Design Science	Design Research
6.	Fallman	The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration	Design Research
7.	Julier	From Visual Culture to Design Culture	Design Research
8.	Findeli	Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion	Design Education
9.	Kolko	Abductive Thinking and Sensemaking: The Drivers of Design Synthesis	Design process
10.	Manzini	Making things Happen: Social innovation and Design	Collaboration design
11.	Margolin and Margolin	A “Social Model” of Design: Issues of Practice and Research	Design process
12.	Margolin	Design, the Future and the Human Spirit	Eco-design/system design
13.	McCoy	Information and Persuasion: Rivals or Partners	Graphic design
14.	Morelli	Designing Product/Service Systems: A Methodological Exploration	Product/service design
15.	Oosterlaken	Design for Development: A Capability Approach	Social design/system design
16.	Norman and Verganti	Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change	Design Research
17.	Secomandi and Snelders	The Object of Service Design	Service Design
18.	Swann	Action Research and the Practice of Design	Design Process
19.	Tromp et al	Design for Socially Responsible Behavior: A Classification of Influence Based on Intended User Experiences	Behavior-based design
20.	Wai and Siu	Users Ceretive Repsonses and Designer Roles	Design Research

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The value of design: How does design enhance commercial value in co-branding strategy development?

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Emergent trends of co-branding strategies are increasingly being utilised in fashion marketing and retailing; as such, the role of design is becoming paramount in collaborative partnerships when devising co-branding strategies. In particular, designers are central to the process of collaborative partnerships when developing highly novel products more that are attractive to demanding consumers. This paper critically examines the role of co-branding strategies as a source of innovation in fashion marketing; and to understand how organisations draw upon co-branding to inform the development of new products, services and brands. Branding strategies, new product development, design, innovation, and fashion marketing are discussed and critically analysed.

Keywords: Co-branding strategies, Fashion marketing, new product development

1. Introduction

In historical context, fashion consumption is image the sign of status and rich in culture (Fernie, J., & Grant, D. B., 2015). In today, fashion consumption is a common behavior to every people in daily life. By the society development, consumer's consumption structures have started to change. From very basic necessities product consumption demand, consumers have more varieties desires for fashion consumption. As fashion consumption demand increases, apparel producers and fashion retailers are now starting to transform their design, branding and marketing strategies. Along with strong competition in the fashion retail market, co-branding strategies have become a highly popular tactic to enhance the relationships between fashion retailers and consumers. In addition, co-branding strategies build connections between fashion brands and designers, it enriches the attributes of fashion products, improves the awareness and popularity of fashion brands, and innovation of fashion concepts.

A cooperation brand strategy prevailing in the contemporary market, Fashion retailers need to respond quickly with rapid iteration, innovation is increasingly becoming more important. Between joint brands, selection of partnerships, co-branding model, co-design product collection are also becoming complex and diverse. This paper will explore and critically debate the role of design as a driver for market orientated innovation, and how design can provide the company an invaluable source of differentiation in competitive marketplaces. Findings from the literature will inform the second stage of research activities (empirical data collection) due to be undertaken by the authors. However, for the purpose of this paper, it will offer a comprehensive overview of current literature on branding and co-branding strategies.

1.1. The Value of Design and Design Strategy

By definition, strategy means “a plan to make or achieve something” or “a careful method”. Lockwood explained it is not too difficult to see the similarities between design and strategy; however, in today’s typical large organizations, the strategy department and the design department are different sectors. The challenge in building design strategy is to bring these two disparate discipline into an alignment. Both strategists and designers share a common ground in the desire to accomplish business goals. When combined, both the strategist and the designer can be a powerful force working together. He added, “No one really expects the strategist to become a designer, but it’s not so unlikely that the designer will start strategizing. This is precisely one of the roles of design management: to bring design and design thinking into organizations, in support of the development of corporate strategy.” (Lockwood & Walton, 2008).

Today, businesses have recognized how important design is to financial success. Which means they are prepared to invest big money into creative projects. However, clients often look for certain assurances that designers can deliver a work that understands their business problems and that the results will bring a return on their investment. This is where strategy in design comes into place; it creates value for the designer. Strategy gives design more context; it allows it to become research driven and ensure the success of the project. Incorporating research methodologies to the process of design can transform a designer into a consultative role, which brings more value to the profession (O'Grady, 2009, p. 11). It is widely known, that clients pay accordingly to the quality and reputation of the designer. It is widely accepted that the role of design at a strategic level can lead to successful product or service developments, which can ultimately lead to commercial competitiveness. This means, adding strategy can increase the design firms perceived value of whatever they are offering while also differentiating from competitors. Successful organizations will no longer focus on lower cost, but strive to value added products that are distinctive and appealing.

Depending on how big the organization is the roles of Design Manager and Brand Strategist varies. In large design firms, it is most likely that Design Manager and Brand Strategies work in separate departments, where a Brand Strategist would take on a role where he will solely focus on brand building, strategy and brand evaluation, while the Design Manager will focus on other sectors of innovation & design within the company. However, in micro and small-medium design firms, it is common for the employees to take on multiple roles at once. Normally, the person who founded the company are the strategist, manager and designer themselves. For example, an art director who previously worked for a large design firm, decided to step down and start her/his own design firm where at the beginning he would be the CEO, Creative Director, Design Manager, and Brand Strategist all at the same time. This situation is very common for companies with less than 10 employees, and it is getting popular nowadays with the high growth of design start-up companies. Naturally, the roles of both Brand Strategist and Design Manager are similar; the role of Design Manager has a much wider range of jobs especially within the company, while the Brand Strategist often works under a Design Manager specifically working on Branding.

Identity design is a common project for freelance designers and small design firms. There has been numerous studies on what branding is all about, and what identity system is. However, still in the industry these two words are often misunderstood as the same thing. This often occurs on small-scale projects involving a freelancer or a small design firm and a small-medium company. ‘Branding’ is commonly used as a title of a project, when clients approach a designer for help. However, what they really meant is they need help with an ‘Identity’; because usually what they need is a logo, packaging, stationeries, and all things that support the brand as a whole. Branding has a much broader meaning that just focusing on the visual elements. This happens when the client is not aware about the differences between the two terms, and is the job of the designer to make sure at the beginning of a project.

2. Brands and Branding: an overview

In general perspective, according to many authors and institutions give some similar definition, both the American Marketing Association (MAM), Keller (2003) and Neil (2018) quoted Aaker (1991) define that the brand combines certain elements set of name, term, sign, symbol (sign, logo, trademark) or design, which is aimed at identifying the products and services of sellers and to distinguish them from those of their competition. As the argues that one perspective of brand is “*a name with the power to influence*”, which means the brand should have the ability to construct a community with reliable, passion, respect and so on to consumers. Neil (2018) argues that the classification of a brand could be diverse; it is associated with the construct, commercial and legal.

Keller (2003) emphasized branding is the process of creating differences, and the main point of branding is consumers should think that in the category of brands are different. Both individuals and firms achieve important benefits from brand. In addition, Aaker (2003) also discussed when a brand faced with competing brands trying to offer similar products; it should protect the producer and consumers from their competitors. Kelly (2003) discussed that consumers could gain important benefits from brand, regardless of Individuals or firms.

For building a brand structure, Keller established a model with six building blocks (1) brand resonance, 2) brand judgments,3) brand feeling, 4) brand performance, 5) brand imagery and 6) brand salience) and four steps (Brand identity, brand meaning, brand responses and brand relationships). Each of these processes involves building a strong brand and building a long-term stable customer relationship. Keller also discussed the creation of brand 'meaning' involves the establishment of brand image and brand characteristics. Many researchers argued the positive loyalty brand is strength, favorability, and the consumers prefer brand (Shen, B et al, 2014) (Kelly 2003).

Keller (2003) argues that when branding for services or products, giving the consumers a label of a product could distinguish it from other branded products, in part, to explain the meaning, function and specific attribute of the products. However, this "label" could be processed as not only a product level, but also as an event, a person, an organization and so forth. The rise of social media appearing a number of bloggers and celebrities, who create their own social media account to promote brands, and then start to collaborate on brands and products, using their names as brands in their own particular right.

Furthermore, Keller (2003) argues that Brand strategy refers to the way to use brand elements in company products. Laforet and Saunders (1994) cited by Rao et al. (2004) discussed three classifications of branding strategies, which are 1) joint branding, 2) mixed branding, and 3) house of brands. Among of them, joint branding strategy, the co-branding name is not only occupying a dominant position in all or part of the product and service of the firm but also is an element of the product brand name (Rao et al, 2004).

2.1. Brands and Branding

The use of brands has developed considerably, especially in the last century. We live in a branded world, almost each day we interact with brands. As stated by Maurya and Mishra (2012) brands are omnipresent; they penetrate almost every aspect of our life: economic, social, cultural, sporting, even religion. Due to brand tendency to pervade everywhere, they have come under growing criticism. In postmodern societies where individuals want to give the name to their consumption, brands can and should be analyzed through various perspectives: macroeconomics; microeconomics, sociology, anthropology, history, semiotics, philosophy and so on (Kapferer, 2004). Indeed, the words 'brand' and 'branding' are now such a common currency that their original meaning is in danger of being weakened (Hart & Murphy, 1998).

According to de Chernatony & McDonald (2003), 'a successful brand is an identifiable product, service, person or place, augmented in such way that the buyer or user perceives relevant, unique, sustainable added values which match their need more closely.' The definition starts with successful brand. To develop a brand takes time and money, and is in effect an investment, which if properly managed, should produce healthy rewards. Unfortunately, some organizations do not take a sufficiently long-term view of brand building and, because they do not achieve rewards early on, cut back on investment (De Chernatony, 2006). Brands are a direct consequence of the strategy of market segmentation and product differentiation. Branding means more than just giving name and signaling to the outside world that such a product or service has been stamped with the mark and imprint of an organization (Maurya & Mishra, 2012).Branding consists in transforming the product category; it requires a corporate long term involvement, a high level of resources and skills (Kapferer, 2004). Branding is probably one of the most misused word in the industry.

Most designers think of branding as a re-designing or creation of a logo or an identity system, the truth is there is much more than that. According to Marty Neumeier, author of the book The Brand Gap, logo is short for logotype, a design-speak for a trademark made from a custom-lettered word. A trademark can be a logo, symbol, monogram or other graphic device, but it is not a brand. A brand is a person's gut feeling about a product, service or company. We cannot control the process, but we can influence it (Neumeier, 2006). Therefore, without understanding a larger context of branding, an identity design or a logo design would be merely a pretty looking symbol. Branding is about solving a business problem; every brand is usually linked to a specific target audience, a segment. This segment consists of a group of consumers who share a similar set of needs and wants (Kotler & Keller, c2007). The principal purpose of branding is to distinguish the goods or

services of one producer-provider from the goods or services of all the others in the same class, category or sector. Branding differentiates. Branding separates. Branding reduces consumers' confusion. It makes life easier for them (Brown S, 2016). Adding to the point, brand-building or branding is highly beneficial for the longevity of the business, many studies show that powerful brands are able to command premium prices (Apple, Nike). In addition, successful brands can easily extend or innovate into new category of products. For now, it is sufficient that branding works. MRI scans of consumers' brains show that branded versions of products like coca cola are more desired by consumers, even when the actual drinks being tested are identical (Lindstrom, 2008).

2.2. The Brand Identity System

As Robert Jones (2017) stated, 'Branding works on our rational brains.' Through our experience with using a product, and through the messages conveyed by its advertising, we build up a set of beliefs about it. This is the rational side of branding. Aristotle, the ancient Greek philosopher, anticipated the techniques of branding in his book Rhetoric, and talks about this as logos: the word, or the rational argument. (Logos is also the origin of 'logo', the term we use to mean 'brand emblem'.) (Jones, 2017). However, the real power of much modern branding is that it goes deeper. It also appeals to our intuitive, unconscious, irrational, and emotional selves. Through the pleasure a product has given us, through the memories it evokes, through the attitudes we have picked up from friends, through the storytelling in its advertising, through the colour of its logo, we build 26 up a set of feelings. In these ways, branding creates a 'brand personality', and helps us to feel that a particular decision is right. (Jones, 2017) Brand Launching in a new market requires a firm to design a strategy for creating a set of associations to the brand in terms of 'What the brand stands for' and 'What the brand promises to deliver to its customers' (Brand Identity).

Aaker described Brand Identity as 'a unique set of brand associations that the brand strategist aspires to create or maintain. These associations represent what the brand stands for and imply a promise to customers from organization members.' Brand Identity could be regarded as to 'provide direction, purpose and meaning for a brand'. (Aaker, 2010). One key to successful brand building is to understand how to develop a brand identity – to know what the brand stands for and to effectively express that identity (Sharma, 2013). As competition has become increasingly intense, it is more important than ever for a firm to differentiate itself from other firms and to effectively communicate these differences to the public (Nandan, 2005). He added, 'strong brand identity can create and maintain brand loyalty. Nevertheless, a brand identity should represent the firm's vision and how they want the customer to perceive them as. The visuals, logo, colours, all associated with brand identity speaks to the instinct of the customer, and the customer actually does not have words to describe. A well-designed brand identity creates an emotional connection between the firm and the customer. In particular, the focus of a brand identity can become confining and ineffective. In particular, the focus of a brand is too often restricted to product attributes, existing brand images, brand position, and the brand's external role of influencing customers (Aaker, 2002, p. 76). Aaker stated, 'a key to developing a strong brand identity is to broaden the brand concept to include other dimensions and perspectives.

3. Co-branding strategies

Many researchers have offered a diverse range of definitions of co-branding. Tom Blackett and Nick Russell defined that co-branding is often engaged with two or more brands, all of the brand names in the cooperation are kept on the same product. A co-branding strategy is normally a medium to a long-term partnership, but it is not enough to create a new brand because its net value creation potential is too small (Leuthesser, 2003) (Blackett and Russell, 1999). Leuthesser argued that co-branding should be accompanied by a long-term agreement and cooperation. In terms of the development of new products, the brand names should appear on the logo or packaging of the new product. Moreover, one of the main aims of co-branding is to launch new products in new markets or existing markets. Leuthesser (2003) argues that co-branding involves combining two or more well-known brands into one product. At the same time, co-branding has the potential to accomplish "*the best in the world*" cooperation and to make novel products and new markets by taking advantage of the unique advantages of the two co-brands. The new products created by the two or more brands as a branding strategy, will produce a new brand name for the unique product. (Park et al, 1996). In addition, the joint products belong to one or both of these two brands. Additionally, Grossman (1997) stated that the two partners of the cooperative brand could collaborate in many marketing contexts such as advertising, products, product positions and distribution outlets.

Besharat (2010) suggests a branding strategy for marketing, some companies launch new products by an established brand. Brand extension strategy and co-branding strategy is quite similar but not the same, Leuthesser (ibid) argues that brand extensions strategy and co-branding encountering a number of problems. Comparing with brand extension strategy, for instance, new product development strategies, launch a new product line to extent brand collection, co-branding has some advantages. *To assess the relative attractiveness of co-branding, it is important key to understand the customer's perception of co-branding* (Leuthesser, ibid).

Two brands working together to create a new marketing project are popular in many industries (Shen et. al, 2014). Co-branding becomes a popular approach in brand extension strategy because co-branding can acquire the distinctive features of the brands of the two companies, and the brands of the two companies can complement each other. Leuthesser (ibid) also argue that three features of co-branding strategies need to be considered. Firstly, in the case of brand cooperation between the companies, the perception of co-branded products may have spillover effects on one of the companies, and the less well-known one may be more affected. Moreover, when the "high status" company brand is associated with the "low status" brand in, the "high status" company brand may not be adversely affected. Meanwhile, co-branding can have a negative impact on less well-known brands. (Cunha et al, 2015)

In addition, the customer base that one of the two brands brings to the joint product will provide potential customers for the other brand in the partnership. The perception of consumers is also one of the main factors influencing brand cooperation. Consumers can find the degree of correlation between the brand assets of two different brands, and the feelings generated have more influence on the harmony or consistency between products (Ahn et al, 2010). The collaboration of the two brands with complementary attributes are better than expansion of a dominant brand or two very popular but non-complementary brands (Park et al, 1996).

4. Fashion retailing

Fashion retail contains a diverse range of retailer types, and it can be defined into varieties of sectors, such as luxury brand, designer brand, high street, fast fashion, supermarket (Bhardwaj et al., 2010). Moore (2010) stated that among international retailers, the most productive sector is fashion marketing. Fashion retailing has significantly transformed the shopping behaviours of customers (Fernie et al., 2015; Bruce et al., 2006).

Fernie &Grant (2015) argues that there was a new phenomenon when, the fashion market began to change, fast fashion retailers changed marketing on the high street. Fashion retailers have certain significant characteristics. *Firstly, one of the purposes of fast fashion is to get new clothes into stores in the shortest time* (Bruce et al., 2006). They keep delivering a large number of designs in small batches, so the latest designer clothing is always on display (Fernie et al., 2015). Fast fashion brands reduce the time to put fashion products into stores, commit to a seasonal buying system that keeps the product range updated throughout the season (Barnes et al., 2010). Indeed, the mass fashion brand has a variety kinds of collections in different colours, types, with the amount of stock (Bruce et al., 2006), so that the display time of products is short. In that case, markdowns and sales are the most common strategy (Fernie et al., 2015), this kind of approach is to get rid of excess inventory quickly and replace them with more fashionable products (Bruce et al., 2006). Thus, the price of most fashion merchandise is affordable (Fernie et al., 2015), when compared with luxury or designer brands.

Luxury retailers have many significant differences. Depends on the elite culture in historical, only a few privileged class can use Luxury brand (Wong et al, 1998; Tsai, 2005; Fernie et al, 2015), after developed in few ages, now it became more affordable for more mid-market consumers (Tsai,2005), but the price is still unexpansive when compared with fashion products. Fernie and Grant (2015) argue that the purpose of consumers purchasing luxury goods is for expressing their own values and symbolism. Luxury brands by definition are based on the features of the luxury concept (Fernie, 2015). Moore and Doherty (2007) summarized five attributes of luxury fashion retailers as exclusive design for retailer, unique branding identify, high-class design quality and craftsmanship, pricing above the average market level, sold at leading retailers, such as in the hotel (Fernie,2005), flagship store (Moore et al.,2003). In addition, Fernie and Grant (2005) summarized more luxury brands as - a global brand reputation, a better shopping experience, a heritage of artisanship, a relationship with the original country, a limited amount of products and purchase channels.

Among fashion retailers, marketing strategies are both in-store and online strategies. As a conventional way of retailing, in-store strategies have advantages as they are an effective way of interacting with customers, such as the window display, layout, and display of the stores, showroom, fitting room, can enhance the shopping

experience to customers in the physical environment (Barnes et al., 2010). In contrast, online strategies in fashion retailing advantages are working on shopping experience mentally (O'Brien, 2010). Online fashion retailing is more focused on better understanding consumer behaviour (Rowley, 2004). Such as more promotion, more choices of products, more comfortable to compare different products with reviews, more accessible to purchase and return (Blázquez, 2014).

Fernie and Grant (2005) stated that a multichannel-retailing platform is the most effective way of all fashion sectors because customers desire information of products from various sources and willing to purchase and return goods. Thus, many retailers use click-and-collect as a way to attract customers with both online and in-store channels, so to enhance the customers experience (Fernie et al., 2005). Multichannel retail could bring more benefits to fashion retailers and also improve the customers shopping experience (Blázquez, 2014).

5. Co-branding strategies in fashion collaboration

Co-branding in the fashion industries as branding strategies is becoming a widespread phenomenon, in both luxury brands and mass brands (Oeppen et al., 2014)(Shen et al., 2014). The phenomenon of fashion collaboration can be turned into varieties of branding strategies (Ahn et al., 2010), more connections between two cooperative brands in the joint marketing, brand extension, ingredient branding, composite branding and so on (Oeppen et al., 2014; Ahn et al., 2010). Cooperation with a brand with the same usage situation, user identity, and brand perceived value is a necessary condition for allying with a fashion brand with variable relationships and various symbolic meanings (Ahn et al., ibid).

For the rapid development of cooperative brand partnerships in the fashion industry, many scholars offer the following perspectives. Firstly, it is a positive way to expand the existing market scope (Oeppen et al., 2014). What's more, in the perspective of companies, co-branding brings to the fashion industry a steady stream of new things and competitive advantage. From the perspective of designers, it provides a good chance to get new ideas, and consumers enjoy new experiences (Shen et al., 2014). Furthermore, co-branding in fashion industries bring benefits for both partner brands. The use of co-branding to attract future brand partners by increasing brand awareness with other potential brands (Oeppen et al., 2014). Cooperative brands can obtain a high media exposure rate, and joint brand products are fast becoming the most popular commodities.

There are many different forms of cooperation between fashion brands, even with other non-fashion brands, additionally; all the international fashion brands are trying to launch joint brands collections. These include:

1) With different attributes of branding partnerships – luxury brands and fast fashion brands co-branding collection (Shen et al., 2014). Through the cooperation with luxury designer fashion brands, the affinity of the brand was increased, and the image of the fast fashion brand was enhanced (Shen et al., 2014). For instance, H&M is a typical example, Alexander Wang (2014), Versace (2011), Marni (2012). Recognized luxury brands most often work with mass-market brands, often creating lower-priced products. At this point, short-term cooperation can protect the brand from being negatively viewed by its existing consumer base and stimulate consumers' interest in a new market through mass-market retailers (Oeppen et al., 2014).

2) Similar attributes of brand cooperation, such as two luxury brands involved one collection (e.g., Burberry & Vivien Westwood). Fashion cooperation strategies can be used as a means to promote high-end cooperation between luxury brands and well-known brands, and such cooperation will become a branding management experience (Oeppen et al., 2014).

3) Collaboration with an individual objective, with celebrities, bloggers or designer, such as puma & Rihanna (2015), Celebrities who cooperate with the brand generally have similar values or connections with the brand. Celebrities have their own image and popularity in the minds of consumers and have a certain degree of fan base. Therefore, celebrities can leverage the relevant elements of a brand and are feasible brand partners (Seno, 2007).

4) Collaboration with an e-commerce platform, such as End clothing & Timex (2018), Mr. Porter & Balenciaga (2018). E-commerce retailer platform and fashion brands have the relationship of interdependence, and these e-commerce retailers have clear positioning of customers (Reichheld et al., 2000). In addition, e-commerce retailers gathered multi-ranges of fashion brands, exclusive collections that can satisfy the customers' need for uniqueness (Shen et al.,2014) (Hippel, 2005), improve customer loyalty (Reichheld et al.,2000) for the platform so to enhance the competitiveness of online retailers.

5) Fashion brands cooperation with non-fashion brands. So called inter-industry collaborations (Varley et al., 2019).Fashion brands collaborate with technology, such as Nike & Apple (2006), Samsung & Armani (2007). The cooperation between fashion brands and different cultures can form the diversity of customer division. Fashion brands collaborative with homeware retailers, such as Anglepoise and Paul Smith Lamps.

6) Multi partnerships co-branding such as Uniqlo x Kaws x Sesame street (2018), Chanel x Pharrell x Adidas (2017). The collaborative of triple brands means that the customers' group are extended and diversified. Meanwhile, the difficulty of cooperation between parties will increase so as the potential risk for participation also increases. For example, maintaining the individual brand features while harmoniously integrating the design elements of the three brands is a challenging element. Co-branding strategy does not always strengthen the brand image, on the contrary, after the failure of cooperation it may cause brand image damage (Geylani et al., 2008).

6. Open Innovation in Fashion

A strong brand can influence the relationship between the brand and its customers, and it can also cause creative activities (Neil, 2018) and extend to the pricing of innovative products. Increasingly more joint brands occupy a place in the market, and two different brands are used for the same product. The relationship between brand and innovation could be extended to the joint brand. Neil (2018) argues that co-branding has positive advantages for product innovation. Although only one brand has strong strength, as long as it brings benefits for both brands, it indicates that co-branding in product innovation allows the development of the less powerful brand. Whether the relationship between joint brands and innovation is different from that between brand and innovation becomes another argument (Neil, 2018)

Moreover, with the rising popularity of the concept of design management, Design becomes an indispensable part of the branding process. In addition, design is a strategic tool for creating a strong brand with integrated experiences (Kent, 2003). Kent also points out that the general positive interaction with customers of developing new products and services could be easier by combining design management with the branding process and new product development (NPD). Indeed, enhancing brand experiences and promotion is a dynamic set but not a static process, which should be consistent through the impact of design (Kent, ibid).

The fashion retail industry is becoming much more competitive in particular to new market entrants on a daily basis. Almost all the established fashion brands have been formed by their own culture with their own concepts, as such, demands of customers have changed, for satisfying more demands of customers, innovation is necessary, and co-branding strategies in the fashion industry was transformed by the development of changing consumer needs; non moreso than the millennial market segment. The cooperative brand strategy makes the old fashion house popular again and opens up new elements for the fashion industry. The retailers need to establish effective connections with customers through innovative techniques and upgrade technical support to improve customer experience (Blázquez, 2014).

Fashion has become more democratic; customers have different personal requirements. With the development of changing consumer behaviours, customers' demands for personalization are increasing gradually, and more customers are willing to pay and get the customized product. (Hippel, 2005). The original custom service was meeting the needs of some special small groups, such as traditional garment customization by manual labour, technical is typically handcraft. In the 1980's Booms and Bitner (1981) introduced the concept of 'servicescape', which draws a correlation between services offered by the company and the environment in which they are provided to the consumer. In relation to the fashion retail landscape, the retail interior plays a critical role in reinforcing and communicating brand values, and how service provision is integral to reflecting these values. Retail environments are complex areas of design consideration where visual communication elements and merchandising have to be carefully integrated and orchestrated. Zaccai (cited in Lockwood, 2010) articulates design as "a way of thinking that creates insights that inform what and how you execute, as well as how you communicate, market, support, and service once the product is introduced." (Lockwood, 2010, p. 18). Thereby, design informs the whole business strategy. However, the decision by an organisation to become more design-centric depends on the personality of the company leadership. Zaccai suggests that a gradual implementation of design-driven approaches could be the first move. If it is first applied in one part of the business, it could learn from the mistakes and lately transfer it into the entire organisation (Lockwood, 2010). A formal framework is established by Fraser (2009) introducing design as a path to understand stakeholder needs, a tool for visualising new solutions and a process for translating novel ideas into effective strategies. Fraser proposes a methodology called 'The Three Gears of

Business Design': Gear One makes reference to get a deep user understanding where new opportunities are revealed. This helps reframe the business challenge through the eyes of the end user and set a human context for innovation and value. Gear Two is the phase of development where there is a broad exploration of possibilities to meet the needs found in gear one. New solutions are generated and visualised through prototyping. Gear Three aligns the new idea with the proposed future by designing the business itself. It is about exploring what it takes to take the idea to the market, identifying the strategies that will drive success and prioritizing the activities the organisation must do. The final step is the integration of the new concept into the current operation as well as the identification of the barriers and how they will be overcome. Along this methodological framework, Fraser proposes a mindset for the individuals in the organisation consisting of: (1) mindfulness, (2) open-minded collaboration, (3) abductive thinking, (4) permission to risk early failure, (5) imperfection and iteration early in the process, (6) creative resolution of trade-offs and constraints. The combination of both is what drives breakthrough strategies for enterprise success.

7. Design and new product development

Very often, the term 'design' is commonly associated with the aesthetics of an artefact. When the activity of design is carefully managed and incorporated within business strategy, the ability of design providing a unique set of value propositions is desirable for target users. Design is an indispensable part of contemporary business, which can extend the life of companies and their associated brands for long-term development and success. With the increasingly fierce competition in the commercial marketplace, new technologies are constantly providing advantages and disadvantages for traditional business models. Design is a vital relationship between market requirements and product development, and it can transform consumers need into product development (Dorst, K. 2010).

Holston (2011) points out that design process can gain innovative solutions through multiple perspectives: from business, competition, consumers, and other strategic sources. He also stated that design process is a comprehensive method to achieve innovative design concepts that differentiate products from their competitors and connect with the consumers at a deeper level.

If the design is simply to meet customer needs and design innovation is not enough, organizations should have a broad vision; look far ahead a higher level of design needs. Repeated offers of similar products that only meet a single need lead consumers to consumption fatigue. Moving beyond the traditional 'product', design is moving into new realms of commercial activity and importance, whereas 5-10 years ago it would have been considered inconceivable as a vital source of meaningful activity (Jassawalla, A. R. & Sashittal, H. C. 2002).

Design can be used effectively regardless of company size, structure and market orientation; it is an equally powerful tool that benefits organisations from micro start-ups operating within highly niche and specialised markets, through too small to medium-sized enterprises, and older more established organisations competing in a fast moving dynamic market context. What a healthy and balanced economy requires is not more SME's but small companies that wish to grow into larger organisations that are more profitable. A significant percentage of SME's do not possess the capabilities, capacity or indeed the desire to increase in size - the key is to encourage and support well-managed high-growth potential companies to use design as a mechanism for long-term success.

8. Summary and Further Research

In today's retailing background, brand and design are closely related, the relationship between brand strategist and designers is worth in-depth study. The emergence of a co-branding strategy evidence that the business model of the retail industry is changing with the time changing and the demands of consumers. Co-branding retailing should focus on brand marketing and relationship marketing. The quality of the product can effectively affect consumer's perceptions of the fashion products. Additionally, brand marketing and relationship marketing can effectively improve customer satisfaction and customer stickiness, which will lead to long-term business growth. It is able to increase the target customers' brand loyalty and customer satisfaction.

As an important role in the business operation, designers need to respond accurately to consumers' preferences and market demands. Fashion as a public necessity, It is not only relevant about the retail industry, but also a series of values such as culture, entertainment, aesthetics and so on. Besides, the design could reflect business performance. Design is not only a function of aesthetics, but it can also develop and give

play to commercial value. Although the value of design cannot be simply estimated, the value of design can still be found in products, services, communications, and consumer comments. In the context of the creative era, designers should be more closely connected with the whole process of product development and enterprise value chain.

In the competitive fashion retailing environment, co-branding strategies is a highly innovative strategy. From the perspective of fashion retailers' internal. Co-branding strategies can create trends and generate more selling points. Fashion industry has certain particularity affairs, these different elements; culture collision stimulated the enthusiasm of consumers. However, as collaboration strategies increasingly trendy, much negative effectiveness has come up. New collaboration products are coming out faster, co-branding news explosion in social media; the NPD process has been compressed. The quality of product becoming decline, it causes consumers will soon start to get bored, and also have the risk to loss original consumer groups. So how to stand out from the numerous competitors has become one of the most concerned in the industry.

The theoretical research of this paper provides the theoretical background for the design commercial value in fashion retailing business. This paper is the basis of the academic in the library, literature on the Internet and some of the user experience analysis report; it would be valuable to conduct this research with a rich case study to explore the insights of collaboration in design and retailing of partnerships brands. Moreover, gain the perceptions into consumer's experience from the marketing. Although the future of co-branding strategies in fashion industries is unpredictable, it is changing the brand business model. And also, from the perspective of current cooperative brand development, the co-branding strategy has not yet reached its maturity. It is still a challenge to make the right response to new elements in design and business.

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Identifying Product Design Trends at Dutch Design Week

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Trends in design manifest in many ways, from fads in form or production to themes or topics explored. These trends are often generated within the design community, but also reflect local and global culture. To identify meta-trends in contemporary design culture, we worked with nine student researchers to gather data seen during an academic trip to Dutch Design Week in 2017. The results indicated growing interest in four central themes: identity, globalization, technology, and production. From these themes, nine trends were outlined; social engagement, production consciousness, design for agency, material innovation, humanist design, humanity and technology, re-interrogating history, speculative design, and questioning the role of design practice itself. We noted a shift from narrative-driven to experiential designed objects and a change from individual expression toward communal experience. We also observed a discipline in flux as designers struggle with these large themes, objecthood, and the role of the designer.

Keywords: Industrial Design, Trend Forecasting, Undergraduate Design Researchers, Design Field Study, Design Education

Introduction

Trends in design manifest in many ways, from fads in form or production to themes or topics explored. These trends are often generated within the design community, but also demonstrate links to culture on a more widespread level, ranging from local issues to the global economy (Watson, 2012). These larger trends indicate the changing ways designers engage with the issues surrounding them, as well as what issues are connected to changes in the design community.

Oftentimes trends reflect ideological movements as they interplay with events of the world around them. This relationship shapes the way we understand historical eras and movements in design, such as the Arts and Crafts movement (born in opposition to the Industrial Revolution) or the birth of Modernist ideas in the wake of massive inequality and war (Fiell & Fiell, 2013). When broken down, these movements are composed of smaller repeated practices that can be recognized as trends. Such trends can manifest as aesthetic tendencies, common manufacturing processes, objects produced, challenges faced, and other articles of design that contribute to building a movement. We found interest in what we termed meta-trends: larger than popular styles or formal details, but smaller than era-defining movements. Thus, we turned our study towards these patterns in design work that provided us meaningful information about the ideologies and processes of their creators.

We sought to research these trends, their evolution, and their impact on young designers as we worked with a student team to collect data and analyse the trends seen at Dutch Design Week (DDW) in Eindhoven,

Netherlands in October 2017. Understanding trends helps students place their own work into a historical and social context and develop understanding and critical perspective toward their responses to designs they encounter by others. This increased perspective also helps them create, frame, and discuss their own work. As we collaborated with students to learn more about contemporary trends, we asked ourselves how we might help them evaluate their own work and place it in cultural context.

As is documented in efforts to enhance student understanding of the cultural power of design through design history classes, contextual learning is important to helping students develop an informed perspective (Cardall & Howell, 2018). If students fail to develop the ability to synthesize trends in design, their ability to engage with and influence contemporary culture is limited. This lack of analytical skill places young designers in a position to be more easily swayed to create work in reflection of local style or what is perceived to be "cool" rather than intentionally placed in contemporary context. Our goal in our research was to study trends with a method in which student participation was instrumental in hope of helping students who may not be exposed to work on the level shown at international exhibitions like Dutch Design Week construct contextual understanding and definitions of contemporary design trends and their relationship to culture.

Research Method

To identify meta-trends in contemporary design culture, we worked with a team of 9 undergraduates student researchers from Brigham Young University's industrial design department to gather data during an academic trip to Dutch Design Week in October 2017. The students were asked to photograph projects they perceived to be unique, outstanding, or relevant to them using their personal judgment. These images were collected in a single Google drive folder upon return and analysed in multiple affinity mapping sessions by three course participants and the tutor. Affinity mapping/diagramming is an established method of finding connections between multiple variable elements and is outlined by IDEO in their method cards (2003).

Our instructions to the students while on site at DDW were left open-ended to allow them to exercise their own critical judgment. As this was an educational practice, this was in part to encourage development of their critical perspective, but also to engage their expertise as a layer to our collective curation. On the trip, students viewed much of the same material, often together, so these open instructions provided space for their individual viewpoints, as certain pieces were noted my multiple students and others by just one, although their peers had experienced the same display.

The student researchers contributed two elements to our study: first, they aided us in collecting images and analysing and identifying potential trends, our primary research focus. Second (the main reason for student involvement), we hoped participation in this research would enrich their awareness of the relationship between culture and design in a way that would have meaning to their work as designers. This coordinated with other efforts in our program, specifically our design history course, to tie in thinking about society and design. By scrutinizing how work showcased on an international level engages with trends they see in local design culture, students can begin to understand and practice engaging with culture in their own work as they dictate their personal definition of what it means to be a designer

Themes & Trends

The analysis indicated growing interest in four central themes: identity, globalization, technology, and production, with many of the trends observed questioning the role of design itself. From these four themes, we extracted what we believe to be nine unique trends that define modes of discourse within contemporary design. For each trend, we worked with the students to classify examples from the work documented and examine potential influences and societal factors that could contribute to the trend's motivation. We used this evidence to write our own definitions of each trend.

We attempted to define the observed trends by motivation, not theme; many topics were reflected across categories. Our interest lay in the response's designers formed that contributed to contemporary methods of designing, not the subjects currently in cultural vogue. By structuring our analysis using motivating concepts, we sought to dissect the ways designers process and react to culture through their work, and how these actions are emblematic of culture in themselves. Some of these trends reflect both concept and topic as they utilize disciplines like history and technology to navigate issues, but these pieces borrowed from these domains in a way unrelated to their topic in order to contribute to more topical conversation. In a sense, our trends analyse how designers design. For this reason, we are viewing these as meta-trends, each serving as

conceptual categories for more specific aesthetic, formal, and structural trends within the larger contemporary moment. The nine trends we identified are: Socially-Engaged Design, Production-Conscious Design, Design for Agency, Material Innovation, Humanist Design, Humanity + Technology, Reinterrogating History, Speculative Design, and Questioning Design Practice.

Socially-Engaged Design

Design taking into consideration the social aspects of its creation, use, and aesthetic. While these projects can include environmental interrogations, they primarily deal in social, cultural, and ethical issues. This category questions, innovates on, and considers societal values through designed objects and experiences. Perhaps derivative of the much discussed socially-engaged art movement and often influenced by the design thinking movement led by Jane Fulton-Suri at IDEO, these pieces are rooted less in form and physicality than humanitarian results. As design thinking becomes increasingly prominent in corporate culture (Bjogvinsson, Ehn, & Hillgren, 2012), design that is explicitly human-centred to the point of emphasizing social aim over object detail is perhaps a natural evolution. Oftentimes, this includes departures into participatory projects, design for accessibility, and politically-engaged work that applies design skills, processes, and principles to another field's practices, or at the very least, uses these values to drive creation.

This category was perhaps the dominant trend seen at Dutch Design Week. Trend cycles are often understood in economic terms, flowing directionally from sources of power in the producers of objects or, when democratization is considered, flowing upward from producers of culture to those who create objects. When we examine design history, it becomes apparent that on a large level, trends are linked with societal changes. Maria Mackinney-Valentin argues trends stem not from specific points or events, but from the process of "becoming," and are therefore linked to multiple economic groups and directions coming together (2013). This concept suggests trends form as creators and consumers alike collectively attempt to change and respond to their surroundings. Under this understanding, the rise in socially-conscious consumable objects suggests a response to an increase in political upheaval in both the United States and Europe. It is unsurprising that during this time, designers began to create items that, while not necessarily political in nature, allow them to act as politicians in kind by creating projects and systems to enact social and communal good.

Projects students documented from this category spanned a wide range but shared common themes. One collection by a Design Academy Eindhoven graduate Alissa Rees (2017) created vests to allow patients greater mobility and humanization by allowing them to wear medication supplied via IV or cannula instead of pulling it on a trolley (Figure 1).

Figure 1: IV Walk: graduate student Alissa Rees's intravenous delivery system that can be worn, giving hospital patients more freedom to move around. Dutch Design Week, Eindhoven 2017.

Another Design Academy graduate linked large balloons to cellular devices to alter the experience of their use in social situations to make phone users more aware. Other projects were very production-oriented; design collective Social Label employed workers with disabilities to help create and design a collection of ceramic

dishes with prints inspired by their production. Similarly, designer Ro Smit connected the local wool industry with makers with disabilities to create woven blankets that unlocked their common skill, with the weave and pattern of the blanket designer to accommodate its makers specific skill set depending on their needs and interests, empowering them to have a specific and skilled role in the creation of the piece. These pieces vary from provocative to marketable but share a common interest in actionable social change.

Production-Conscious Design

Design driven by its production methods, taking into consideration the economic, cultural, and ecological consequences of making and manufacturing to determine the final product. Many of these projects focused primarily on creating objects produced sustainably, though projects designed for sustainability were seen in a much wider conceptual range.

Often these projects overlap with Socially-Engaged Design, such as the work by Ro Smit and Social Label discussed above that utilized their supply chains and manufacturing processes to accomplish their design goals. Others of these projects play with material innovation or historical practice, exploring readymade design as a form of sustainability (as seen famously in work by Piet Hein Eek, among others).

Another segment of work, like the ceramic light fixtures displayed in Figure 2, unites craftsmanship with narrative by using the method of creation to give form. In one such case Travel Agency (2017) used recycled plates to create ornamental lighting, giving a discarded item a new role. Viewers must then engage with the process of the object's production as they engage with the piece visually, and are therefore prompted to ask questions about time, labour, and value, making it a piece about production as much as it is a light fixture.

Figure 2: Light fixtures created from discarded ceramic plates by design studio Travel Agency. Dutch Design Week, Eindhoven 2017

Design for Agency

Design that pushes against standardization in order to bestow greater power on the user to determine the role a product best fulfils. This category includes ambiguous, customizable, and sometimes participatory design. These objects represented an interesting wave of pushback to the Modernist dialogue of destratification via standardization still espoused by (and praised in) corporations like Ikea. These pieces were made to place the power with the individual user, not the designer who created them, or the manufacturer who controlled their cost. Sometimes these pieces overlapped with production-conscious design by being made possible through new technology like 3D printing, while other times these pieces created space for pluralistic readings of historical objects.

One notable piece in this category, entitled Prinstrument, was created by Design Academy Eindhoven graduate Kristaps Polītis (2017) to allow children to learn about how sound is produced by creating their own instruments (Figure 3). Various modular forms could be 3D printed and connected and reconnected so their users could continually experiment with designing their own instruments and sounds. This project checks off the triumvirate of qualities central to pieces in this category: its forms are ambiguous enough to not connote a pre-defined limited-use object of a type; it is designed for complete individual customization; and it is participatory in nature, asking its users to help build the project as they use it to suit their functional aims.

Figure 3: printed instrument pieces shown by Kristaps Polïtis at Design Academy Eindhoven. Dutch Design Week, Eindhoven 2017

Material Innovation

Design that relies on new development of tactile or non-technological materials to create a product in an innovative way. Similar to how production-conscious pieces place craft and manufacture at the centre of their product narrative, material innovation builds around a specific material, often repurposing a natural substance or by-product for an unexpected or secondary purpose. Cow stomachs, salt, and fungus were all repurposed into high-quality objects for everyday use, using their material as a base for objects that enhance their natural abilities. For instance, Design Academy graduate Billie van Katwijk's (2017) work finds the leather made from cow stomachs contains beautiful, unique textures that are showcased brilliantly on handbags, creating functional luxury items out of what was previous wasted in traditional meat or leather production (Figure 4). These projects play in a space between those objects that push boundaries of what design can be and those that ask questions about what design has been.

Figure 4: Cow stomach leather purses by Billie van Katwijk shown at Design Academy Eindhoven, Dutch Design Week, Eindhoven 2017.

Humanist Design

Perhaps a derivative of socially-engaged design, but lacking the category's solution-oriented agenda, humanist design focuses on connection and humanity in ways intended to foster emotional and cultural poignancy. These pieces focused on elements that grounded a sense of being by finding beauty in community and heritage, exploring sensory narratives, and building connections between person and place. Their purpose was not action, but connection, with a more holistic and less political approach. A standout example was shown by Atelier NL (2017), whose designers collected sand from participants living around the world to create dozens

of unique types of glass, each “native” to their own location (Figure 5). These glasses were then explored and combined into a series of dishes and vessels that worked together symbolically.

Figure 5: To See a World in a Grain of Sand Exhibition by Atelier NL, Dutch Design Week, Eindhoven 2017, Photo Courtesy of Atelier NL.

Naturalized Technology

More than now-mainstream user experience design asks how we interact with digital devices and interfaces, these projects ask how our humanity is enriched by (or attacked by) the technological innovations around us. What if selfie sticks were watching us? What if plants were electronic? This is a question posed by Studio Drift (2017) with their luminescent dandelions (Figure 6). By integrating the visceral and natural aspects of the human world with technology, a realm of alien products pushes the boundaries of the human relationship to technology in a surprisingly optimistic manner. These are not additions to the self-contained world of smartphones, but digital additions to the physical world.

Figure 6: Dandelion fibers mix with LED lights in this piece by Studio Drift, Dutch Design Week, Eindhoven 2017.

Re-interrogating History

Design that reinterprets and questions previous trends and eras to draw from design history in a way that is more inclusive and less problematic, while still learning from the past. These projects seem particularly linked to today’s era as they contrasted older norms with contemporary views: what role do product designers have

in pollution? How have designed objects and systems contributed to discrimination? The projects seen that fit into these trends took current issues, like climate change and civil rights, and placed them directly within the heritage of design as a profession. Consequently, these pieces played into a highly referential discourse made possible by the largely design literate audience present at Dutch Design Week. In this way, these pieces are some of the most closely linked to the narrative-driven design art pieces of the last ten years.

One example of this was a chest designed by Design Academy graduate Kostas Lambridis (2017). Lambridis' piece was a patchwork of different historical styles of production and ornamentation in various states of completion and decay (Figure 7). By piecing together a disparate collection of chests into one chest, he creates a form both unfinished and old, familiar and not, rich in artistry but intentionally lacking an aesthetic thesis in order to create a conceptual statement. The chest combines a variety of chests to create a meta-chest, more about the idea of what a chest might be, and how style, culture, and ornamentation plays into that, than about operating as a chest.

Figure 7: This chest by Kostas Lambridis combines various historical styles and states of decay, Dutch Design Week, Eindhoven 2017.

Speculative Design

Design driven not by function, but by desire to make a statement about an issue. This design poses questions about the future and experiments with breaking boundaries and eliciting a desired reaction, requiring a different kind of design goal, often asking a 'what if' question. Like the work discussed in the "reinterrogating history" meta-trend category, these pieces share a relation to design art through their non-commercial nature and willingness to prioritize statement over all else. Consequently, these designers ask important questions about the possibilities of objects in a way that feels both imminent and out of reach.

One such piece, "Domesticat" by Veerle Kluijfhout (2017), created clothing from cat hair in place of wool (Figure 8). Why do we use some animals' fibers to produce our clothing, while others we keep as pets? Another piece, the Gene Machine, designed by Design Academy graduate Mies Loogman dove farther into the realm of science fiction to ask questions about products already prevalent in society — in this case genetically modified food. The machine gamified the selection of genes to allow participants to thoroughly engage with the concept of a "genetic lottery" and look at how that could not unreasonably be executed for future foods. Through its fantastical presentation, the Gene Machine allowed viewers to sustain an idea that would otherwise feel far-fetched or controversial.

Figure 8: Sweater knit from cat hair by Veerle Kluijfhout, Dutch Design Week, Eindhoven 2017.

Questioning Design Practice

Designs that question the constructs we use to define 'design.' These designs use the act of designing and the resulting objects (or lack thereof) to question the way we view and create objects. Consequently, these pieces often have highly non-traditional forms as they explore the boundaries of what can be designed. This can experiment with new media and disciplines, interactions with senses, the forms we expect our products to take, and reasons why we create items.

One such example was a set of morgue refrigeration boxes in which the viewers could enter to experience narratives told by scent and sound. By immersing the participant in darkness, their sense of sight, often the most dominant sense when analysing design, was disabled, and participants were able to engage with their other senses more fully. Such a project was highly speculative in nature, but its role as a designed experience was didactic, as it highlighted to its audience a new way to design and process objects in a critical sense.

Figure 9: Students participating in a sensory narrative experience from inside a morgue refrigerator, Dutch Design Week, Eindhoven 2017.

Comparison to Previous Years

Work seen suggested design is in a period of evolution as evidenced through comparisons to research of the recent past. One project referencing work shown in Paris demonstrating a very different design ecosystem focused on playful conceptual work, specifically interpretations of figures of speech (Howell, 2008). Another evaluation from a similar time frame found an emphasis on pushing boundaries of design using organic "blob" forms, a craft perfected in their own unique ways by such diverse and notable talents as Karim Rashid, Ross Lovegrove, and Zaha Hadid (Holt & Skov, 2005). Of particular importance in Dutch design in the recent past was the emergence and dissemination of conceptual design powered by Droog, a movement that contained the playfulness of the figurative designs seen in Paris and the open allusions of the blobjects as well. These three together depict an era much more object-oriented than our current one, but very open to experimentation within that construct. Often referred to as "design art" (Taylor, 2010), work of this nature developed a basis for a new kind of design: these designs, progressed farther than their postmodern predecessors away from formal and functional emphasis and toward narrative emphasis, often with a playfulness and joviality that in retrospect seems definitive of the era.

It is easy to draw the pathway, however, of the contemporary experience-driven work as a natural evolution of these narrative-driven trends. The Dutch emphasis on readymade manufacturing by Droog and its contemporaries shows beginnings of decoupling from the object as the canvas for design, and it also shows interesting ties to recent work that interrogates the history and production of designed objects and processes. Similarly, the processes used in designing around figurative language exhibits a storytelling similar to that seen in contemporary projects that placed human stories as their central compelling argument. The organic objects, motivated by desires to reframe what stereotyped items must look like and discover new and scientific approaches toward design and manufacturing show a similar trajectory of thinking to some of the speculative projects, particularly those exploring how humans might interact with technology in a way that looks very different from how we expect it to now.

Analysis

By understanding meta-trends at play, we can try to understand the societal themes that compose them. Using these themes, the interactions and relationships between trends can be examined to help identify future trends, micro-trends, and other innovations that might provide solutions to consumer needs and satisfy the zeitgeist. When looking at the big picture, these trends can be separated into larger groups based on the questions they try to answer. This shows how design is responding to the current cultural climate, as well as showcasing where it can go in the future. While some seek to establish the role of the designer, others seek to respond to technological innovation or current events. It is of particular importance for students to begin to understand the relationships between design trends and society as they develop their voice as designers and begin to produce work in the world.

Our era in design is in some ways dominated by the functionalist rationale of design thinking. While design thinking was not the foremost design method employed at the event, its voice was definitely heard, and its participatory, value-driven ethos was reflected in many of the trends observed. Design thinking's influence has seemed to represent a swing towards the moral and pragmatic motivations over purely artistic in design. Whether this is seen as a lasting change or a temporary shift on the design marketplace and whether that will be of positive or negative effect on the discipline remains to be seen. Julka Almquist and Julia Lupton suggest this migration towards design that is universally problem-solving endangers users to oversimplification as it breeds globalization, creating a mass consumer culture easily packaged and sold (2010). That design leans this way echoes populist sentiments seen worldwide. Socially-engaged art has been criticized for being self-complimentary and ineffective, and Claire Bishop argues its evaluation is so commonly simplified to "good" or "bad" based on ethical aim that the work has come to function as a political tool more than an artistic piece (2012).

However, this somewhat cynical reading discounts many meaningful aspects of this era. While many trends sought to solve large-scale problems, in and of itself a noble aim, others dealt in specificity, often seeking to work from a specific place or moment in time. This is interesting in a time when movements for and against nationalism are on the rise. Socially-engaged art and design thinking both have become major movements in their fields, drawing both praise and criticism for their reorientation of success for creative work away from the physical object and toward the collective social experience. Björgvinsson et al. argue there has been a quest for participatory design to reinvent objects, and, more deeply, human interaction with objects, for much

longer than our current rendition has been trending, linking this pursuit to negotiations around the democratization of the workplace in Scandinavia in the 1970s (2012). This origin story reflects both the political motives and speculative quality seen in much of the work researched for this piece. It also provides a source for the "big tent" view of design's migration away from the physical object, something demonstrated by the number of sensory and experiential pieces observed.

Our student researchers in particular noted a shift from narrative-driven to experiential designed objects. While trends of the past ten years, demonstrated by Droog in the Netherlands and others in Paris (Howell, 2008), played with language, convention, and storytelling, the emerging trends showed a much more externally-focused perspective. The former group created expressive work of a nature often highly personal to the designer, but the latter placed the focus on those who view, use, and engage with the design. These works often centred around the experience of the object in some way designed to enhance a life process. Our students speculated as to the cause of this change: has the internet connected the world, but also isolated it, causing designers to seek community? Or is our contemporary interest in well-being, which permeates social politics, healthcare, consumption, technology, and culture manifested through this desire to improve experience in any way possible? As students in our program's design history class pointed out, the rise in design work around ephemeral concepts like food, biology, and the sharing economy is emerging from the object-oriented, highly artistic work very prevalent in the recent past. This presents a shift away from individual expression toward communal experience as the primary value in design.

This movement toward experience is mirrored by the emerging disciplines (Howell, 2016) stemming off industrial design away from the world of hard products. Experience design, service design, systems design, interaction design and more see designers today as thinkers to problem solve for experiences and facilitate interaction in a way that was not always required of designers of physical goods and spaces. These trends showed a group of still object-oriented designers grappling with this change as they brought a layer of experiential awareness to products, garments, spaces, and more. We also saw a shift away from the object itself, as with many products the object served as an example or derivative secondary in nature to the theoretical or conceptual work being done. Many projects instead displayed articles like projections, prototypes, books, samples, or art objects that were not "designed" in the traditional sense. Some pieces disconnected themselves from objects entirely, their artefacts of a less corporeal, more sensory and experiential format. With this shift, we see movement not just toward new disciplines, but away from a disciplinary understanding of design entirely towards what Craig Bremmer and Paul Rodgers understand as "metadisciplinary," "alterdisciplinary," and "undisciplinary" as they find designers' processes anchored more in issues and research than discipline-centric skill sets (2013).

David Puttnam proposed the changes afoot in design stem from the dominance of digital technology in our era. The digital world, he argues, is not performed like our physical world, but is created entirely by designers (1996). Perhaps the mentality developed by designers thinking in the ways required to build an online universe from scratch has seeped outside the world of digital design and back into the physical one, causing a blurring of disciplines and migration toward problem-and solution-oriented thinking. Similarly, the push towards connection with society, history, and fellow humans resembles a physical search for the global closeness that can be experienced (or, one could argue, simulated) on the internet. The internet's role in the deobjectification of design and the role young designers native to the internet play in this poses questions for future study.

Conclusion

Our research documented a discipline in flux as designers took on massive themes like humanity, technology, sustainability, and globalization and adjusted their results to match them. While the trends we analysed represented nine unique ways of questioning to produce work around those themes, we found they together grappled with objecthood and the role of the designer, something that was duly noted by our student team from an industrial design background. While, when compared to objects of the recent past, the work observed for this research seemed more sociopolitical in nature, it is important to acknowledge that designed products are always products of culture. History is possibly the clearest place we see this, as we remember eras by their household objects, fashions in garment and decor, and general aesthetic inclinations. Though designed objects of the current moment may feel more overtly political, seemingly apolitical objects are not created in a vacuum, and are perhaps political in their own way, just not the one in vogue at the contemporary time.

Also noteworthy in our research was the specific role Dutch culture played in the event, despite its international nature. Less projects were seen that focused on certain topics. For instance, our North American students anticipated seeing more work around feminism and gender studies, some of the most discussed and politicized topics in the United States at the time of research, but found the issues held less prescience in contemporary Dutch politics. Similarly, Eindhoven's strong craft tradition and focus of programs at the Design Academy led to significant amounts of work on materiality and history from current students and alumni. These local factors were considered, but not discounted when analysing trends, considering the strong international community present in the overall Dutch design sphere and at the event itself, as well as the fact that all documented trends were observed both at projects affiliated with the Design Academy and not.

A primary function of our project was our attempts to conduct research in a way that might be impactful to the student team. We worked with students to discuss how design for trends might be implemented, and how meta-trends and larger culture could influence their work. This coordinated with other efforts in our program, specifically our design history course, to tie in thinking about culture in design. By scrutinizing how work showcased on an international level engages with trends they see in local design culture, students can begin to understand and practice engaging with culture in their own work as they dictate their personal definition of what it means to be a designer.

Many of the student researchers were fourth year students working on their own self-guided theses at the time of this undertaking. As the students worked on completing their projects, more than half reported in a survey that the work studied had a significant impact on the direction of their work (Larsen & Howell, 2018). Interestingly, nearly all these senior students exhibited theses that fit cleanly into one of the outlined meta-trends. Many of their peers worked on theses that also fit into these trending categories, although the non-research group had a higher number of projects outside the delineated trend map.

Since much of the work at Dutch Design Week was shown by young designers not significantly more experienced than our student team, we found it particularly interesting to see what work resonated with them initially, and then stayed with them as they progressed through their studies and continued to realize their voices. In a sense, this project itself took on a participatory level as the students we worked with aided in trend research, and we learned about their educational experience from the work they conducted. Our goal to improve their social understanding of design through trendspotting research in order to approve their ability to interface with contemporary culture through design was successful in the early engagement and conversations seen. As students can often be quick to cycle through trends, rapidly adopting and migrating as they seek to establish their own ideologies, the long-term effects of this project on them remain to be seen. However, their participation in meta-trends on some level seems likely given their demographic and the relationship drawn between many of the trends we observed and internet culture.

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Track 4.b Introduction: Designerly ways of innovating

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More and more organizations are using designerly ways of innovating to improve and transform their innovation systems and outcomes (e.g. Liedtka, 2018). This transformation implies the adoption of an innovation process characterized by experimentation, iteration, and fast failure rather than a linear, stage-gate type of process that is focused on failure prevention (Brown, 2008). In particular, when seeking to create and implement innovations that are radical in nature, iteration and experimentation are essential and require organizational flexibility, for example, in the field of strategizing (Deken et al., 2018). It also requires organizations to open up their innovation systems and co-create with a broader set of stakeholders (e.g., Gemser and Perks, 2015). Interestingly, designerly ways of innovating are not only embraced by established organizations, but also by new ventures (Klenner et al., 2015). Organizations, be they newly created or established, not only borrow from the designers' toolbox, but also seek to create a more enduring, overarching creative mindset within the organization. Such organizations may assist their employees in breaking out of their habitual ways of seeing, knowing, and acting by means of, for example, investing in creative, inspirational workspaces (Barry and Meisiek, 2010) or design thinking training programs. At the same time, the mass-marketing and commodification of designerly ways of innovating have led to a host of problems (Barry, 2017), and there are many challenges to overcome when implementing and using designerly ways of innovating in organizational settings (e.g. Carlgren et al., 2016). In this track, we seek to further explore these challenges.

Overview of the papers included in this track

The papers chosen for this track represent an eclectic mix of methodological approaches, conceptual frameworks, and data collection methods. Yet all papers share the same aim – the quest to advance our understanding of designerly ways of innovating and shed light on the phenomenon.

In our first paper, "Developing and applying performance metrics to evaluate co-design activities in design-led innovation" the authors Jamie O'Hare, Elies Dekoninck, and Lorenzo Giunta examine the role of co-design activities in design-led innovation. To advance the current debate around the effectiveness of co-design in design-led innovation, the authors develop a tailored suite of design process performance metrics that can be of use to design researchers and practitioners engaged in design-led innovation.

Christos Chantzaras' paper "The 3rd Dimension of Innovation Processes" advances our understanding of how architecture can provide an alternative frame for fostering innovation. The author explains and discusses the basic principles of integration through two case study examples, and he proposes that the specific skill set and thinking of architects offers a valuable 3rd dimension of innovation processes.

Our next paper, "Design practices for strategic innovation in start-ups" was written by Daphna Glaubert, Zarina Charlesworth, Nathalie Nyffeler, and Luc Bergeron. The research team studied a 4-day Innovation by Design Challenge workshop. They found that design practice integration into the initial development of a start-up can

indeed provide a lever for success by providing the strategic vision needed to persevere and bring products or services to market successfully.

The fourth paper in our track is titled "Enhancing Collaboration: A Design Leader's Role in Managing Paradoxical Identity Tensions Through Dual Identification." The authors Emma Coy and Johanna Prasch leverage paradox theory and social identity theory to shed light on the management of identity tensions in the context of multifunctional innovation teams. The authors argue that leaders should enable individuals to both identify as designers and innovation team members, and they provide suggestions for the implementation of such leadership practices.

Next, we turn our attention toward the use of design artefacts in innovation. The paper "Design artefacts as flexible and persuasive tools for customer-centric innovation" by Jacqueline Wechsler and Jochen Schweitzer reports on a practice-led case study proposing five distinct roles of design artefacts as flexible and persuasive tools that mediate the social and intertwined demands of customer-centric innovation strategies.

Our sixth paper, "Exploring the Design Space of Innovation Canvases" by Katja Thoring, Roland Mueller and Petra Badke-Schaub outlines the potential design space of innovation canvases. The paper advances our understanding of the working mechanisms and fields of application of existing innovation canvases and provides support for developing such visual innovation tools for new purposes.

The paper "Storytelling and Low-Resolution Prototypes for Innovative Simulated Experiences in User-Centered Research" was authored by Daniela Szabluk, Ana Berger, Andrea Capra, and Manuela Oliveira. The paper discusses the use of low-resolution prototypes and storytelling as tools for planning and building simulated interactive experiences as a part of an exploratory method of user-centered research.

Titta Jylkäs, Essia Kuure, and Satu Miettinen's contribution shifts the discussion to the topics of service design and artificial intelligence (AI). Their paper "Service Design Creating Value for Industrial Corporates through AI Proofs of Concept" explores how proof of concept (PoC) is used at different AI project stages and explores how service design can support the creation of such PoCs.

Our next paper "Disruptive Innovation Ecosystems: Reconceptualising Innovation Ecosystems" by Badziili Nthubu, Daniel Richards and Leon Cruickshank reviews a variety of scholarly perspectives on innovation ecosystems and applies 'design focused ecosystem thinking' to propose a new type of Disruptive Innovation Ecosystem (DIE) that can be leveraged by businesses for building sustainable innovation ecosystems.

In their paper "Unlocking the Potential of the Salesperson in the Virtual Fitting Room: Enhancing the Online Retail Experience for Fashion Brands" the two authors Eirini Bazaki and Vanissa Wanick compare and contrast virtual fitting room models found in the literature with examples from popular websites. Their paper introduces the concept of the salesperson in the virtual fitting room and provides recommendations as to how this concept can be further explored from a design perspective.

The final paper in this track "Speeding-Up Innovation with Business Hackathons: Insights into Three Case Studies" by Myrna Flores, Matic Golob, Doroteja Maklin, and Christopher Tucci presents a methodology for organizing hackathons. The authors elaborate on this methodology through the application of case study examples.

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Developing and applying performance metrics to evaluate co-design activities in design-led innovation

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Abstract – An increasing number of companies are experimenting with 'designerly ways of innovating' to improve the agility, speed and hit rate of their innovation activities. Co-design activities are emerging as part of a design-led innovation approach. Whilst there is extensive academic literature on design process performance metrics, they have rarely been applied by organisations that are testing co-design activities, possibly due to the time and effort that is required to apply them. This paper begins to address this challenge by developing a tailored suite of design process performance metrics. Some basic guidelines from the academic literature and the results of a practitioner survey inform the selection of metrics. We go on to apply the metrics to real-world projects within companies that are trialling technology-supported co-creation sessions. The metrics and the insights into their development and application are likely to prove useful to other design researchers and practitioners that wish to evaluate the benefits of adopting co-design activities as part of a design-led innovation approach.

Keywords: Metrics, Design process, Co-creation, Co-design, Augmented Reality

Introduction

An increasing number of companies are experimenting with 'designerly ways of innovating', adopting approaches and practices from 'design thinking' (Brown, 2008) to improve the agility, speed and hit rate of their innovation activities. One of the core principles of design thinking is to test ideas, gather data to evaluate what works and then reject what is not working and retain that which does work. But how can design practitioners evaluate what innovation methods work and do not work for their organisation? Whilst there is extensive academic literature on metrics that can be used to evaluate the performance of innovation activities and the design process, they have rarely been applied by organisations that are testing a design-led innovation approach. This may be due to the fact that many of the proposed metrics require significant data gathering activities and analysis to apply. This paper therefore sets out to establish a set of design process performance metrics that can be quickly and efficiently applied by organisations that are experimenting with design-led innovation approaches.

The motivation for this work comes from the SPARK project, a three-year, collaborative research project supported by the EU's Horizon 2020 research programme that is investigating the potential for using augmented reality technologies to support co-creation in product and packaging design. The industrial partners of the project have been experimenting with the 'Spatial Augmented Reality' (SAR) technology

developed within the project, which enables a physical 3D prototype to be enhanced with a digital overlay to show various features of a concept. For packaging design, such features can include logos, labels, product images, and other graphics. For product design, features such as buttons, displays, speakers, and lights can be represented - see Figure 1.

Figure 1: Examples of SAR prototypes used for packaging design (left) and product design (right).

There are several potential benefits of using SAR technology as a means of creating prototypes for co-creative design sessions. First, the prototype retains its tangibility, which can help to avoid misinterpretation of concepts by participants. Secondly, it provides the ability to represent multiple concepts on one physical prototype, thereby reducing prototyping costs. Finally, it offers the ability to make on-the-fly changes to the prototype during the session.

Whilst initial experiments SAR technology within co-creation sessions have demonstrated some benefits - such as improved idea generation and idea filtering - the impact on the overall performance on the design process has not been assessed. The SPARK project needed a set of metrics that could be used by the industrial partners to evaluate the benefits of SAR-enabled co-creation sessions. Beyond the specific interests of the SPARK project, there have been calls for more studies of 'real-world' co-creation and its outcomes as well as studies that help to measure the costs associated with customer co-creation (Gemser & Perks, 2015).

This paper attempts to address this challenge by first developing a suite of metrics for evaluating the impact on design process performance of co-design activities. This is done through a survey of design practitioners that asked about their use of design process performance metrics. We go on to apply the metrics to real world design projects with the objective of demonstrating the practical feasibility and value of applying design process performance metrics when experimenting with design-led innovation approaches.

Literature review

In the following section the academic literature on the development and application of design process performance metrics is discussed.

Metrics of design process performance

Within the design process, performance metrics are typically used to measure the effectiveness of the design activities (i.e. how well objectives are being achieved) and their efficiency (i.e. how well resources are being used) (O'Donnell & Duffy, 2002). The types of metrics used by an organisation vary depending on its operations, goals and objectives and the choice of metrics should be linked to quantifiable objectives and performance standards (Beaumont, 1996; Neely et al., 1997; Siemens, 2009).

Design process metrics focus either on a single business function or the entire process. However, no one business function is the sole contributor to the design process (Bhuiyan, 2011). For example, a performance metric that measures the productivity of an R&D department might show constant improvement, but that

does not necessarily mean that there will be an improvement in the rate at which new products reach the market (Meltzer, 2002).

The scope of application of design process performance metrics is important to consider. Bhuiyan, (2011) states that it is important to measure the performance of the stages of design process in an interdependent fashion. Similarly, Cedergren, Wall and Norstrom (2010) suggest that there is a need to extend the perception of performance into a more holistic system perspective before there can be any real improvement to the performance measurement system.

There exist many metrics of design process performance. Applying too many metrics can result in a complex measurement system, engendering confusion rather than clarity. Conversely, Griffin (1993) warns against overly limiting the choice of metrics to measure single issue, such as lead time, is unlikely to be beneficial as "producing product flops faster than the firm did before will not help you stay in business" (p. 113).

Other difficulties in measuring design process performance arise from: the less tangible nature of some outputs from design activities (such as knowledge); the long duration and wide range of influences from design to market launch; or the difficulty in defining and measuring design quality (O'Donnell & Duffy, 2002).

There have been a number of guidelines proposed that aid in the development of performance measurement systems (Beaumont, 1996; Neely et al., 1997; Siemens, 2009). While the specifics of these guidelines differ, the steps to the various approaches can be summarised and categorised as follows:

2. Define intervention (if applicable)
3. Define the scope of the design process or design activity to be analysed
4. Outline purpose/objectives
5. Define success factors
6. Turn objectives and success factors into metrics to be measured
7. Create a measurement plan

When developing metrics for the measurement plan (step 6), it is important that the metrics are accurate, informative and objective. Tatikonda (2008) posits that a metric is characterized by the combination of four aspects: its managerial purpose, object of interest, measurement forms and linkages with other metrics. Additionally, it is important not to focus on what is easily measurable instead of what is important to measure (Beaumont, 1996).

When evaluating the performance of a design process, is it important to either develop or use existing metrics that relate to the purpose of measurement. Sometimes existing metrics are appropriate and other times new ones should be developed and while some metrics can be predetermined and developed in advance, in other cases they emerge during the evaluation (Acosta, Araújo & Trabassos, 2002). Using an existing indicator or measure can have the advantage of producing robust data which can be compared to other studies, as long as it is appropriate.

Table 1 summarises the design process performance metrics that were identified within the academic literature. The metrics are categorised in terms of their topic (product, process, or market and financial) and sub-topic.

Table 1: Design process performance metrics identified from academic literature.

Topic	*Sub-topic*	*Metric*	*Source*
Product	Technical Performance	Depends on the product	(Mallick and Schroeder, 2009; Griffin and Page, 1993; Hannachi, 2015; Siemens, 2009)
	Cost	Unit cost of production	(Mallick and Schroeder, 2009; Primo and Amundson, 2002; Siemens, 2009)
	Quality	Quality of primary product performance characteristics	(Primo and Amundson, 2002)
		Quality of secondary options or features	(Primo and Amundson, 2002)
		Reliability of the product	(Primo and Amundson, 2002)

		Conformance to established standards	(Primo and Amundson, 2002)
		Durability	(Primo and Amundson, 2002)
		Serviceability	(Primo and Amundson, 2002)
		Aesthetics	(Primo and Amundson, 2002)
		Overall product quality perceived by customers	(Primo and Amundson, 2002; Hannachi, 2015)
		Met quality guidelines	(Hannachi, 2015; Griffin and Page, 1993)
Process	Cost	Projected R&D budget	(Primo and Amundson, 2002; Hannachi, 2015)
		Development cost	(Griffin and Page, 1993; Siemens, 2009)
		Production cost	(Mallick and Schroeder, 2009; Siemens, 2009)
		Project speed/ Project completion time	(Primo and Amundson, 2002; Terwiesch and Loch, 1999; Siemens, 2009)
	Time	Time between milestones	(Terwiesch and Loch, 1999)
		Percentage milestone dates met	(Siemens, 2009)
		Development time utilization	(Mallick and Schroeder, 2009)
		Time-to-market	(Primo and Amundson, 2002; Mallick and Schroeder, 2009; Griffin and Page, 1993; Siemens, 2009)
		Launched on time	(Griffin and Page, 1993; Siemens, 2009)
	Effort	Frequency of redesign	(Terwiesch and Loch, 1999)
		Number of design iterations	(Terwiesch and Loch, 1999; Siemens, 2009)
		Labour hours	(Siemens, 2009)
		R&D resource utilization	(Mallick and Schroeder, 2009)
Market and financial		Market share goals achieved	(Mallick and Schroeder, 2009; Griffin and Page, 1993; Hannachi, 2015; Siemens, 2009)
		Profitability/revenue goals achieved	(Mallick and Schroeder, 2009; Griffin and Page, 1993; Hannachi, 2015; Siemens, 2009)
		Overall commercial success	(Mallick and Schroeder, 2009)
		Return on Investment	(Mallick and Schroeder, 2009; Griffin and Page, 1993; Hannachi, 2015)
		Revenue growth	(Griffin and Page, 1993)
		Break even time	(Griffin and Page, 1993; Siemens, 2009)
		Customer acceptance	(Hannachi, 2015; Griffin and Page, 1993)
		Customer satisfaction	(Hannachi, 2015; Griffin and Page, 1993)

Development of the design process performance metrics

The development of the design process performance metrics was informed by the six generic steps previously identified from the academic literature.

Define intervention - In this case, the intervention was the introduction of SAR-enabled co-creation sessions.

Define the scope of the design process or design activity to be analysed - This was not known in advance, but it was initially assumed that the scope would cover the entire design process.

Outline purpose/objectives - The objective was to compare the evaluate the benefits, if any, of conducting SAR-enabled co-creation sessions.

Define success factors - At this stage it was not evident what potential adopters of the SAR technology would consider to be 'success'. Whilst it was possible to discuss success factors with the industry partners of the SPARK project, it was considered necessary to obtain input from a much wider range of organisations to maximise the potential impact of the SAR technology being developed within the project. In order to obtain this input, it was decided to conduct a survey of design practitioners regarding their use of design process performance metrics - further details of this survey a provided in the following section.

Turn objectives and success factors into metrics to be measured – From the perspective of the SPARK project it was expected that conducting SAR-enabled co-creation sessions would lead to reductions in prototyping costs (as multiple concepts can be projected on to one physical prototype), the number of design iterations (as client feedback could be implemented and reviewed live during the session) and overall design effort (as consequence of the first two improvements). The definition of the metrics was informed by the results from the practitioner survey and is discussed further in the 'Selection of the metrics for application' section.

Create a measurement plan – An initial measurement plan was defined alongside the selection of the metrics to apply and was subsequently refined once the case study project had been identified. This involved adjusting the metrics to better suit the context of the case study project.

Methodology for the practitioner survey

The survey featured two initial questions about the type of organization and industry of the respondent and the importance of design process performance metrics within their organization. Respondents that gave the response 'Not important - we do not use design process performance metrics', were directed to the end of the survey. The remaining respondents were then asked: 'Which of the following design process performance metrics do you encounter in your role?' and were presented with a list of 18 metrics plus options for 'Other' and 'None of the above'. The list of metrics was based the list presented in Table 1 but was reduced from 32 metrics down to 18 to reduce the number of very similar metrics and make the survey quicker to complete (with the aim of increasing the response rate).

The survey was distributed via an email list that included 6000+ designers and engineers from mainly EU-based companies and through design-related networks on social media.

Results of practitioner survey on design process performance metrics

79 survey responses were received. Of these, 21 stated that design process performance metrics are 'very important' within their organization, 28 stated that they are 'moderately important', whilst 30 stated that they did not employ design process performance metrics within their organization.

Concerning the usage of metrics, Figure 2 shows the percentage of respondents that had seen each of the metrics in use in their organisation (n=44). Also shown in Figure 2 is the weighted importance of each of the metrics (n=44). This was calculated by asking the respondents to place the metrics they had selected in the previous question into rank order of importance. A weighting factor was then applied in which the top ranked metric was given a score of 20 (as there were a maximum of 20 possible responses), the second ranked metric was scored as 19, and so on until the respondent had ranked all the metrics they had encountered. The total score for each metric is presented in Figure 2 as a percentage of the sum of all scores.

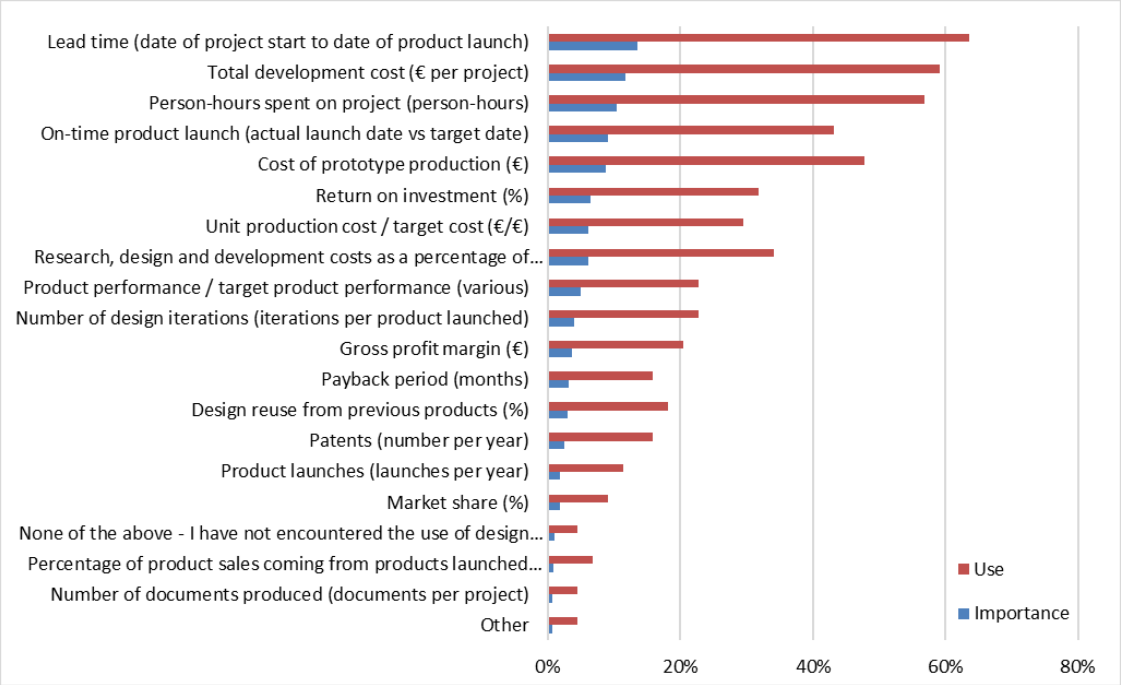

Figure 2: Practitioner survey results showing the extent of use and relative importance of design process performance metrics.

Figure 2 shows the metrics ordered from top to bottom by the weighted importance. A very similar order is obtained if ordered by usage, with the top three most widely used and the most important metrics being: lead time, total development cost, and person-hours spent on the project. The 'Other' category accounted for less than 1% of all response, suggesting that the pre-selected list of metrics was sufficiently comprehensive and complete to capture the vast majority of metrics that are currently in use within the organisations represented.

Selection of the metrics for application

The selection of the metrics for application in the case studies was based on the objectives of the study (i.e. to evaluate the benefits of conducting SAR-enabled co-creation sessions), the success factors (i.e. reductions in prototyping costs, design iteration and design effort were expected), the results of the design practitioner survey, as well as some further practical considerations.

Based on the objectives and the success factors, the 'cost of prototype production', 'number of design iterations', and 'person-hours spent on the project' metrics were prioritised for implementation. Note that the iterations metric was rephrased as 'number of re-work iterations' to clarify that the focus was on reducing the amount of unproductive and repetitive design activities as some amount of 'design iteration' is often linked to positive outcomes in design projects.

From the practitioner survey results, it was clear that 'lead time' and 'total development cost' were both widely used and important metrics and so these were also prioritised for implementation.

In terms of practical considerations, it was not possible to evaluate any of the 'market and financial' metrics from Table 1 as the data required to apply these metrics, such as sales revenue and profit margin, would not be available for many months or even years after the completion of the project. The final practical consideration was the time and effort required to apply the metrics. This led to a self-imposed limit of five metrics. Based on these considerations, Table 2 shows the design process performance metrics that were selected for application along with the initial measurement plan (i.e. expected data sources).

Table 2: Design process performance metrics selected for application.

Metric	*Definition*	*Data sources*
Person-hours spent on project	All hours spent on project by design agency (including unbilled hours)	Time sheets
Lead time	Number of days between project start date and product launch date	Company project records
Total development cost	Direct costs incurred by design agency	Company financial records
Cost of prototype production	Cost of preparing all design representations used in collaborative sessions (materials and labour)	Time sheets Company financial records
Number of design iterations	Total number of failed attempts to pass a stage gate	Self-reported by design team

Example application of the metrics to novel co-creative practices

The main aims of this study were to validate the practical applicability of the design process performance metrics and go on to compare the performance of design projects conducted with and without the use of technology-supported co-creation sessions. This study was completed in collaboration with Artefice, a medium-sized brand and packaging design agency based in Italy.

Methodology for the application of the design process performance metrics

The first step was to find one of Artefice's clients that would be willing to participate in co-creative design sessions as part of a real project. The client identified was a large Italian company that produces a wide variety of food products. The client is referred to as 'Food Inc.' in this paper to maintain the anonymity of the company and the personnel involved.

It was then necessary to identify some projects that had previously been completed by Artefice with Food Inc. that had been completed without the use of technology-supported co-creative sessions. The objective was to apply the design process performance metrics to these projects in order to have some benchmark data for the subsequent comparisons with projects that had involved technology-supported co-creative sessions.

Three suitable projects were identified as being representative, in terms of their scope and complexity, of the projects completed by Artefice for Food Inc. The projects were:

- Packaging for frozen pizza, two varieties.
- Packaging for yoghurt, five flavours, two pack sizes.
- Packaging for soup, four flavours.

The next step was to apply the metrics to the selected project. However, a number of challenges for the application of the metrics were identified that required some modifications to the definitions of the metrics.

The 'lead time' metric had been defined as the number of days between project start date and product launch date. Artefice noted that further consideration was required in defining the start and end points of the project in order to ensure a fair comparison between projects. They explained that their design process model covers five main stages: Brief, Analysis, Strategy, Creativity and Output. A common brand strategy had already been developed in a previous project and so these projects had begun at the 'Creativity' phase – see Figure 3.

Figure 3: Artefice's design process model, with scope of metrics application shown in the box.

More importantly, they noted that the duration of the 'Output' phase could vary significantly because the final preparation of the artwork for printing relied on receiving information from the client (such as the nutritional label data) and the manufacturer (print specifications) and was largely beyond the control of Artefice. For this reason, it was decided to omit the Output phase from the comparison and focus the scope of the application of the metrics on the Creativity phase.

Within the Creativity phase there are two stages, 'Ideas Production' and 'Ideas Development'. Ideas Production involves the Artefice design team proposing three to five alternative concepts that are consistent with the brand strategy. When working with Food Inc., the normal practice is that these concepts are sent to the client in the form of a Powerpoint presentation delivered by email. The client reviews the concepts through an internal meeting and then provides written or verbal feedback to the Artefice project manager. Based on the client feedback, some concepts may be filtered out, whilst others might be refined or merged with other concepts to create new variants. From this description of the typical working practices, it was not clear how the 're-work iterations' metric could be applied. It had originally been envisaged that the design team would be able to self-report the number of failed attempts to pass a stage gate in the design process but it seemed defining a 'failed attempt' would prove to be very subjective, as had previously been discussed in the academic literature (Wynn, Eckert & Clarkson, 2007). Hence, alternative ways of defining the re-work iterations metric were explored. Ultimately it was decided to focus on the number of versions released to the client, either by email or within co-creative design sessions. This was less subjective as part of Artefice's quality and data management policy was to retain digital copies of each version of work released to the client. It was therefore a simple task to review these records and count the number of versions.

The final challenge concerned the 'cost of prototype production' metric. The majority of the 'prototypes' shared with the client during the benchmark projects were digital files (2D layouts or 3D renders) shared by email. This meant that there were no materials costs for prototype production. There were some labour costs, which included the time required from 3D design specialists from within Artefice to produce the 3D renders as well as a small amount of time required from the graphic designers to export the artwork from their design packages into a Powerpoint presentation and add some annotations. The latter was estimated by the Artefice Art Director as requiring 15% of the designers' time on the project on average. The updated definitions of the metrics are presented in Table 3.

The revised metrics were applied to the three benchmark projects. The relevant data for each of the projects was gathered and collated by the Operations Manager from Artefice working with members of the research team. Where clarifications were required, the designers who had worked on the project were consulted.

The final step involved monitoring a new project with Food Inc. concerning the design of packaging for two varieties of a new fresh pizza product. A co-creative session was organised involving two representatives from the marketing department of Food Inc. working with the Creative Director, a Designer and the Account Manager from Artefice. The session made use of a SAR-based prototype to present a range of alternative concepts – see Figure 4.

The client representatives provided feedback on the concepts and then a number of new concepts were generated by using the touchscreen interface and the SAR prototype to modify some of the initial concepts presented.

It had initially been assumed that two or three of these co-creative design sessions would be necessary over the course of the project. In fact, according to the Artefice design team, the outputs of the session were sufficiently good that only minor refinements were necessary during the follow-up design work and the client agreed on the final concept shortly after. Hence, only one co-creative design session was held.

Once the project was complete the design process performance metrics were applied in the same way as had been done for the benchmark projects. A comparison was made between the frozen pizza project and the fresh pizza project due to the very good similarity in the content and scope of the projects e.g. very similar product, two flavour varieties for each project, same starting point and end point. The results of the metrics

application for the benchmark projects and the comparison with the fresh pizza project are presented in the following section.

Figure 4: Co-creative design session making use of a SAR-based prototype.

Results of the application of the design process performance metrics

Table 3 shows the results of the design process performance metrics for the benchmark projects and the for the fresh pizza project, which included SAR-enabled co-creative design sessions. The total development costs and cost of prototype production have been normalized, taking the costs for the frozen pizza project as the reference and setting them equal to 100. The costs for the other projects were then scaled accordingly. This was necessary due to the commercial sensitivity of the data.

Table 3: Results of the design process performance metrics for the Artefice projects.

Metric	*Definition*	*Soup*	*Yoghurt*	*Frozen pizza*	*Fresh pizza*
Person-hours spent on project	All hours spent on project by company (including unbilled hours)	98	166	58	39
Lead time	Number of days between project start date and product launch date	124	114	100	21
Total development cost	Direct costs incurred by company	180	253	100	23
Cost of prototype production	Cost of preparing all design representations used with client	191	300	100	147
Number of design iterations	Number of versions released up to end of creative phase	13	21	8	4

The first point to note is that the application of the metrics only required about 3 person-hours to apply to each project (about two person-days in total). This confirms that the metrics do not require excessive effort to apply and that they can provide timely feedback to the design team. The speed of metric application was helped by the fact that, like most design agencies, Artefice invoice clients based on the actual time and resource spent on a project and so have good processes in place for recording labour and direct costs.

In terms of the impact of the SAR-enabled co-creative sessions, it can be seen from comparing the results of the frozen pizza and fresh pizza projects that the fresh pizza project showed significant improvements in terms of the person-hours spent on the project (33% reduction), the lead time (79% reduction), total development

cost (20% reduction) and re-work iterations (50% reduction). Only the cost of prototype production showed a negative trend (47% increase). This was attributed to the additional time required to prepare the digital assets and model for the SAR prototype used in the co-creation session. Clearly, this extra effort in prototype production is worth investing in if it leads to 33% reduction in person-hours on the project.

These results were presented to the Artefice design team and relevant managers a short time after the completion of the fresh pizza project. Artefice were impressed by the design process performance gains that were achieved through the use of the SAR-enabled co-creation sessions. These results contributed to Artefice deciding to expand the use of technology-enabled co-creative design sessions within their design process.

Conclusions

This paper began by highlighting that, whilst there are a wide variety of approaches, tools and technologies that claim to facilitate co-creative design practices, their impact on the overall design process has seldom been analysed through real-world application of performance metrics. The primary contribution of this paper is that it has demonstrated that it is possible to develop a suite of metrics to assess design process performance that can easily be applied by practitioners to evaluate the benefits of adopting new design-led innovation approaches.

The experience of applying design process metrics to real-world cases has generated (or reinforced) a number of insights that may be helpful for design practitioners and researchers. First, deciding which metrics to apply will depend on a number of factors:

The main purpose of applying the metrics (Beaumont, 1996; Neely et al., 1997; Siemens, 2009) - For example, in this study the main purpose was to evaluate the impact of conducting technology-enabled co-creative design sessions. This led us to include metrics concerning prototyping costs and re-work iterations as metrics that were very relevant for this topic.

The audience for the results - As designers were the main audience for this study, the focus was kept on metrics that could provide timely feedback about the efficiency gains that could be obtained from conducting technology-enabled co-creative design sessions. If the audience is senior executives, it may be more important to present metrics related to the market success of the product even if that means waiting longer to gather the market data to feed such metrics.

The availability of data within the company – This is important as it will help to ensure that the metrics can be applied with minimal additional effort. It is very useful to see what types of design records are kept (in terms of time sheets and project expenses accounting etc.) and the level of granularity of those records as this will help to avoid defining metrics that require changes to the record keeping practices within the company. However, this goes against the recommendation of Beaumont (1996), who suggests that metrics should be selected based on what is important to measure rather than what is easy to measure.

Another insight is that it is important to carefully consider how to define the start and end points of the project to ensure a fair comparison. This will depend on the main purpose for applying the metrics but should also take into account the nature of the design process and the normal ways of working at the company. Companies that have formally defined stage gate processes may be more conducive to metric application than those with more fluid, informal design processes.

A secondary contribution of this paper is that it provides some initial data concerning the impact of SAR-enabled co-creation sessions on design process performance. The findings suggest that conducting this type of session can lead to significant improvements in design process performance in terms of: person-hours spent on the project, lead time, total development costs and the number of re-work iterations. Further studies are required to further validate these initial findings and the metrics could be proposed for studies of other types of technology enhanced sessions.

The main limitation of this paper is that the proposed design performance metrics do not take into account any factors concerning the market success of the resultant products. Evaluating metrics related to market and financial success is clearly possible as they are widely mentioned in the academic literature (see Table 1) and several of these factors appeared in the results of the practitioner survey (e.g. 32% of respondents had encountered the use of Return on Investment as a design process performance metric). However, from a designers' perspective, the practical value of such metrics might be limited as there is often a significant time delay between the end of the main design activities and the point at which meaningful market success

feedback can be obtained (in the order of many months or even years). From a design managers' or senior executives' perspective market success metrics are still likely to be useful when evaluating the success of the product strategy and overall business strategy. This highlights that design process performance metrics need to be selected taking into consideration the intended audience and purpose.

In summary, we have shown that, by following some basic guidelines, it is possible to develop a suite of metrics that can be applied quickly, using data that is readily available within most organisations and that the results can be used to provide meaningful and timely feedback to the design team. This approach could therefore prove useful to other design researchers and practitioners that wish to evaluate the benefits of adopting design-led innovation approach.

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Research Perspectives IN THE ERA OF Transformations

The 3rd Dimension of Innovation Processes

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Architects understand and visualize organizations and processes differently from their counterparts in management disciplines. With the increasing complexities of markets and blurring of organizational boundaries, linear models of innovation processes are unable to account for the range of possible interrelations and interdependencies. Design-led disciplines have become of interest in providing frames and 'design' structures for fostering innovation. Though it deals specifically with the conceptualization and realization of R&D and innovation centres, architecture has been largely overlooked in this regard. This paper explains how architects' approach to reframing complexities, focussing on social interactions and shaping invisible patterns prior to building design offers new perspectives for innovation research. It critically reviews the changing context of innovation and relational models in the literature, and outlines the relevance of integrating spatial proximities and time for a constructive 3-dimensional representation. Via two case studies, the basic principles for the development of an integrative approach are sketched out and suggestions made for further research. The specific skill-set and thinking of architects offers a 3rd dimension of innovation processes.

Keywords: innovation process, innovation architecture, design, 3rd dimension, spatial proximities

Leaving the Plan

Architects understand and visualize organizations and processes differently from their counterparts in management disciplines. While management focus on the performance and competitiveness of the company, architects use their analyses and depictions for the purpose of building design (Boland & Collopy, 2004; Schürer & Brandner, 2004; Martin, 2013). They seek to understand the interrelations and interdependencies of processes and workflows, align them to requirements of physical areas and technical equipment, and synthesize a new whole bringing the different and conflicting parts together under one theme (Lawson, 2005; Nelson & Stoltermann, 2012). Especially when assigned to research & development projects (R&D), e.g. the design of a new innovation center, architects seek to map existing workflow patterns and to integrate the new requirements given by the client. Architects can challenge the given demands and create together with client and user an alternative conception of how the organization will work, produce and innovate in the future (Schürer & Brandner, 2004; Shamiyeh, 2007). This systemic architectural approach, prior to the design of a building, has the potential to create new perspectives on the company's processes, to visualize what was previously invisible and transform it into new ways of working and innovating. Given the increasing complexity in markets, products and services and the growing need for dynamic forms of collaboration and co-operation across departmental and organizational structures, an architectural approach can provide an fresh understanding of today's and future innovation processes (Boland & Collopy, 2004; Shamiyeh, 2007; Burke & Tierney, 2007; Hidalgo & Albors, 2008; Laloux, 2014). Architecture, as first hypothesis in this paper offers a 3rd

dimension to innovation processes, which leads to future-proof organizational designs. This perspective has so far been obscured by its focus on physical results, and thus inaccessible to both architects and managers.

Management, on the other hand, has started to change its view on innovation and innovation processes by approaching creative fields (Boland & Collopy, 2004; Buchanan, 2008; Martin, 2013). While in the second half of the past century innovation progress was pursued by quality improvement, process optimization and efficiency increase to serve consumer needs, the strong one-directional push altered in the 1980s (Martin, 2009; Trott, 2012). Existing managerial methods, models and tools have become less applicable in coping with complex environments, demands and the transition into a post-industrial era of services, networks and platforms driven by the advances in information technology (Boland & Collopy, 2004; Chesbrough, 2005; Burgelmann, Christensen & Wheelwright, 2009; Trott, 2012). Developed in stable circumstances, linear ways of thinking as well as the focus on decision making as choosing between existing alternatives - instead of the creative generation of entirely new options - have struggled with pivoting strategies for companies and in imagining future markets (Boland & Collopy, 2004; Christensen, 2016). With the growing importance of innovation for remaining competitive, management have turned to design disciplines, which have had to tackle similar problems of complexity and wickedness, but dealt with them in a different, creative and non-linear way (Buchanan, 1992; Rith & Dubberly, 2006; Martin, 2009). Design thinking has thus begun to receive wider attention as means to support creativity, collaboration and to be suitable in dealing with complex challenges. It became integrated in companies as a structured innovation, creativity and collaboration method (Carlgren, 2013; van der Pijl, Lokitz & Solomon, 2016). Interdisciplinary teams, face-to-face interaction, equal participation of team members, valuing ideas of any kind, forward oriented action using a broad set of tried and tested tools, and continuous visual communication to create a common understanding are vital for the process' success (Brown, 2008; van der Pijl et al., 2016; Lewrick, Link, Leifer & Langensand, 2017). By outlining prototyping and the focus on user and markets, the design thinking method tests ideas and concepts and iterates them until a promising solution is reached or agreed upon (ibid.). Though it emphasizes collaboration, it does not explain how and where innovation occurs for an entire organization. After years of intense implementation in management challenges across industries, the method in its structured form and emphasis to specific tools is facing criticism for not developing radical new ideas for the market and society (Keeley, Pikkel, Quinn & Walters, 2013; Verganti, 2017).

Innovation as a social process depends on the interaction, the understanding, perception and acting of people (Fagerberg, Mowery & Nelson, 2005; Fichter, 2014; Godin, 2017). Despite current distance-shrinking technologies and advances in digitization, face-to-face communication still is of the highest importance for successful teams and employees (Waber, Magnolfi & Lindsay, 2014). The engagement of a team is equally important for its success in creating something new, as is the exploration, i.e. moving outside the group for contrarian views and inspirational thoughts (Pentland, 2015). Awareness for social interaction has risen in recent years (Groves & Marlow, 2016). Despite the research on the correlation of direct social interaction with creativity and innovation, management disciplines have hardly integrated human or social factors in organizational approaches or models of innovation. Management, as second hypothesis put forward in this paper, has to leave its two-dimensional understanding as descriptive plan or graph over time and consider the complexity, simultaneity and parallelism of social interactions between involved people in space for sustainable innovation processes.

The paper is an excerpt of a currently running doctoral project on the architecture and design of innovation processes applying the thinking and tools of architects. Firstly, the changing context of innovation and their processes to express the need for alternative approaches is explained. This 1st dimension of innovation, retrieved from the text and literature review, is followed by an outline of the 2nd dimension: the management of innovation over time, based on linear descriptive and normative models. The 3rd dimension of innovation turns its view to an alternative conception of architecture beyond building design. The characteristics of architectural thinking are described in their applicability to innovation research and management. To underpin the approach, two case studies from architecture are presented, which deal with the analysis and creation of innovation processes for small-and-medium-sized engineering companies in Germany. The paper closes with an outlook on the next steps of research within the doctoral project.

The 1st Dimension - Describing the Changing Context of Innovation as Text

Literature on innovation has grown significantly in the past two decades (Chesbrough, van Haverbeke & West, 2014; Goffin & Mitchell, 2017). With the ongoing technological advances and growing digitization, new

business models have appeared, new forms of organization have evolved, and new approaches to innovation have been developed (Chesbrough et al., 2014). As the capability and potentials to innovate have become core to a company's competitiveness, the interest in how to innovate faster, more radically or disruptively has risen across industries (Chesbrough et al., 2014; Christensen, 2016). With the creative turn of management towards design thinking, agile methods and open frameworks have become more widely used (Martin 2009, 2013). Alternative definitions of innovation are leaving the industry-bound context of technological innovation with its reliance on quantifiable and trackable improvements (Keeley et al. 2013). Design manuals, playbooks and toolboxes are published to guide companies into becoming open, agile, adaptive and resilient (Keeley et al., 2013; Uebernickel, Brenner, Pukall, Naef & Schindlholzer, 2015; Lewrick et al., 2016). Though the recent publications for practitioners use graphical elements, diagrams and pictures for formulation and explanation, the greater part is text-based (ibid.). The changing context in which innovation happens is described in verbal analyses, case study descriptions, lists of insights or principles of action (ibid.; Hidalgo & Albors, 2008). Among the multiple aspects innovation has to deal with, three are currently receiving much attention, which the same time relates to the field of architecture, and are relevant for the above-stated hypothesis.

Innovation deals with current and future forms of complexities, what has to be captured, challenged and reframed: the complexity of the environment, the complexity of the problem formulation, and the complexity of the process itself (Rith & Dubberly, 2006; Martin, 2009). Through all these levels, dealing with complexity implies actively working with and accepting uncertainty, in order to observe, understand, interpret the specific characteristics of innovation tasks as open, wicked problems, and to acknowledge that in future the solution to a task will be less scalable for market penetration (Conklin, 2006; Prahalad & Krishnan, 2008; Martin, 2009; KPMG, 2011). Prototypes may become the final state of a product, which means that innovation will lose scalability and diffusion as an element of its definition (ibid.). Complexity theory besides being a field of research in its own right seems to "fight complexity with complexity" as Senge puts it, questioning existing analytic tools, thereby forecasting techniques and strategic plans in their applicability to dynamic complexities (Senge, 2006, p. 72). In his view, analysing, modelling and forecasting detailed complexity prevents us "seeing patterns and major interrelationships" for the creation of "dramatic breakthroughs in managing a business" and requires the fifth discipline of systems thinking (ibid., pp. 71-72.). Simon et al. (1986) point in a similar direction by valuing alternative tools – absent from linear management thinking – to cope with complex problems in business:

> *"Most corporate strategy problems and governmental policy problems are at least as ill structured as problems of architectural or engineering design. The tools now being forged for aiding architectural design will provide a basis for building tools that can aid in formulating, assessing, and monitoring public energy or environmental policies, or in guiding corporate product and investment strategies." (Simon et al., 1986, p. 29)*

Secondly, for innovation, social interaction is becoming the focal point on multiple levels and scales, as who interacts with whom matters (Lundberg, Sutherland, Blazek, Habicht & Penzenstadler, 2014; Groves & Marlow, 2016; Sørensen & Mattsson, 2016). The inner workings of a novel idea coming into existence depends on the behaviour of various people interacting with each other, their involvement, engagement, and labour. They exchange thoughts and tacit knowledge, they contribute to or are part of the development of an invention and its implementation (Fagerberg et al., 2005; Nasiri, Alleyne, Yihui & Nisar, 2016). An organization relies on its organizational structure, culture and the capacity and skills of its employees and networks to innovate (Chesbrough, 2006; Laloux, 2014). Social interactions which drive innovation are characterized by creativity at individual, team, and organizational level (Mumford, Hester & Robledo, 2012). The people involved share a deep understanding or empathy for complex processes, systems, and meanings; they evaluate and interpret, immerse themselves in requirements and needs to imagine preferred states which ought to be (Verganti, 2009; Nelson & Stolterman, 2012; Fichter, 2014). They show proximity in collaboration and co-creation, spatially and relationally, for the exchange of ideas and their further progress (Waber et al., 2014; Groves & Marlow, 2016). The importance of who is interacting and when needs to be linked to the dimension of where – in both the physical and virtual realms. When dealing with innovation, it is becoming important to consider how people act creatively, empathically and relationally as well as in spatial proximity to each other, regardless of their function or departmental belonging (Fichter, 2014; Groves & Marlow, 2016).

Thirdly, to foster innovation, the activity is shifting from process management to process design (Verganti, 2009; Martin, 2009; Lockwood & Papke, 2018). Designing a process implies a synthesizing approach, where different elements and often conflicting parts are integrated into a new whole (Nelson & Stolterman, 2012). It requires to think of organizations, their people and physical assets as a system where the parts interact with

each other. Design does not simply turn existing situations into preferred ones; it adds meaning and purpose to the new whole, which is then accessible to the people within (Simon, 1996; Verganti, 2009, Nelson & Stolterman, 2012). It escapes the linearity of process and allows for simultaneity and real-time interaction on multiple levels. Innovation processes designed as systems show an emergent property allowing ideas to evolve into innovations over time beyond a project schedule (Allen & Henn, 2007; Groves & Marlow, 2016). The awareness of process and emergence can be achieved by being visual and comprehensible, and connecting the involved, interested or unrelated actors by depicting their location and proximity spatially in a model (Allen & Henn, 2007; Lockwood & Papke, 2018). Design aims for changes in behaviour and the appropriate design of an innovation process may lead to or foster innovative behaviour (Buchanan, 2015). A systemic view of the process design helps becoming aware of the complexities and considering the dimension of time and emergence in an iterative way. It needs to be visual for awareness, communication, and engagement (Fichter, 2014; de Mozota, 2013).

Figure 1: Changing context for innovation processes: dealing with complexity, focusing on social interactions and designing processes. Author's own representation.

The 2nd Dimension - Management of Innovation over Time

Innovation research and management focus on the characteristics of innovation, which are different from business operation. Innovation research explains how innovations occur and what the drivers are, while innovation management provides the framework to manage and foster the processes (Fagerberg et al., 2005; Hauschildt, Salomo, Schultz & Kock, 2016). While it is an interdisciplinary field integrating perspectives and approaches from other areas as sociology and psychology, management is the leading domain (Fagerberg et al., 2005; Burr, 2014; Godin, 2017). In its beginnings, research and development centres shaped an era of technology-push, bringing advances in sciences and technologies from the corporate side to the market (Godin, 2017). This phase described as first generation of management of innovation processes, linear and sequential; the second generation focused on market demands and developed innovations by a close analysis of needs; the third generation pursued a combination of the two paradigms as iterative model; innovation occurred by technology-push, from companies to demands, and by market-pull, from users to companies. In its current fourth generation, the management of innovation has opened towards "a network of partners designing an integrated innovation system" (van der Duin, Ortt & Aarts, 2014, p. 489). The shift from a closed innovation paradigm, characteristic of the preceding generations, towards an open innovation paradigm has altered the relation between companies and external actors (Chesbrough, 2005). The mind-set on innovative activities has shifted from a company centric view to a dynamic network view, where people, technologies and

ideas were sourced and aligned across and outside the company's boundaries. The open innovation paradigm changed the attitude towards internally developed ideas beyond the core scope of services or products.

Innovation management in German innovation research is defined as conscious design of an innovation system, consisting of the single processes and institutions in which these processes occur (Hauschildt et al., 2016). It requires an integrative approach of leadership, resources and diffusion, distinct from R&D Management, and favours a dynamic approach and culture, in which innovation teams are encouraged to proceed for radical innovations without specified or SMART goals, which tend to be inhibitors (Hauschildt et al., 2016).

Models of innovation have tried to explain the processes behind it. In the 1960s, models started to be used and were multiplied in subsequent decades (Godin, 2017). Analytical models put "a conceptualization or theorization […] into a schema, graph or diagram." (ibid., p. 2). The process models later evolved into system models, considering the whole and parts, relations, factors, and causes. Their basic function is of a rhetorical nature; itgives form to reality or a theory, acts transcursively, advertises a conception and pretends a scientificity with a synthesizing virtue, attractiveness, abstraction and promise of success (Godin, 2017, pp. 213-215). In his analysis of models of innovation, Godin (2017, p. 181) deduces their meanings: models are simplified conceptualization of reality, a narrative of sequence of events, a paradigmatic perspective or a graphical figure in the form of chart, diagram, scheme or cycle. In its fifth meaning as a tool, models of innovation are a theoretical structuring device or a practical guide to become pragmatic, decide, check, teach and highlight important points. In contrast to other disciplines, including architecture, the innovation model in innovation research "is not an instrument to explore, manipulate, and experiment with a theory, to stimulate the world and get better theories." (Godin, 2017, p. 208). Models are used in a prescriptive and descriptive way, instead of being constructive or prospective and so creating an alternative reality (Cross 2007a). The process models show a step, phase or stage thinking of a sequence over time; systems model thus display the structure of a process, than a conception of interacting parts (Godin, 2017).

Another classification of relevance for relating architecture to innovation research, groups models in voluntaristic, contextual and interactive models. Until the turn of the millennium the prevailing understanding of voluntaristic models emphasized the individual actor (e.g. persons, organizations, R&D departments) in a linear way; contextual models outlined innovation as responses to changed circumstances and markets depending on organisational structures and industry sectors (Fichter, 2014). With increasingly dynamic markets, growing collaboration and complexity, interactive models gained in importance. They focused on holistic-systemic, process and interactive points of view, where the non-linearity and non-directed creative dynamism of the innovation process could be explained more accurately (ibid.).

In a review of innovation process design methods, 63 different approaches were mapped and analysed according concept, inner structure, and applicability (vanPatter & Pastor, 2016). As findings, graphic depictions of models started in the 1950s, but are lacking a visual clarity in respect of time and duration of each of the executed step. Roles within a process are visually not indicated nor is the human factor. The process models are ordered in six groups: creative problem solving, design, product design, service design, organizational innovation and societal innovation (ibid.). They are text-based as principle steps in acting or graphically representing the phases to be undertaken. A third dimension showing the involved actors or institutions is not included. As mentioned, models in innovation research and management are directed to prescriptive, actionable steps and processes rather than explaining the inner workings of an organization as a whole. They do not design innovation processes in a constructive way oriented towards a future innovation system of self-organized interacting parts. Though social elements have been taken into consideration since the beginnings of innovation research, the models and principles applied in practice rarely entail a dynamic, emergent, or human element. "It would be more interesting if models could be dynamic. It will make them more human" (Larry Leifer quoted in de Mozota, 2013, p. 288).

The 3rd Dimension – Architecture of Innovation Processes in Space

The growing interest by management in creative approaches for innovation processes has been focussed on disciplines such as industrial design. Architects acting at the forefront of design thinking in the past century have remained mostly unnoticed by management studies (Rowe, 1987; Dorst, 2011; Shamiyeh, 2016). The work of Schön (1983), Cross (2007b, 2013), Lawson (2005) and Lawson and Dorst (2009) refer to a large extent to architectural ways of design thinking or observe architects as case group. It is important to focus on the special characteristics of architects, trained and practiced in synthesizing a new whole out of often conflicting

and contradicting parts (Lawson 2005, Lawson & Dorst, 2009). Architecture as a profession has been intensively linked to the rise and development of different industries (Nerdinger, 2012; Rumpfhuber, 2013). The diverse field of projects architects are involved in stand in close relation to areas of management and innovation. The design and planning of a research facility require an intense deal with the underlying, projected, or yet-to-be defined processes. This creative thinking and structured work conducted to understand, design, and realize new processes, which precede the planning, have been underestimated in their value for organizational challenges, and as yet barely discussed in the scientific literature (Shamiyeh, 2007; Awan, Schneider & Till, 2011, pp. 27; Samuel, 2018). To access architecture in its relevance for innovation research and management an alternative conception is framed in the doctoral project: firstly, architectural design thinking is applicable to structuring innovation along with other design thinking approaches; secondly, the architect-client interaction contains information on vision, processes, and requirements important for redesigning an entire organization and its innovation paths. Thirdly, the focus on buildings needs to be shifted to the focus on systems and system design (Koolhaas 2004; Hyde, 2013; Luebkeman 2015). The changing context in which innovation processes are embedded – i.e. rising complexity, relevance of social interactions, and the call for design – can also be traced in the thinking and work of architects and this entails the addition of a 3rd dimension.

Architects embrace complexity and reframe it to a workable degree (Venturi, 1992; Lawson, 2005; Noennig, 2006; Gänshirt, 2012; Bachman, 2012). They exclude and include information and iterate different points of view. With parallel lines of thought they alternate between paths until a new meaning and solution unfolds (Lawson, 2005). Architecture copes with complex surroundings without simplifying and withholds contradictions inherent in conflicting goals or the contrarian requirements of clients, stakeholders, and users (Noennig, 2006; Bachman, 2012). To create a coherent whole by integrating different aspects and requirements, architecture gives order and at the same time allows disorder (Lawson & Dorst, 2009). “Simplicity” in art and architecture “is at bottom complexity” (Pallasmaa, 2014, p. 40). “To present complexity in simple ways is the designer’s noblest aspiration” (Norman 2016, p. 174). In contrast to management disciplines, architects use a 3rd dimension to cope with complex structures, relations, and interdependencies, and consider qualitative as well as quantitative information. Social interactions of people are thought together with physical area requirements and technological equipment, the form of organization – its architecture and design – is the medium to communicate meaning (HENN & WITTENSTEIN, 2016). Though the physical is dominant in the conception of built architecture, the value lies in the (invisible) art of arrangement. Applied to innovation research, this approach to complexity offers a new approach to the innovation processes of a company, integrating different parts in a multi-dimensional way while making its complex structure comprehensible to the actors involved. Embracing complexity is one of the core pieces of advice in innovation management literature – something for which architects may be well prepared (Schoeneberg, 2014; Lewrick et al., 2016).

Relations have a spatial dimension for architects. The question of who interacts with whom about what is connected to the question of when and where. Architects develop a deep understanding of people, their interrelations and interactions, their pathways and movements, and depict their proximity spatially and relationally (Pallasmaa, 2016). Organizational systems understood by architects fundamentally differ from the organizational charts in management or innovation theory. The visual and non-linear thinking of architects combined with their specific use of models provide three-dimensional access to a problem, process, or organization. Architects add a 3rd dimension to setting, organizing and transforming relations and dependencies. They graphically externalize thoughts, ideas, and knowledge in order to start a communication between the sketch, diagram, drawing, or model and the practitioner themself or other involved parties (Gänshirt, 2012; Schubert, 2014). It is less a picture of a finished idea which appears than the process of formation of an idea using a tangible medium. It is “the demonstration of an idea as well as its advent” (Leatherbarrow, 2001, p. 91). This reflection-in-action process reveals new possibilities and options, which could not be detected or observed up-front, and underline the prospective mode architects work in to transform the existing and to imagine as well as to construct a future state (Schön 1983; Lawson, 2005; Boschung & Jachelmann, 2013). While innovation management works descriptively or prescriptively, formulating a process to follow, architecture creates a frame of possibilities for the entire organization, empathically confronting people with transformation. As futurists, they are inherently optimistic that a better state can be thought of, created, realized, and operationalized (Dator, 2016; Gänshirt, 2012). This visual and spatial construction may help to broaden the view of innovation design for a company as a whole with its human actors.

Making the invisible visible is central to architecture. The architects' ability for synthesis relates to the real (world) and seeks for application in the end. This means that architects use their developed frames of complexities and their understanding of social interactions to finally design a coherent new whole (Lawson, 2005; Nönnig, 2007; Nelson & Stolterman, 2012). They abstract, represent, integrate, relate, and synthesize continuously by sketching, diagramming, planning, modelling, and prototyping: the tools they use, are tools to think and to design (Lawson, 2005; Lawson & Dorst, 2009; Gänshirt, 2012). These tools are at the same time analytical and constructive. "The ability to design," Cross (2008, p. 9) points out, depends not only on the internal depiction of an idea in the individual's mind, but "even more on being able to make external visualizations." Besides sketching as primary tool, diagrams and models are important means for designing a system (Gänshirt, 2012; Boschung & Jachelmann, 2013). In a diagram, the holistic and systems thinking of architecture becomes visible: it depicts an organization as socio-technical system by combining functional aspects of areas and processes with people, flows, interactions, and relations while not determining its final form (Boschung & Jachelmann, 2013). Diagrams reveal 'a hidden or invisible reality,' information and relations (Hnilica, 2013, p. 243). In this philosophical realm, diagrams in architecture can contain a narrative and story: they merge quantitative and qualitative information without having to be scientifically correct and extrude a metaphor in a vertical direction (Boschung & Jachelmann, 2013). The diagram stands as a concept and 'template of possibilities' which does not necessarily anticipate the building design and offers in this state valuable perspectives on organizational structures (ibid.; Dortdivanlioglu, 2018). It is "architecture's best means to engage the complexity of the real" (Allen, 1998, p. 17). At this abstract, yet constructive level, the diagram can serve as general scheme or outline for activities at the overlap of the visible and invisible. To capture and design the fuzziness of innovation processes, this may be a valuable tool.

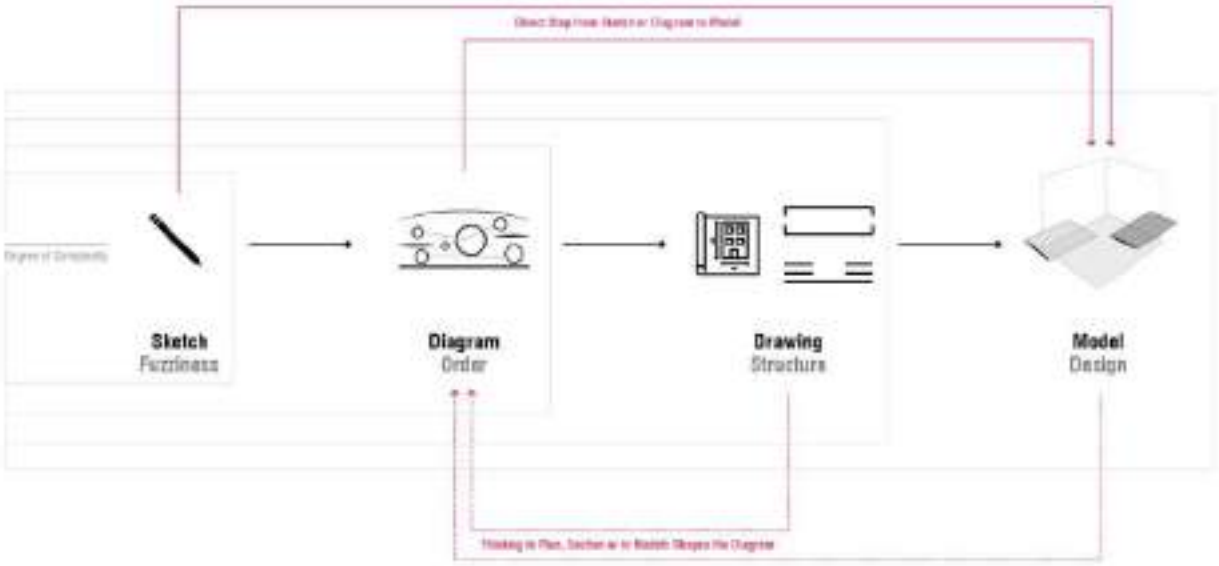

Figure 2: Design tools of architects, with interrelation and interdependencies between the tools. Author's own representation.

Models are used and understood differently in architecture than in management (Boland & Collopy, 2004). While in management the descriptive and prescriptive character in 2-D prevail, models in architecture are 3-dimensional and generative. They are used for experimenting or testing and serve as a boundary object or shared system image for communication, participation, co-creation, and presentation, both internally and externally (Doll, 2009; Gänshirt, 2012). In working models the "ephemerality of assemblies" is what allows us to add, take away, shuffle, and re-arrange parts or the entire model, while reflecting on and evaluating the conducted actions and their consequences (Wagner, 2000, p. 385). As persuasive artefacts they offer a special kind of openness, immediacy, and interpretive flexibility (Wagner, 2000, p. 388). The models also represent the prototyping mind-set of architects and show the relational and spatial proximities as well as the parallelly

and simultaneously performing parts of a whole (Gänshirt, 2012). They are abstractions and representations of the constructed real, not the final product itself, which requires the architect to continuously imagine, foresee, and think of the implications and consequences when a design is going to be built (Rittel & Webber, 1984). It speaks for a holistic approach with a long-term perspective beyond current client, user, or market demands (Maescher 2018).

Reframing complexity, understanding interactions and designing a system in an architectural way leads to a 3-dimensional conception of an organization. If this kind of thinking and tools could be applied to the design of innovation processes, new models could evolve as unique solution for a specific company. To underline this argument, two case studies will be presented, where architects have worked on architecting and designing innovation processes for small-and-medium sized companies (SMEs).

From Random and Structure to Network – 2 Case Studies

The goal in both cases was to analyse and understand the client's requirements, processes, culture, and vision and to synthesize a concept model of the future organization as the basis for a subsequent building design phase. Two SMEs were facing a major transformation and development in their structure. In the first case, an innovation factory, a successful company in mechatronics needed to enter a higher level of complexity by leveraging its innovation processes from linear to network. In the second case, a nanotechnology R&D headquarters, the successful growth of a start-up required a new state for its processes turning from random to network. Both companies were approached by an architectural consulting service called architectural programming in 2009 and in 2015, conducted with and by the author (WITTENSTEIN & HENN, 2009; attocube & HENN, 2015). Initially serving as brief for a satisfying building design, the architectural programming can be viewed as a 'research and decision-making process', which could be applied to problems detached from a physical solution (Cherry, 1999, pp. 3, 229-230). It is one goal of the doctoral project to re-direct the principles applied in architectural programming and early phases of architectural projects for the development of new organizational designs.

Mechatronics Innovation Factory / 2009[1]

As a leading company in the fields of mechatronic technologies, the capacity and competence to permanently create new ideas, develop innovative technologies, and apply them to markets has been vital. By the time of the case study in 2009, the employees were responsible for around 80% of innovation projects, while 20% were initiated by customers outside the firm. The questions were how to maintain the speed of innovation, how to achieve a share of 50% in-house and 50% externally initiated innovation projects, how to foster an innovative mindset and self-organization among employees, and, finally, how to attract international talent and expertise. The vision was to create an innovation center, where engineers, developers, and clients work together and follow the process of idea generation, development and dissemination in production.

The progress towards a 3-dimensional innovation process within the architectural consulting service consisted of six phases: information collection, linear process mapping, 3-d process visualization, sections, diagrammatic sections, and systems modelling.

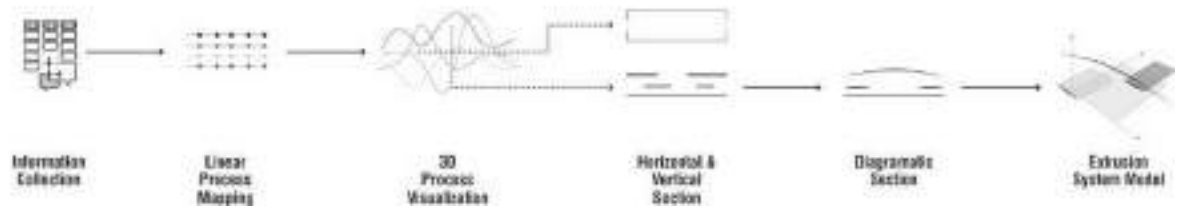

Figure. 3: 3-dimensional diagram of the organizational process in new product development and innovation. Author's own representation.

[1] The sources for the case study description and analysis are based on the author's notes and reports, presentations and models handed over by the consulted companies for research. The author was team consultant during the project in 2009, sources from internal documents released for publication are quoted with 'WITTENSTEIN & HENN, 2009.'

In the information collection phase reports and data-sheets were reframed and visualized graphically. The image of the organization changed by using different forms of visualization, which were discussed and refined in workshops. The illustrations served as boundary objects, leaving textual dependencies for visual simultaneity, and dissolving personal contributions towards commonly visible information (Boland & Collopy, 2004; Henn 2004; Peña & Parshall 2012). With an increase in information level, the visualizations were shifted from two-dimensional to a three-dimensional view, co-locating people and functions in three directions, while maintaining visibility and awareness.

The linear process mapping started from intangible elements (thoughts, ideas, knowledge) towards the physical manifestation of a finished prototype or product. It was conducted for each department and business unit, as well as for the movements of employees, customers and visitors, and for the new product development process. In a second step, each line of the processes were overlaid at the required point of interaction. As some processes needed to intersect multiple times at different stages, the 2-dimensional linear depiction reached its limits. By bending the lines in space, the architectural consulting developed a 3-D process visualization, where the joint points of intersection could be detected while not interrupting the flow line of each process. The visualization revealed a multidimensional organizational system where processes interacted in centres while remaining visible and open in-between. It led the linear thought models of organization towards an emergent system approach, where self-organization, freedom of flow, and exploration could be imagined.

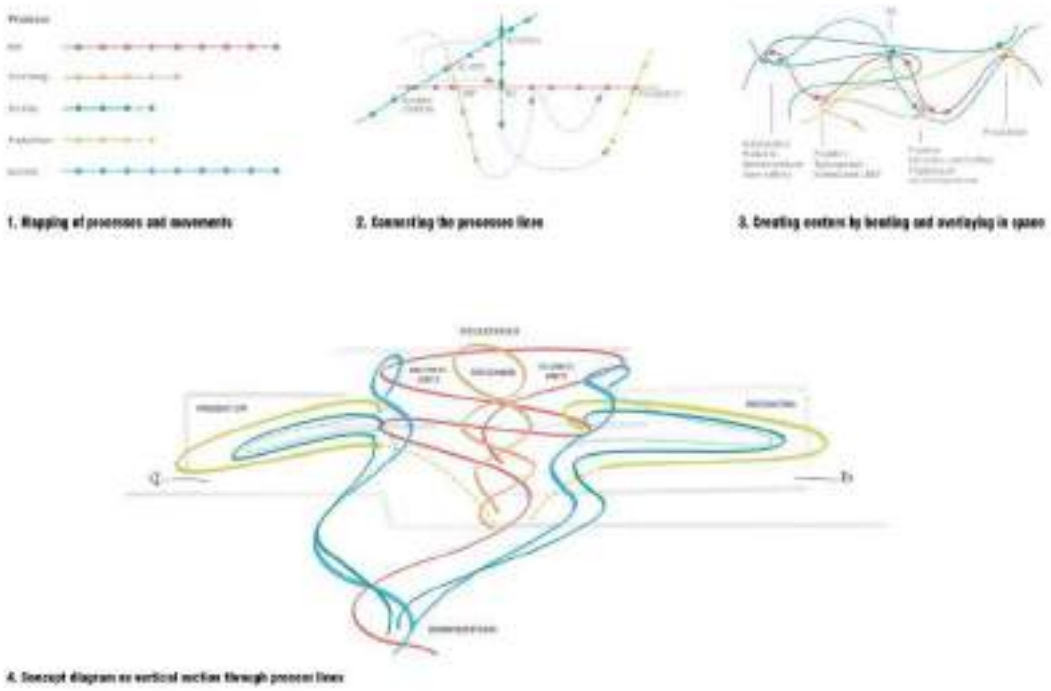

Figure 4: 3-dimensional diagram of the organizational process in new product development and innovation. Source and copyright: HENN & WITTENSTEIN AG, 2016, pp. 10-11.

The developed diagram was interpreted in a spatial dimension. By adding the elaborated information from the previous visualizations, the architects created a horizontal and vertical section through the diagram to explain the situations at intersection points. Through the 3-D arrangement of spines, the created diagrammatic section was modelled physically to show all aspects of work processes, flows, and organization of units, as well as the required spatial, technical and site requirements. It depicted for the company the future way of working and innovating in a multi-dimensional, integrative and simultaneous way. By extruding the conceptional section in different directions, the potential of the new organizational structure became visible. What formerly was depicted in a two-dimensional, linear and determined way was visible as 3-dimensional system.

Figure 5: 3-dimensional diagram of the organizational process in new product development and innovation. Source and copyright: WITTENSTEIN & HENN 2009.

Nanotechnology R&D Headquarter / 2015[2]

The start-up, founded in 2001, was in a transition phase from a grown structure of 90 people to a company of more than 175 employees. While the mechatronic company was leaving 'linearity' in processes and organization, the nanotech start-up was leaving 'dispersion.' Through the consulting of architects their vision, values and processes were reflected. The main questions in 2015 were, how to grow as company while maintaining a spirit of a community and start-up; how to achieve a share of 50% industry products and research projects (coming from 25%/75%); how to integrate management departments with innovation, research and highest-precision production; how to communicating mind-set, values, and remain attractive for researchers and high-potentials in engineering and natural sciences.

With modifications to the first case study, the process also followed six steps: information collection, process section, 3-D process visualization, section, diagrammatic sections, and systems modelling.

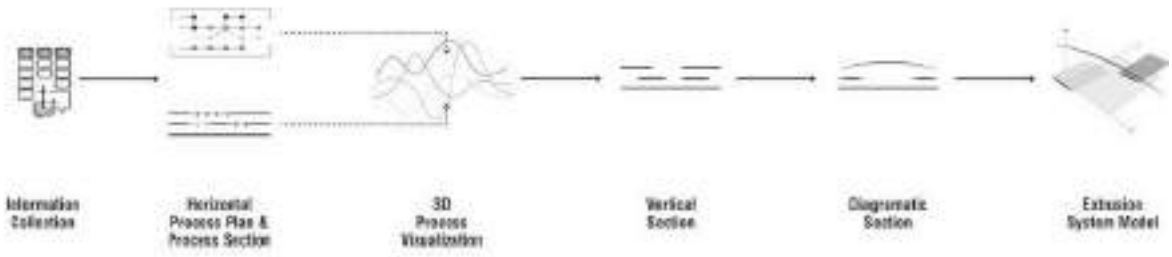

Figure 6: 3-dimensional diagram of the organizational process in new product development and innovation. Author's own representation.

The available reports and documents on the company were processed visually and enriched with the information gained through workshops and interviews with members of the board, researchers, developers and administrative staff. The process for the research and industry business were mapped in plan views and sections. The materialization of an idea was represented in plan/top view from left to right, and in section from top to bottom. The two perspectives were brought together in a 3-dimensional diagram of the organization. Employees, distance, and proximity as well as process allocation and spatial functions were considered in the model. The digitally rendered visualization was then viewed from different angles, and revised until it matched the perspectives of the board and employees.

[2] The sources for the case study description and analysis are based on the author's notes and reports, presentations and models handed over by the consulted companies for research. The author conducted the project as architect in 2015, sources from internal documents released for publication are quoted 'attocube & HENN, 2015.'

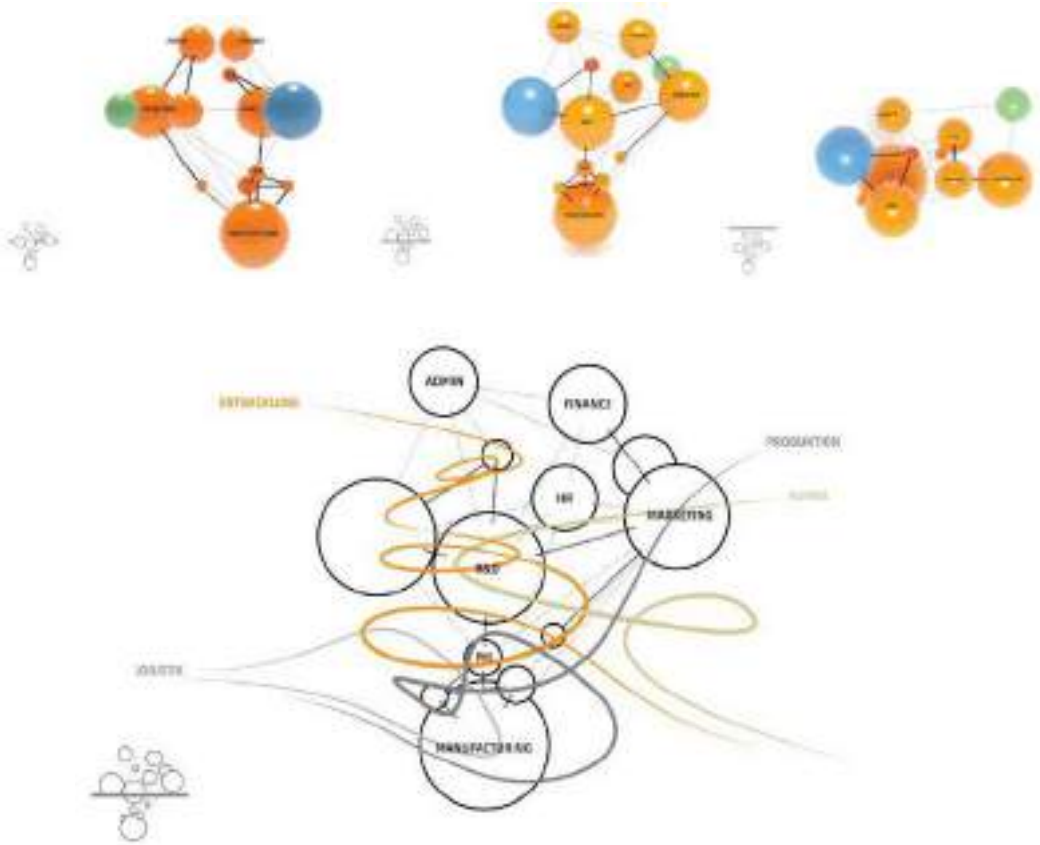

Figure 7: 3-dimensional model of employees, relation and spatial organization. Source and copyright: attocube systems & HENN, 2015.

Applying the prior elaborated process from plan view and section to the 3-D model, made the flows of interaction visible to client and architects. By cutting through the model a principle section of the entire company structure was created, which additionally displayed the values and mind-set of the company. The diagrammatic section served as intermediate structure between narrative and organization. In extruding the section in different directions, the innovation process space evolved, balancing out awareness, functions, and project flows of the company.

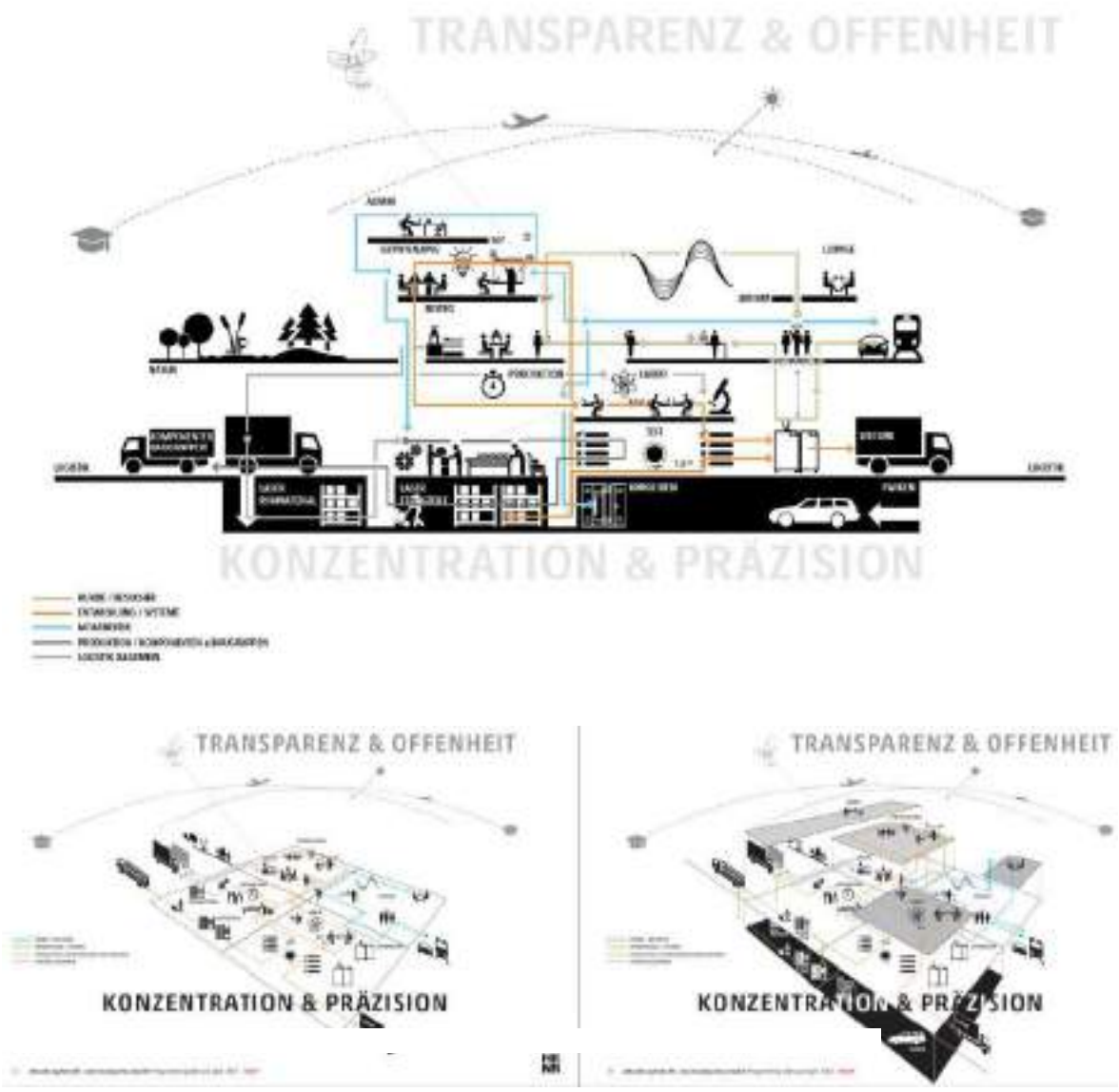

Figure 8: Concept diagram section of values, employees, relation and spatial organization with extrusion model. Source and copyright: attocube systems & HENN, 2015.

Further Research

As the consulting process of architects prior to a building design has not been scientifically analysed, the case studies serve as an important source in two respects. Firstly, to develop a separate view of the principles applied detached from a building focus. Secondly, to develop suitable principles and tools for implementing architectural thinking in a management and organizational design context. The visual representations of the organizations in the architectural programming are difficult to access by managerial understanding and constrained by the image of a physical building design. Though the presented works resulted in physical output, they were able to change managerial perspectives on the future organization and innovation processes. For the ongoing research it will be relevant to compare the visual and spatial approach of architects with related works from other disciplines and industries. Despite the existing text-based examples for innovation process design, new digital tools are applied in innovation management and research. Software and applications such as innotrace or innosabi foster agile innovation across companies (Lundberg et al., 2014; Innosabi, 2019). So far, a spatial-dynamic dimension for an organization as a whole has not been detected as this will be pursued in the doctoral project. By comparing existing principles and tools with architecture, is the intention is to develop an architectural approach to innovation research and management, and outline a conception of architecture as an innovation design discipline. This extended field of architecture working at a

systemic, organizational level could integrate the relational and process understanding of management with a spatial system of dynamic flows.

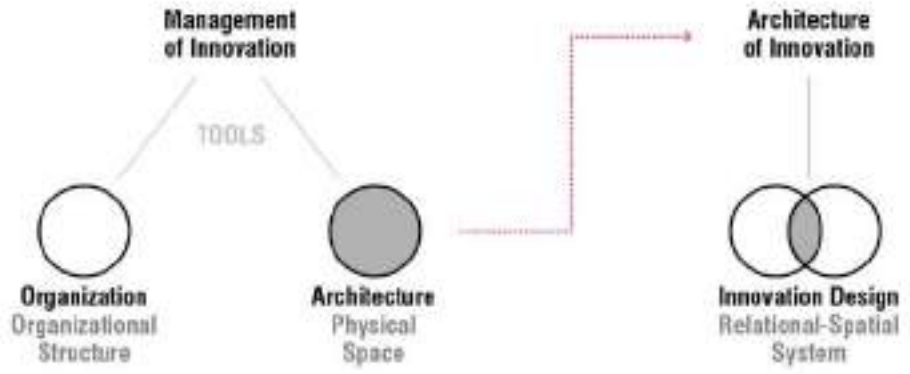

Figure 9: Re-positioning from architecture as tool to architecture as management for innovation. Architecture of innovation creates a relational-spatial system of innovation processes. Author's own representation.

To bridge communication between the two disciplines, the tools and working modes of architects need to be explicitly shown and explained. The development of further digital tools based on architects' understanding and perspectives on organizations and their innovation processes will provide additional support. An interdisciplinary project with students from information technology has recently been started to create an integrative, easy-to-use, and adaptive application. It will serve as first prototype towards creating a 3-dimensional interactive process design tool from architecture for management.

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Research Perspectives IN THE ERA OF Transformations

Design practices for strategic innovation in start-ups

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This paper looks at the use of design practices in start-up firms for the creation of strategic advantage through product/service innovation. Start-ups face non-negligible challenges during the early-stage of development. The research questions examined to what extent design practices can provide the leverage needed to face these challenges. A 4-day *Innovation by Design Challenge* workshop provided the field for the research carried out. Participants were start-up firms each working together with two designers to form six teams. Methods used included: observation for the mapping of team activities; a short self-report questionnaire and; pre- and post-workshop semi-directed interviews with the start-ups. The findings support the idea that design practice integration into the initial development of a start-up can indeed provide a lever for success and provide the start-up with the strategic vision needed to go through the early-stage and bring their products/services to market successfully.

Keywords: Start-ups, design practice, co-design, innovation

Introduction

In a recent article on the nature and desirability of innovation, Pisano (2019, p. 19) reminds us of the difficulty that organizations have in both creating and sustaining it. Yet in a constantly changing world, innovation becomes a necessity and this even in the case of early-stage start-ups. The question is then what options are available to such firms that allow for the agility necessary for quick market response and, at the same time the creation of a competitive edge? Among the contenders one finds design practices.

This research focuses on how such practices can be made to work and leveraged strategically by an early-stage start-ups for the creation of new opportunities or to improve its product/service through the use of a human-centred approach. Young firms often do not go so far as to have well-written strategic agendas despite having an ear to the ground and an understanding of the importance of providing a product/service in line with what the market requires. Design practices can lead to “meaningful innovation [which] puts together real users’ problems and expectations with new technologies or a new use of a known technology” (Rossanese, Zilse, Arantes, & Tobias, 2017, p. 3)

There is an ever increasing need to integrate diverse areas of knowledge “where the ability to work across boundaries represents a key ingredient for competitive advantage” (Hacklin & Wallin, 2013) in which co-design and design thinking methodology play an important role and where “design thinking can be defined as the application of design methods by multidisciplinary teams to a broad range of innovation challenges” (Seidel & Fixson, 2013, p. 19). Furthermore, the integration of a design perspective means that “the emphasis is

transposed from business need to user need" (Newton & Riggs, 2016, pg 2) placing the user at the start of the design process rather than at the end.

Literature review

It has been noted, more than once, that the appropriate deployment of design resources allows a firm to achieve its organizational objectives (Gorb, 1990) and to foster value creation (Borja de Mozota, 2006). Although particularly true for large companies (Design_Council, 2007), this also applies to young structures such as start-ups. Reported research focusses largely on the implementation and use of design practices in large organisations (Bau, 2016) with a smaller body of literature reserved for small businesses (Acklin & Hugentobler, 2008; Malins, 2011; Ward, Runcie, & Morris, 2009). In large part, the design practice literature does not differentiate between established firms, large or small, and start-ups. We believe that there is indeed a difference here which has, in turn, guided our research. This section presents the challenges faced by start-ups and how design practices can provide a strategic response to them within the framework of current models and methods.

Specificities of Start-ups

Whether start-ups are presented as the result of the entrepreneurial act (Chew, 2015), or as "a human institution designed to deliver a new product or service under conditions of extreme uncertainty" (Ries, 2011, p.8) their activity focuses on the development of ideas, opportunities and the design of new products or services. All start-up firms can be seen to go through several clearly identified phases and all generally face the same challenges.

The start-up development goes through different stages that include (1) the Bootstrapping stage (2) the Seed stage and (3) the Creation stage (Radovic-Markovic & Salamzadeh, 2012). Those stages are used to transform the entrepreneur's idea into a profitable business. The objective is to position the company by demonstrating the feasibility and acceptability of its product to customers as well as its financial capacity and team management skills (Brush, Carter, Gatewood, Greene, & Hart, 2006). Companies increasingly recognize the importance of design during the early-stages, also known as the Fuzzy Front End, by using the skills of designers not only for the realization of new products/services, but also for the co-creation of concepts (Calabretta & Gemser, 2016).

In the early stages start-ups generally do not have the luxury of time nor money yet need to reduce the risk of failure to a minimum and a lack of resources can prevent the start-up from collaborating with a designer from start to finish. Working under such constraints (Glaubert, Nyffeler, & Bergeron, 2018) can contribute to the high failure rate exhibited by start-ups especially during the early-stages where the risk of failure is omnipresent.

Liedtka (2018) suggests that design practices, particularly design thinking, can be regarded as a social technology which she defines as a "blend of tools and insight applied to a work process" and goes on to suggest that "it has the potential to do for innovation exactly what TQM did for manufacturing" (p. 72), in addition to answering the challenges that firms face in the innovation process including the identification of superior solutions and the lowering of risks and costs. She joins, to a certain extent, the position taken by Acklin and Wanner (2017) that design practices are more than design but should be considered a management function, one that "embeds design or design processes in companies in order to create added value in products, services, experiences, processes and structures" (p. S471).

Despite a dearth of research on the challenges faced specifically by start-ups there seems to be a general consensus that such firms face similar challenges and ones other than those faced by established firms. Giardino, Bajwa, Wang & Abrahamsson (2015), identified ten critical challenges faced by start-ups based on a world-wide sample of 4709 start-ups and which include resource (financial, human and physical) and market related issues. This corroborates what has already been said about keeping financial and time investments down all the while paying particular attention to market needs.

Seen from this point of view it becomes clear that start-ups particularly serve to gain from collaboration between those who have competencies complementary to their own, namely, designers. And this, despite a reticence on the part of a certain category of start-ups as "budding entrepreneurs from the engineering disciplines often associate the term 'design' with art and as not relevant for their future business" (Acklin &

Wanner, 2017, p. S470). Design allows for a user-centred focus and "humanizes" (Buchanen, 2000) the technology, of importance when start-ups, particularly high-tech start-ups, are looking for investors or are in the process of addressing future clients.

The integration of design practices can be seen as a key success factor and a risk-reducing one, something of high importance for young start-ups in the early-stage (Sheppard, Kouyoumjian, Sarrazin, & Dore, 2018).

Innovation by design

As mentioned in the introduction, we live in a fast-paced world, one where innovation has become something of an overused buzzword. This banality has today's consumer taking novelty as a given and expecting to see it with ever greater frequency. Some talk about design as the latest best answer to innovation with Owen (2006) going so far as to say that design thinking "offers a way of approaching issues, problems and opportunities almost uniquely suited to innovation" (p. 3). Yet design practices alone will not suffice, nor should one imagine them as the Holy Grail to start-up success.

Both design and innovation are used with ever greater frequency, as well as interchangeably, to describe a method comprising products, services and systems. If design can indeed be seen as a resource, it is closely tied to the user and can translate into an advantage as the focus is on the human aspect versus that of the technology (Kolko, 2007). Monori, Arruda and Araujo (2015) suggest that successful innovation depends on "the understanding of user needs, competitive advantage and synergy between the company's strengths" (p. 2201).

The role of design in innovation has long been under discussion, see for example Roy (1994) for an initial discussion of how design supports innovation and Na, Evans, Zitkus, Whicher and Walters (2018) for one more recent. Its role in incremental and radical innovation was also well described by Borja de Mozota (2003).

In a recent report published the British Design Council (Benton, Miller, & Reid, 2018), design is identified as a resource for innovation with survey results showing that firms placing importance on design activities and with "design functions or facilities in-house are significantly more likely than average to have developed completely new and original products, services or processes" (p. 28). Over the past twenty years design has taken an ever-increasing role in the creation of unique and innovative marketing approaches and is increasingly seen as a method of ideation to be used by both design and non-design firms (Kolko, 2007). Today design is taking on a further element of importance as it allows for the development of products and services that have meaning for the customers and it "has the ability to add value in many ways, including economic, social, and environmental" (Lockwood, 2007, p. 91).

Despite an accrued interest in design practices, there is little empirical evidence (Malins, 2011) to support long term results of using such practices for innovation. Firms must be aware that such practices need to fit with company values and that they are but one option to choose from.

Co-design

The integration of design practices within startups requires knowledge of multidisciplinary collaboration and co-design. Indeed, they are an integral part of the design thinking methodology where different stakeholders are integrated into the project's thinking to address broader innovation challenges. The term co-design has more than one definition going from its restriction to designers alone or to a more all-encompassing definition put forth by Sanders and Stappers "co-design in a broader sense to refer to the creativity of designers and people not trained in design working together in the design process" (2008, p. 6). Such collaboration allows the firm to step back and view the project in question from an alternative point of view. In the words of Schwartz, Bransford and Sears "we think it is especially important to note that innovation often requires a movement away from what is momentarily most efficient for the individual or the organization" (2005, p. 30). This calls on the firm to invest some of its limited time resource to pause and reflect upon questions frequently asked by designers including what the purpose of the innovation is; who the target user is and; how it will be used.

Although the ideas of co-design have been around for some time now and, with the design domain, can be seen to have their roots in the participatory design movement of the 1970's (Sanders & Stappers, 2008), it would seem that industry was not ready until recently, however, to embrace these principles.

Crossing disciplinary boundaries

Taking the debate one step further we looked at the research on team composition within design practice. Much of the literature ignores the fact that design practice teams are often interdisciplinary and look more at team dynamics and successful team performance. Yet interdisciplinary teams have an additional level of complexity which should be taken into account if one is to achieve the desired "interdisciplinary knowledge integration [which] depends on the ability of individuals in teams to combine knowledge in novel ways" (Hacklin & Wallin, 2013, p.781).

In addition to the disciplinary differences that one might find among team members and, of particular interest in our research, are Ho's (2001) research findings which suggest that there is "an obvious difference between experts and novices in the way they approach the problem" (2001, p. 43). Expert designers were found to look at the design problem before using working-backward strategies to come up with design knowledge in answer to the problem whereas novice designers tended to use working-forward strategies in search of design solutions already at the outset (Ho, 2001).

In summary, what design practices today can most benefit from is teams which have the support necessary to allow for boundary-crossing by the individuals concerned to function optimally. This might take the form of models, processes, or even toolkits to help structure and allow for the integration of such practices.

Design in practice

Models and methods

By the early 2000's design practices came to be seen as a "complex thinking process of conceiving new realities, expressing the introduction of design culture and its methods into fields such as business innovation" (Tschimmel, 2012, p. 2). With this, reference to and attempts to adopt design thinking became increasing widespread. In order to facilitate the use of design thinking a number of models were created to allow for its integration into any organisation.

The most notable among these were the IDEO models which included the 3I -Inspiration, Ideation and Implementation and the Hearing, Creating, Delivering HCD models (Tschimmel, 2012). Two other important contributions to the model literature were the Double Diamond model introduced by the British Design Council (British Design Council, undated) and the Service Design Thinking (SDT) model (Stickdorn & Schneider, 2011)

As an alternative to the phase/step approach provided by the models, a number of authors, focused on the identification of key questions to be addressed during the design process. This includes research done by Austin et al. who in some early work on interdisciplinary design teams (2001) found the process to be iterative. Although no structure or method resulted from their work, they did note that without any guidance the teams studied proceeded in an ad hoc manner. Liedtka (2014) highlights the importance of what she identifies as the 'questioning period' with four essential questions to be asked: what is, what if, what wows, what works in order to create not only successful but productive teams.

Complementary to the model-based approach one also sees a number of process-related methods including that developed by Google Ventures and shown in Table 1.

Table 1: GV Design Sprint process

Day 1 **UNDERSTAND**	*Day 2* **DIVERGE**	*Day 3* **DECIDE**	*Day 4* **PROTOTYPE**	*Day 5* **VALIDATE**
• who are the users • what are their needs • what is the context • competitor review • formulate strategy	• envision • develop lots of solution • ideate	• choose the best idea • storyboard the data	• build something quick and dirty to show to users • focus on usability not making it beautiful	• show the prototype to real users outside the organisation • learn what doesn't work

The afore-mentioned process combines elements of existing models with guidance on how to proceed at each stage. This provides a framework that, for those new to design, can allow for a structured adoption process.

Finally, we now find an increasing number of design practice tool-kits available aimed at the smooth integration of design practices into business, just a few of which are listed in the references (Calabretta & Gemser, 2016; IDEO.org, 2015; Sanders & Stappers, 2013).

In summary, design practices for early-stage start-ups is a field that has not been the subject of much empirical research and one which we esteem could be a viable strategic option for such firms helping them to face typical start-up challenges. This has influenced our research focus and led us to define the following research questions:

Within the framework of a 4-day workshop open only to early-stage start-ups and designers:

1. What are the key activities used to solve a short-term design objective?
2. What is the team's perception of its productivity, collaboration and individual involvement?
3. To what extent might design practices be seen as a strategic option for start-up firms?

The answers to these questions will provide the basis for the identification of best practices with the intent to develop a method accompanied by specific tools for strategic innovation through design in start-up firms.

Methods

We chose to use action research in order to carry out this project as, more than any other paradigm, it takes the interests of all stakeholders into account (du Preez, 2011). Based on the framework set out by Dick (1993) we have followed three defined steps: *intention*, *action* and, *review*. These headings are used below to present the research carried out in what is the second iteration of the project. Results from the first iteration (Glaubert et al., 2018) allowed for the continued development of the 2nd Innovation by Design Challenge (IDC) the results of which are reported in this paper.

Intention

In order to provide an opportunity for start-up firms to test design practices as a strategic tool for competitive advantage we organized for the 2nd time, an annual a 4-day, evening-only, workshop called "Innovation by Design challenge". Our intent was to foster collaboration between start-ups and designers allowing the start-ups to improve their products/services through design practice angle. Six start-ups and twelve designers worked actively during four three-hour evening sessions over consecutive days with a final presentation one week later. This programme was designed and implemented by the School of Management and Engineering Vaud (HEIG-VD) and the ECAL/Ecole cantonale d'art de Lausanne and sponsored by a Swiss municipality (Ville de Renens) and an organisation supporting entrepreneurship in the state of Vaud (Innovaud) (Figure 1).

Action

This stage called for the implementation of the action research which, within the framework of the workshops, included active observation, informal participant feedback, the completion of a self-report questionnaire and, semi-directed interviews held with the start-ups involved.

From the first iteration of the challenge we learnt that some designers had difficulties in understanding the start-up's objectives and the short-term issues they wanted to find solutions for. As the result depended on the designer's knowledge and ability to work with the start-up this was a critical issue. In order to foster quality collaboration, we chose a more structured format with set milestones for the 2nd iteration, the results of which are presented here.

The proposed workshop drew upon two complementary models. The rationale for this being that design practices in entrepreneurial organisations alternate between open, explorative approaches on the one hand and more focused, specific ones on the other (Nguyen, 2016). The more explorative "Double Diamond" approach of the British Design Council (British Design Council, undated) has four phases: Discover, Define, Develop and Deliver, phases that allow the participant to meander. The focused method selected was the product design sprint process developed by Google Venture (Knapp & Zeratsky, 2016) a structured method using specific tools to achieve rapid prototyping within a short period of time.

Using our knowledge of the two approaches and given the five collaborative sessions at our disposal, we created four phases to structure the workshop: Reframe, Imagine, Realize and Present. These are presented below.

1. Reframe :
   Where we introduce the challenge and help to build a common understanding of the existing product and its context (clients, usability, business model, problems encountered, constraints). Then at the end of the first session all teams are asked to formalize the challenge that they want to address during the workshop. As in the previous challenge, we sent a list of questions to the start-ups to prepare prior to the first session and asked all teams to formulate the problem they wanted to solve during the workshop with two questions: HMW (How Might We) question and the value proposition question (Osterwalder & Pigneur, 2014).
2. Imagine:
   The second and the third sessions concentrates on proposing one or more solutions with a focus on customer experience and the use of the product/service, followed by the selection of one of the proposed solutions and its subsequent development.
3. Realize:
   The fourth session is dedicated to the production of visual materials (presentation, prototype) in order to help pitch the projects to the public.
4. Present :
   The fifth session is devoted to the final presentation.

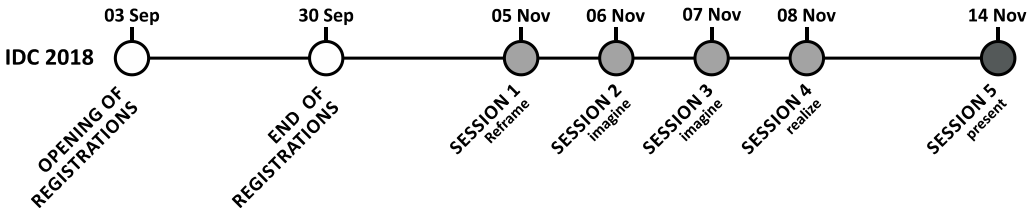

Figure 1: The entire workshop programme

Participants: In order to select the teams a call for start-ups and designers was launched between 03rd September 2018 and 30th September 2018. A total of eleven start-ups and nineteen designers applied. The criteria were the same as in the first iteration : start-ups were (1) to be located in the state of Vaud; (2) to have been founded in the last five years or to be in the creation phase and; (3) to propose an innovative project; designers were (1) to be a final-year Bachelor's or Master's student or a professional under 40 years of age. The choice of start-ups took into account the needs and short-term objectives stated on the application form. Six start-ups and twelve designers were selected for the challenge, each start-up was assigned 2 designers with complementary knowledge, experience or studies background (table 2). Indeed, the start-up challenge requires several disciplines in design to solve it. Several designers had multiple design skills and two teams (team D and F) benefited from the experience of a senior designer (having more than 10 years of experience) and with knowledge of design thinking and the strategic approach of design (Service design or experience design or MBA background).

Table 2 : Start-up workshop participant and designer profiles

Start-up	*A*	*B*	*C*	*D*	*E*	*F*
Creation	Feb, 2016	Dec, 2017	Jul, 2015	Sep, 2016	Fev, 2017	Jun, 2017
Sector of activity	Industrial Machinery and environment	Industrial machinery	Optics, mechanics, software, engineering	Drones, infra-structure	Transport	Planning and management of end-of-life data
Main offer	Machines capable of	Efficient and effective	Planar micro-	Detect drones in air	Participatory workshop on	Secure digital

	collecting lake algae and transforming it into powder.	beverage machinery	tracking system that can redirect light in various direction	traffic to avoid collisions	motorcycle and bicycle	platform that stores all important information at the end of life
Full-time employee (FT)	3	2	10	6	3	6
Needs	Present your product in a simplified way	Review the product design for production launch.	Clarify our message to our potential prospects	Redesign the digital platform	New identity to reach new customer	Invent a complete experience around an emergency card
Designer 1	Product designer	Product designer	Product designer	UX designer	Service designer	Product designer
Designer 2	Architect	Product designer	Product designer	Architect and design strategist	Product designer	Senior product designer and design strategist

Data collection : During the Challenge, we collected three data sets. The first data set was based on an observation of the activity of each team during the three first sessions. The list of the activities of each group have been quantified and classified according to the nomenclature of the phases of the double diamond model, namely discover, define, develop, deliver. Our intention was to use this data to map the creative activities and identify divergent and convergent moments. The second set of data collected during the sessions concern the perception of collaboration. Each member was asked to answer to a short self-report, 8-item questionnaire at the end of the session in order to better understand the team dynamics, their alignment on the process and their perception of the collaboration, engagement and productivity. The team B didn't answer the questionnaire the second evening, their data is excluded from our analysis. The third data set concerned the semi-structured interviews with the six start-up managers. We used an interview guide to conduct the semi-structured interviews held at two time periods: T01 = before the workshop, T02 = after the workshop. This set of data focus on the awareness of design, the role of design for the start-ups, and their expectation of the Challenge.

Review

The final stage of an action research approach calls for review. After the 1st iteration of the IDC workshop an informal review was done in order to revise and prepare for the 2nd iteration reported here. This in turn will be subject to review prior to the 3rd workshop planned for 2019.

Research findings / data analysis

The aim of the observations was to analyse the creative process of each team in order to validate and improve the tools used during the workshop sessions and identify the critical activities to foster collaboration between the start-ups and the designers.

Creative process

The observations allow us to list the activities of each team and visualize their creative process according to the double diamond model. We distinguished teams with novice designers (A, B, C, E) and teams with senior designers (D, F). As per the results, the novice designer teams do not follow the double diamond process in a linear way. Indeed, for teams A, B, E, the develop phase can occur regularly from the first S1 session and the define phase appears several times throughout the process for teams A, B, E until the last S4 session for teams

C. In addition, it is noted that teams with senior designers follow a process closer to the double diamond model with distinct phases. The discover and define phase appears in time S1 for team D and continues in S2 for team F. The develop phase extends to S2 and S3. Finally, the production phase appears in S4. This shows us that the first phase also has a relatively dense number of activities and that the definition of the in-depth problem allows us to develop solutions without having to come back to the define phase to figure out on the problem.

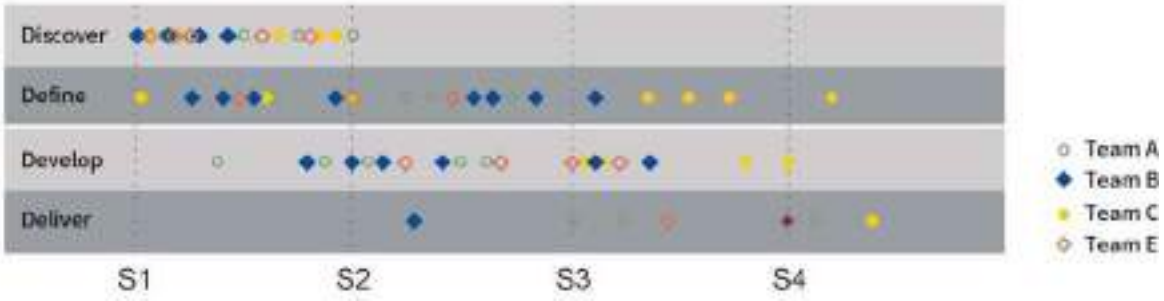

Figure 2: Mapping of the activities of novice designer's team

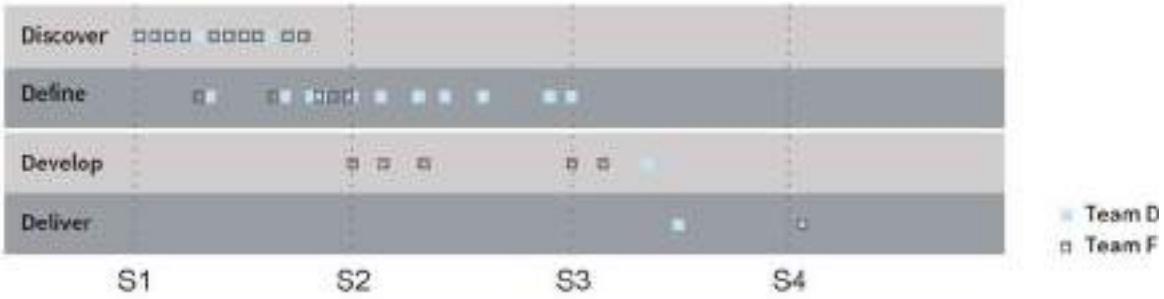

Figure 3: Mapping of the activities of senior designer's team

The management of the creative process seems to have an influence on the perception of the team production, collaboration and individual implication. The result of the questionnaire links team activities to the collective and individual perception of collaboration.

Perception of collaboration

The results show that the quality of the production is estimated lower when they enter the define phase and increases for the develop and deliver phase and that this varied from one team to another (Figure 4). For example, Team C encountered difficulties in defining the start-up's problems and needs. Their perception of their collaboration was at its lowest in S3 at which time they were still defining the problem to be solved (Figure 2). Teams E and F started the development phase in session 2 whilst Team D did not start the development phase until session 3 (Figure 3). Teams A and B followed a more iterative process and both improved and stabilized their collaboration in session 3. The data show that the teams perceive that they have performed better as a team when they agree on, and subsequently follow, a design process. Finally, the assessment of productivity, involvement and collaboration of all the teams improved at the develop and deliver phase.

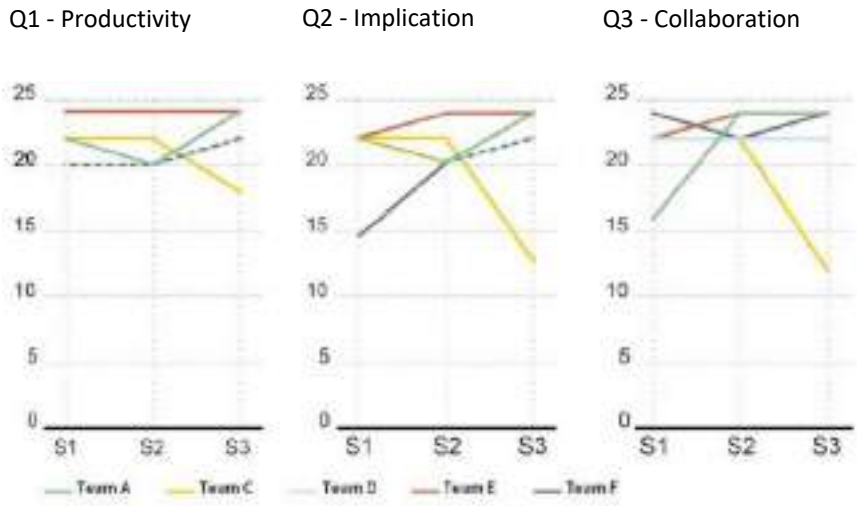

Figure 4 : Team perception of their productivity, involvement and collaboration

The analyses and themes mentioned during the different phases allowed us to see that the develop phase ends when the teams have a complete understanding of the value of the product and how it is used (competitor, stakeholders, technical, prototype, problems encountered, Unique Selling Proposition, offer); the customer segment (who the main customers are and what their needs are) and the short term objective (the problems to solve, the constraints, the deliverables). For the senior teams, they also tried to understand the business model and define the unique selling proposal or value proposition (table3).

Activities and milestones of each phase

The synthesis of the teams' activities during the program shows similarities between the teams' activities and those proposed by the sprint model. Indeed, the identification of target customers, their needs / experience, as well as dividing the challenge into sub-questions and objectives are key elements of the reframing phase. In the context of the challenge, several areas of reflection (industrial, service, digital interactions), designers also evaluate the offer, the added value of the product and its use. The difference between the models can be explained by the type of participants. Indeed, the sprint allows employees who do not have any knowledge of design to actively participate in the creative process, while in the IDC Challenge is formatted for one manager of startups with a predominance of designers. Thus, the creative process is still structured with exercises inspired from the sprint workshop model during the diverge, decide and prototype phases while the imagine and develop phases depend on the knowledge and methods used by the designers. Nevertheless, we find milestones for the development phase with the realization of prototypes, iteration, validation of the concept, distribution of tasks.

Table 3 : Synthesis of the activities during the phases

Double diamond	DISCOVER	DEFINE	DEVELOP	DELIVER	
IDC	REFRAME	REFRAME	IMAGINE	DEVELOP	PRESENT
	Understand the company context		(6) Ideas	(6) Prototyping	(6) Pitch
	(6) Company context		(6) Inspirations	(6) Iteration	
	(2) Competition		(6) Evaluation	(6) Validation of the concept	
Activities	**Understand the product value**			(6) Task distribution	
	(6) Product understanding	(2) USP		(6) Production	
	Understand how the product is used				

	(6) Usability (3) Technical aspects **Define the customer segment** (6) Customer segment **Define the short term objective** (6) Problem to solve	(2) Constraints (6) Pick a target & understand needs (6) Objectives (6) Deliverables (6) HMW		(6) Visual presentation (6) Pitch preparation	
SPRINT	UNDERSTAND	DIVERGE	DECIDE	PROTOTYPE	VALIDATE
Activities	Long term goal Sprint questions Client segment Customer journey Expert interview Importance /difficulty HMW Pick a target	Inspiration Look at competitors Sketch multiple solutions Iteration	Evaluation Create one solution for the prototype Name Make a storyboard	Assign roles Prototype Put together Test Prepare the test with customer	Test with customer

Design as strategic role

The semi-structured interviews provided insight into the perception of design by start-up managers both before and after the event. Clearly the collaboration with the designers allowed the managers to understand that design had a strategic role in positioning their offer and client product acceptance (table 4).

Table 4 : Definition of design by the six managers

Before	• Cannot give a definition (3) • Solve a technical problem, a way of producing a product (2) • Link to communication, identity, marketing advertising (1) • Interact with products and take into account beauty and production criteria to differentiate from the competition (1) • Understand and meet the user's needs (1) • Visualise a process (1) • Make a shape attractive to the eye (1) • Demonstrate empathy (1)
After	• Links between technology, innovation and society (1) • Transform innovation to make it accessible (1) • Redefinition and improvement of the company's tangible and intangible values (1) • Understand a context and the needs (1) • Bring another angle of operational and strategic vision with the user to the centre (1) • Simplify a product in a pleasant and effective way (1)

Five teams believed that working with designers exceeded their expectations and allowed them to take a step back from their product and the issues they wanted to solve. Three teams reviewed the initial product and focused on support of communication of the offer. Collaboration with designers helps the start-ups on the following goals :

- A step back on the product or the issue (5)
- The creation of a tangible solution to present to customers (5)
- Simplifying the message (3)

- The integration of several design disciplines to create a coherent global project (3)

Discussion

With the Innovation by Design Challenge (IDC) we aimed to give an impulsion to start-ups by collaborating with designers on short-term objectives. The IDC was also to provide answers to our research questions. The first question had to do with the key activities used to solve a design objective in the short term. Our findings suggest that design practices can be a strategic step in the transformation of an innovative technology into a significant product by focusing on user interactions. Indeed, to solve the design challenge, the designer must define 3 main elements such as (1) the added value of the product/service, (2) who is the main customer and/or user, what are their needs, pains and motivations, (3) and how the product is used. While senior designers quickly capture these elements, young designers tend to have a more organic approach and oscillate between the definition and ideation phases, which can sometimes be difficult in terms of collaboration.

The second question that we addressed was whether such teams would be perceived by the team members as productive, collaborative and involving all team members. From what we have seen during the first two iterations of IDC, the answer is that the perception, in all categories, was positive. In line with what previous research has shown (Ward & Al. 2009), we found that introducing experienced designers to a start-up can stimulate innovation and create new opportunities. For the start-ups, working with individuals having diverse design backgrounds allowed quick results to be achieved and helped the firms to focus on their main clients.

In response to our third question, design practices were also welcomed by the IDC participants as a potential strategic option and seen to allow for the transformation of an innovation into a useful and accessible product/service for users. While market acceptance is a crucial element for the growth of start-ups, the practice of design with multiple disciplines seems to improve product consistency by focusing on the user experience. Collaboration with a designer makes it possible to make the link between the technology, the user and the context of the product/service following the phases of the creative process. Indeed, the observation of the teams allowed us to understand the collaboration process between start-ups and designers and identify key activities for product and service development. These various activities also allow us to help entrepreneurs step back, simplify the message and create an optimal product experience for users. One can say then that the practice of design consolidates the positioning of the product and validates its future acceptance by customers.

It is also of interest to note that there seems to be some correlation between the senior team process and the one developed during the product design sprint process. Collaboration between designers and start-ups is critical when it comes to understanding and defining the issue. Iterations of the ideation phase can be unproductive and create sources of frustration if the defined phase has not been well resolved beforehand. Project synthesis and scoping tools would facilitate the relationship between participants.

The results of our research suggest that the “reframe” phase could be split into 2 distinct phases : “understand” and “reframe”. The list of the activities carried out by the teams during each phase give an indication about the critical point to solve before going to the next phase (figure 6).

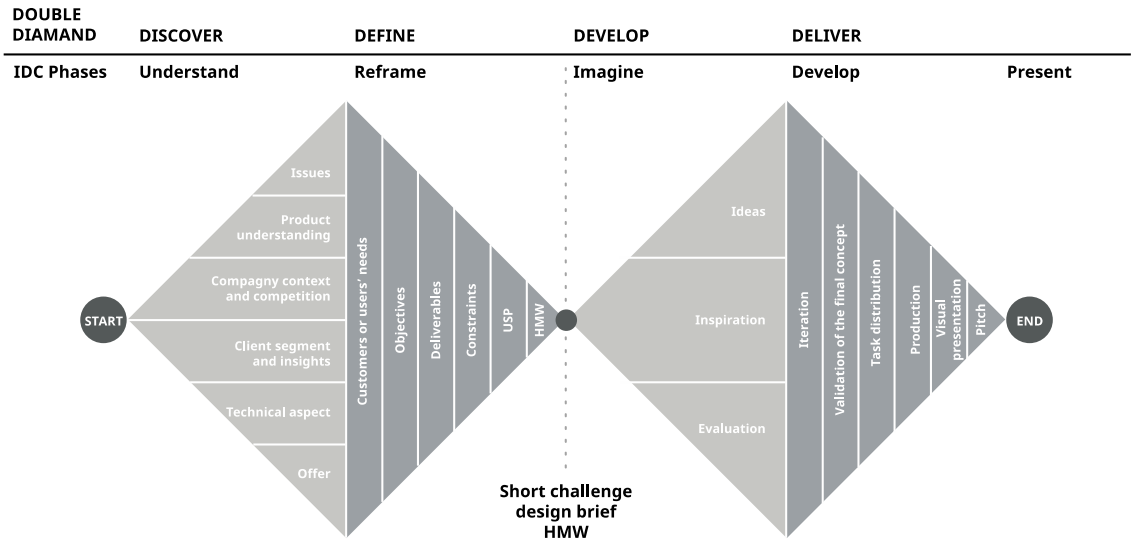

Figure 6 : Guidelines for the next programme

Conclusion

The use of interdisciplinary design teams for strategic innovation by start-up companies can indeed make a difference allowing them not only to bring potentially successful products to market but also allowing them to face up to other challenges including those of time and risk by engaging in a focussed, relatively high-speed process.

With regard to the limitations of this research presented here, only six teams participated in this study. A wider panel would be needed to achieve more generally applicable results. In the long term, the project has already been planned for 2019, and will allow us to test a more structured approach to be able to scale up the program and applied it in various incubators in the region. In terms of future developments and in order to scale up this programme we plan to (1) formalize the creative process activities into exercises, (2) find sponsors to help the start-ups finance the workshop programme, (3) create a toolkit to empower teams when collaborating.

In conclusion, success for an early stage start-up means dealing with challenges particular to such firms in a strategic manner so as to them to take their place in the market. Despite the tool-kits and models that abound, little are geared specifically towards early stage start-ups. This research has taken the specific challenges faced by early-stage start-ups as a starting point for an in situ exercise to evaluate the potential impact of design practices. The research supports the idea that such practices can indeed be included at the incubation stage of a start-up to help it better address used needs from a design perspective. Whether this will in turn impact the firm's longevity is another question but at least it provides the firm with a strong, more holistic basis, from which to move forward. While the study shows that design pratcices can become strategic for a startup, start-ups face difficulties in financing the integration of design into early stages of development, and initiatives to facilitate access to design are required.

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Research Perspectives IN THE ERA OF Transformations

Enhancing Collaboration: A Design Leader's Role in Managing Paradoxical Identity Tensions Through Dual Identification

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As the role of design grows in prominence in the workplace, managing designers such that they can effectively collaborate in multifunctional innovation teams becomes an important consideration. We draw on social identity and paradox research to extend insights on this topic. We suggest that, to operate effectively in the workplace, designers need to experience both similarity-with and distinctiveness-from other colleagues, and that these needs are paradoxical. We argue that tensions arising from these paradoxical needs can be managed through Dual Identification – a model which promotes dual identities, allowing the fulfilment of both needs of sameness and difference. We propose that design leaders can enable Dual Identification in designers through consistent language and associated visuals, and that this will allow designers to feel secure in their identity as both a designer, and as an innovation team member. We suggest that, ultimately, this security will translate to enhanced collaboration of designers in innovation teams.

Keywords: Dual Identification, paradox, design, design leadership, collaboration

Introduction

More and more organizations are looking to integrate design and design-based practices (such as customer co-creation and visualisation) into their business processes as a way of enhancing innovation, improving customer experiences, and to gain competitive advantage (Calabretta, Gemser, & Karpen, 2016). Collaboration between designers and other innovation team members is vital for successful innovation (Calabretta, Montaña & Iglesias, 2008), yet studies indicate that designers' ways of working may be difficult to integrate with other, well-established and traditional management ways of working (Beverland & Farrelly, 2007; Carlgren, Elmquist, & Rauth, 2016; Calabretta, Gemser, & Wijnberg, 2017). Scholars note that this difference in ways of working can affect individual designer identity (Ahuja, Nikolova, & Clegg, 2017; Elsbach & Caldwell-Wenman, 2015; Gotsi, Andriopoulos, Lewis, & Ingram, 2010), which can hamper collaborative activities at the team level (Elsbach & Flynn, 2013) and ultimately impact innovation outcomes (Lovelace, Shapiro, & Weingart, 2001). We develop four propositions that together work to enhance collaboration between designers and other team members within multi-functional innovation teams.

Drawing on social identity - including Dual Identification - and paradox literatures, we propose that design leaders (i.e., a leader or manager of designers) can enact a specific leadership strategy known in the literature

as ‘Dual Identification’. This strategy enables designers to identify both as (1) a ‘designer’ and (2) an ‘innovation team member’ simultaneously and allows the individual designer to manage their paradoxical identity tensions of similarity vs distinctiveness. We propose that this Dual Identification strategy will allow designers to experience greater identity security, resulting in enhanced collaboration between designers and other team members in multi-functional innovation teams. We also suggest that the use of consistent language and associated visuals can act as a cue to enable Dual Identification. We propose that design leaders can enact this strategy in order to induce Dual Identification at the individual designer level. We suggest that the impact at the individual designer level then translates to enhanced collaboration with other team members, such that the impact of Dual Identification at the individual level is also experienced at the team level through harmonization and collaboration with other innovation team members.

While scholars have suggested the importance of self-concepts and identification in a workplace context (e.g., Alvesson & Willmott, 2002; Elsbach & Flynn, 2013; Hogg & Terry, 2000), none have yet introduced a dual identification model as a way of enhancing collaboration within a multi-functional team. Further, while scholars have addressed identity paradoxes, and suggest that management of paradoxical identities is required to enhance outcomes (e.g., Cugnasen, 2017; Gotsi et al., 2010), they have not proposed Dual Identification as a management strategy. With this paper, we aim to integrate and extend the literature on both Dual Identification and paradox.

Our paper first addresses the design context, describing designer identity needs at the individual level that require specific design leadership. We suggest that needs of similarity vs distinctiveness are paradoxical, and argue that design leaders can induce Dual Identification to assist individual designers manage the associated paradoxical tensions. We follow up with further propositions, suggesting that design leaders can enable Dual Identification through the use of consistent language and accompanying visuals, and that in doing so, they may enhance collaboration at the team level between designers and other members within an innovation team. We follow previous scholars (e.g., Gibson & Birkinshaw, 2004) in an understanding that management of paradoxes at an individual level can contribute to a team-level finding. Due to the multi-level impact of Dual Identification, our propositions span both the individual and team levels of the organization. We highlight the role of design leaders, proposing that they play a crucial role in establishing the groundwork for individual designers to contribute effectively at the team level. We close with some suggested directions for future research.

Designers: Individual Identity Needs

Creativity and design skills form an essential part of multi-functional innovation teams (Calabretta et al., 2016; Lovelace et al., 2001). The Co-general manager of Alessi, a leading design-led organization, suggests that designers’ “intuition and sensitivity are considered more effective than traditional market research in capturing latent unexpressed needs and in shaping new product typologies” (Ravasi & Lojacono, 2005, p. 59).

However, designers differ from other innovation team members in their ways of working (Calabretta et al., 2017; Carlgren et al., 2016; Elsbach & Flynn, 2013) and in the style of management and leadership that they need to perform effectively (Gotsi et al., 2010). Research suggests that leaders must tailor their approach specifically to designers to fully realize the benefits of designers and design ways of working (Calabretta et al., 2008; Ravasi & Lojacono, 2005). Scholars advocate for greater understanding of the needs of designers (DeFillippi, Grabher, & Jones, 2007) in order to understand how to manage and lead them (Michlewski, 2008). This is particularly relevant in our context, as scholars note the importance of collaboration between team members and harmonization between ways of working on innovation projects (Calabretta et al., 2016; Calabretta et al., 2017; Miron-Spektor, Erez, & Naveh, 2011).

A designer’s identity can be multifaceted (Ahuja et al., 2017; Owen, 2006). On the one hand, a designer may align to a creative, free-spirit identity, pushing boundaries through artistic expression (Gotsi et al., 2010). Yet on the other hand, a designer who operates in an organizational innovation setting must work within the constraints and boundaries of the organization, making a contribution to organizational goals and financial targets (Beverland & Farrelly, 2007; Michlewski, 2008). We suggest that this contrast in identities illustrates the need for designers to experience both similarity-with and distinctiveness-from their other innovation team member colleagues - a ‘creative free-spirit’ identity will allow the designer to experience differences from others, thus protecting their individuality, whereas a ‘one of the team' identity will allow the designer to experience similarities, enhancing their sense of belonging.

According to literature (e.g., Brewer, 1991; Shore et al., 2011), an individual naturally looks for similarities between themselves and others in order to achieve a sense of belonging. However, they simultaneously look for distinctiveness between themselves and others to protect the uniqueness of their personal identity. Thus, designers may seek to identify as a (1) 'designer', highlighting their personal creativity, or identify as an (2) 'innovation team member', highlighting their role as part of a wider team. The former identification emphasizes difference through a unique contribution, the latter identification emphasizes a connection to their innovation colleagues, working within the same constraints as everyone else.

Paradox: Individual Identity Tensions of Similarity vs Distinctiveness

We follow paradox scholars (e.g., Cugnasen, 2017) in suggesting that needs for similarity and distinctiveness are paradoxical. A paradox relates to "contradictory yet interrelated elements - elements that seem logical in isolation but absurd and irrational when appearing simultaneously" (Lewis, 2000, p. 760). The ability to combine two separate and opposite concepts (such as the need to experience both similarity and distinctiveness concurrently) in a both/and way - rather than making an either/or choice between the concepts (known as paradox poles) - is known as adopting a paradox perspective (Smith & Lewis, 2011). Paradox literature indicates that tensions are inherent to paradoxes, and will always be felt, requiring ongoing management (Smith & Lewis, 2011). While managing paradoxes beneficially can enhance (and embed) performance outcomes, literature warns that paradoxical tensions that are managed poorly can have a detrimental impact, embedding negative responses in a cyclical manner (Smith & Lewis, 2011). We address specifically the paradox of similarity vs distinctiveness at the individual level.

The identity needs of similarity vs distinctiveness are opposite yet interrelated because an increase in 'similarity' necessarily results in a reduction of 'distinctiveness'. Thus activities designed to boost one pole will consistently detract from the other. Meeting both needs of similarity and distinctiveness therefore presents a challenge to individuals. In a study of an organizational merger, Langley and colleagues (2012) find that, to meet these identity needs, employees would make an effort to reassert distinctiveness when presented with organizational initiatives promoting similarity. Applied to our context, when the designer is encouraged to promote a sense of belonging and meet their need for similarity, highlighting their (2) 'innovation team member' identity, this would lead to a greater need of distinctiveness, or relevance of the (1) 'designer' identity. Literature notes that these identity paradoxes which juxtapose a team and individual level identity form a "paradox of belonging" (Lewis, 2000).

As with other forms of organizational paradox, paradoxes of belonging involve inherent tensions between the opposite poles of similarity and distinctiveness. These tensions will be ongoing as the actions to experience differentiation (e.g., by identifying as (1) a 'designer') necessarily affect any actions to experience similarity (e.g., by identifying as (2) an 'innovation team member'). Scholars agree that paradoxical tensions can never be fully resolved; however, tensions can be managed to achieve beneficial outcomes (Lewis, 2000; Smith & Lewis, 2000).

There are various strategies suggested in the literature to manage paradoxical poles and associated tensions. For example, a number of scholars find that "temporal separation" (Poole & Van de Ven, 1989, p. 566) - focussing on one pole and then the other - can enable a both/and outcome over time. Particularly for paradoxes of belonging, studies find that organizations engage in oscillation strategies, and with varying degrees of success and tension management (e.g., Ashforth & Reingen, 2014; Cugnasen, 2017; Huq, Reay, & Chriem, 2017).

In a study of a natural food cooperative, Ashforth and Reingen (2014) find that most members identified as either an idealist or a pragmatist, and that each of the two factions projected values onto the other faction. This large divide within the organization prevented them from engaging in synthetic both/and solutions. However, they were able to meet some of the values of both factions over time by oscillating an emphasis on one faction, and then the other.

Similarly, Gotsi and colleagues (2010) find that creatives don different "hats" in order to differentiate between their consultant (commercial) and artist (creative) identities and separate the roles in space and time. Scholars also find that managerial support may be required for a weaker (Huq et al., 2017) or lower status (Cugnasen, 2017) pole in order to support both/and outcomes. In their study of police detectives, Cuganesan (2017) notes that the balance between similarity and distinctiveness tensions is elusive, and difficult to sustain for all parties.

As Poole and Van de Ven (1989) indicate in their seminal paper, temporal separation of poles can be difficult to achieve as there may be no clear indicator for when a change is required. This can mean that one pole of the paradox becomes over-weighed with emphasis (Cugnesen, 2017), drowning out the requirements of the opposite pole, and exacerbating tensions between the poles (Smith & Lewis, 2011).

In a notable exception (which does not find the paradox of belonging managed through temporal separation), Stadtler and Van Wassenhove (2016) find that, in a study of disaster relief workers engaging in co-opetition (co-operation with competitors), actors developed a nested identity - that is they identify as 'a member of their own organization', yet within a second identity of 'a member of the disaster relief team'. However, identity literature suggests that nested identities may be problematic in the event that relations between the groups become destructive (Hornsey & Hogg, 2000).

We propose a specific strategy for managing tensions and overcoming the fractious nature of paradoxes of belonging, which synthesises the poles in a both/and way allowing identity needs of similarity and distinctiveness to be met and experienced at the same time. We describe this strategy of Dual Identification in the next subsection.

Dual Identification: An Individual-level Paradox Management Strategy

Known as "creative solutions" (Lüscher & Lewis, 2008) or "novel approaches" (Smith & Besharov, 2017) in the literature, a synthesis of both paradox poles is achieved in a way that otherwise may not have been thought to be possible due to the illogical nature of trying to combine the two opposites. Synthesis approaches represent a way of combining the opposing concepts in such a manner as to honour both concepts, consisting of both/and poles in equal measure at the same time (Lüscher & Lewis, 2008). For example, Gotsi and colleagues (2010) find that, whilst also undergoing practices which separate their roles, creatives may apply an identity label of "practical artist" in order to synthesize the paradoxical poles of creative vs commercial merit under a single identity.

A review of the literature on self-categorization has surfaced the notion of enacting dual identities, and we propose that this may serve as a synthesis of the paradoxical poles of similarity and distinctiveness. Building on Social Identity Approach (Tajfel & Turner, 1986; Turner, Hogg, Reicher, & Wetherell, 1987) and individual identity needs for sameness and difference (Brewer, 1991), Dovidio, Validzic and Gaertner (1998) conceive of an approach where individuals self-categorize and identify at two levels: (1) a concrete categorization highlighting a subordinate identity, which is nested within (2) an abstract categorization highlighting a second, superordinate identity. Dual Identification, as labelled by Hornsey and Hogg (2000), allows an individual to experience two identities at the same time - for example both (1) 'designer' at the concrete level and (2) 'innovation team member' at the abstract level - such that both similarity-with and distinctiveness-from is experienced simultaneously.

Abstract categorization into a superordinate group is characterized by targeting the overall picture, whilst concrete categorization into a subordinate group focuses on details. For example, abstract categorization would allow us to see the forest, whereas concrete categorization would induce a focus on the trees. In our context, individuals would self-categorize as an innovation team member (abstract superordinate group level) in order to feel that they are similar and part of the team, or as a designer (at a more concrete, subordinate group level) in order to feel that they are different and unique (from other superordinate group members).

Self-categorizing at both subordinate and superordinate levels simultaneously paradoxically allows individuals to experience both similarity-with and distinctiveness-from at the same time. While the individual is exacerbating similarity by adhering to a superordinate category, the individual is also exacerbating distinctiveness by adhering to a subordinate category. We interpret Dual Identification as a synthesis of these paradoxical poles due to the simultaneous presence of both similarity and distinctiveness. This model does not favour one identity over the other in the manner of temporal separation, suggesting that one has precedence over the other at any given time, but offers a dual identification of both identities at the same time. Thus:

Proposition 1: Dual Identification serves as a paradox management strategy, representing a synthesis of the paradoxical poles of similarity and distinctiveness.

We specifically present enacting dual identification as a paradox management strategy. As tensions of similarity vs distinctiveness in individuals emerge, we propose that enacting Dual Identification will assist individuals to feel the security and sense of belonging associated with the categorization process. This

certainty is expected to ease paradoxical tensions, removing the sense of "stuckness" that is associated with paradoxes (Lüscher & Lewis, 2008) by providing a way for the individual to experience both similarity and distinctiveness simultaneously.

Our proposition draws on Stadtler and Van Wassenhove's (2016) study, which finds that the nested identity allows disaster relief workers to engage in co-operation in what would otherwise be a competitive environment. Their study also notes that the organizational context, and most specifically the leadership from the CEOs set the "tone from the top" (p. 671), allowing the workers the freedom to engage in co-operative efforts.

Design leaders: Inducing Dual Identification in Individual Designers

Alvesson and Willmott (2002) highlight the role of managers in employee 'identity work' (i.e., "establishing both who one is and who one is not"; Watson, 2009, p. 446), indicating that leadership engagement with such work can positively influence workplace behaviours and enhance organizational outcomes. Leaders who engage in identity work with employees can regulate employees' identities, thus helping to reduce anxiety. However, in some cases such identity regulation can become overly constraining or dominating, limiting space for critical reflection (Alvesson & Willmott, 2002). In a study on Dual Identification, Leonardelli and Toh (2011) find that "procedural justice" (i.e., fair and equal treatment of subordinate groups) mediated cooperation effects. This suggests that leaders have a specific responsibility to enact Dual Identification in such a way that creates a fair workplace for all employees.

Design leaders must be sensitive to the style of management and leadership that designers need to perform effectively (Gotsi et al., 2010). We suggest that leadership limitations of engaging with identity work, such as unfairness or dominating approaches, will be especially constraining for designers who benefit from creative freedom (Calabretta et al., 2008; Ravasi & Lojacono, 2005), and as such emphasises the need for design leaders to engage in effective regulation of identity at the designer level.

Andriopoulos and colleagues (2017) find that within New Product Design teams, team members respond to promotion-focussed "benevolent dictatorship" management, such that designers want to be given a high degree of freedom with strong leadership. Other studies find complex identity requirements on the part of designers (Ahuja et al., 2017; Elsbach & Flynn, 2013; Gotsi et al., 2010). While designers want to be supported in their ability to make a specific artistic contribution (Elsbach & Caldwell-Wenman, 2015), literature also finds that this can lead to excessive "prima donna" distinctiveness (Gotsi et al., 2010), making them difficult and uncollaborative team members (Elsbach & Flynn, 2013). These tensions of similarity vs distinctiveness must ultimately be managed in order to avoid the vicious cycles associated with unmanaged paradoxical tensions.

As with all paradoxes, tensions related to identity needs for both similarity and distinctiveness will continue to be experienced by individual designers, and cannot be managed through a once-off approach. One of the reasons for this ongoing tension is because self-categorization is fluid and context-specific (Hogg & Terry, 2000; Hornsey, 2008), meaning that individuals may re-categorize (i.e., contemplate an alternative category) themselves into different groups and adhere to different identities in the event that other identity cues become active.

Literature emphasises the role of leaders in managing paradoxical tensions. For example, Cugnasen (2017) describes how, specifically in paradoxes of similarity vs distinctiveness, senior managers work with employees to manage tensions and engage in identity work with them. Similarly, Gotsi and colleagues (2010) find that, in a study of New Product Design consultancies, managers engage strategies to help creative designers with their identity work. While paradoxical tensions can be felt across the organization at multiple levels, scholars place specific emphasis on leaders to manage the paradoxical strategy and associated tensions (e.g., Knight & Paroutis, 2018; Smith, 2014; Smith, Binns, & Tushman, 2010). They suggest that a contingency either/or approach in leadership is insufficient to keep pace with today's dynamic ways of working (Smith, 2014; Smith et al., 2010).

These works further highlight the role of design leaders in enabling Dual Identification in designers in order to manage the ongoing paradoxical tensions of similarity and distinctiveness in designers. Thus:

Proposition 2: Design leaders who implement Dual Identification can manage tensions of similarity vs difference in designers.

We propose that by understanding Dual Identification is the outcome, design leaders can support designers in the workplace by helping them to engage with both (1) 'designer' and (2) 'innovation team member' identities. Dual Identification acts as a strategy to manage paradoxical tensions of similarity vs distinctiveness, easing tensions by meeting both/and identity needs and enabling designers to feel secure in their identity. We suggest that design leaders can do this by consistently activating both (1) the identity of the creative designer and (2) the identity of the innovation team member at the same time.

Identity Cues: Activating Dual Identification in Individuals

The use of identity cues is an important factor in activating an identity and generating saliency of dual identities, prompting individuals to adopt a relevant identity. Identity cues found in the literature include: actions (Ashforth, Harrison &, Corley , 2008), visuals (e.g., Prasch, Blijlevens, Schoormans, & Carbon, 2018; Hornsey & Hogg, 2000; González & Brown, 2003), physical location (Ashforth & Mael, 1989), and language (Elgendi et al., 2018).

The use of imagery to promote an identity is a theme in Dual Identification. For example, Hornsey and Hogg (2000) use photographs, coloured t-shirts and badges to promote identification. Prasch and colleagues (2018) find that presenting images of the subordinate categories to be activated, whilst encouraging the individual to organize those subordinate categories in a common superordinate category, can induce Dual Identification (e.g., Prasch et al., 2018). Literature also suggests that consistent imagery, such as company or team logos, can form management symbols and activate identity (Ashforth & Mael, 1989).

Paradox literature offers the use of language as a strategy to manage paradoxical tensions (Bednarek, Paroutis, & Sillince, 2016; Jarzabkowski & Lê, 2016; Sheep et al., 2017). In Lewis' (2000) seminal work, she identifies that language allows actors a way in which to think about paradoxes. Specifically, the language which is used to define concepts, allows for delineation of boundaries between what is and is not part of the concept.

In a study of two merging organizations facing a paradox of belonging, Sheep and colleagues (2017) find that actors use specific language to "talk into being" (p. 463) their paradoxical circumstances, such that the language which is used allows the interpretation of the concept and therefore suggests a way forward, justifying paths of action or inaction. Gotsi and colleagues (2010) suggest that consistency of communication from management can aid the integration of commercial vs creative identities. Other scholars studying paradoxes of belonging find that lengthy back and forth discussion is used by actors as a way of confronting paradoxical tensions (e.g., Ashforth & Reingen, 2014; Huq et al., 2017).

Further, Bednarek and colleagues (2017) find that rhetoric – persuasive discourse and argumentation – allows actors to engage in the "constant dynamic work" (p. 85) of generating both/and outcomes. Jarzabkowski and Sillince (2007) suggest that rhetoric that is context-specific and internally consistent can be effective in generating employee commitment to strategic goals. And finally, Jarzabkowski and Lê (2016) note that the use of humorous language can either shift or embed individual responses to tensions.

Drawing on both identity and paradox literatures, we find themes of both imagery and language. Thus:

Proposition 3: Design leaders that use consistent language and accompanying visual symbols which support specific identity work may enable Dual Identification in designers.

Consistently referring to identities in a both/and way through language and supported communications (e.g., through the use of phrases such as: "designers as part of our innovation team", "innovation team designers", etc.) may act as a way of contextualizing both/and in way that makes it accessible as a means of identity categorization. Further, these words may form management symbols that specifically cue work-related identities (Ashforth & Mael, 1989). Accompanying the words with specific imagery in a consistent manner may reinforce this cue, such that it forms both a language and visual identity cue.

Further, accessibility of categories can be influenced by long-term effects such as chronic use, meaning frequent activation of particular categories (Hornsey, 2008). Therefore, frequent use of dual categories may also contribute to the accessibility of Dual Identification as a means of identification. That is, the more an individual is prompted to access dual categories in relation to their identity, the more likely they may be to use the dual categorization. Hence, repeated use of particular phrasing and visuals may be used to form an identity cue that specifically enables an individual to adopt a dual categorization.

Enhanced Collaboration: Impact of Dual Identification at the Team Level

Social identity literature indicates that self-categorization has two main advantages for the individual, namely self-enhancement and uncertainty reduction (e.g., Hogg & Terry, 2000). Self-categorization into a group is accompanied by an assimilation to the group and the according perceptions, attitudes and normative behaviour. Hence, self-categorization reduces uncertainty by helping the individual to feel secure in their place within that group, and also the wider society (Hogg & Terry, 2000).

Despite the positive effects on the individual, self-categorization is associated with negative group effects such as ingroup bias. Ingroup bias is 'a form of favoritism toward one's own group or derogation of another group' (Spears, 2007, p. 2). Social Identity Approach postulates that the social groups that individuals categorize themselves into strongly influence their self-concepts (Hogg & Reid, 2006). Hence, out of a desire for positive and secure self-concepts, individuals are motivated to think of their own group in a positive way (Tajfel & Turner, 1979).

Groups differ in terms of power and/or status, and this hierarchy is usually perceived as changeable (Tajfel & Turner, 1979). Because groups are only conceived through a comparison with other groups (Tajfel & Turner, 1979), achieving or maintaining a positive distinctiveness (i.e., my group is better than your group) between groups helps to maintain positive self-concepts (Tajfel & Turner, 1979). In this way, social categorization can automatically lead to ingroup bias (Chen & Li, 2009). Individuals engage in different strategies in order to achieve or maintain a positive distinctiveness between their own ingroup and relevant other groups (according to their perceived hierarchy). These strategies can be roughly divided into two camps with one approach featuring relaxed and celebratory behaviours such as ingroup solidarity and benign intergroup competition, and the other approach being characterised by fear and destructiveness, featuring strategies like prejudice and discrimination (Hornsey, 2008).

A critical factor explaining the activation of a strategy may be identity threat (Hornsey, 2008). The literature differentiates various forms of threats to identity, for example a possible loss of status or indistinct intergroup boundaries (Hornsey & Hogg, 2000). Put in a workplace context, working together with out-group members can blur group boundaries and induce perceived threat to the own identity. This can then lead to prejudice and discrimination as a way of strengthening group boundaries (Hornsey & Hogg, 2000), thereby reducing cooperation and collaboration efforts with outgroup members. In this way, collaborative efforts can be specifically dictated by how an individual self-categorizes themselves and others (e.g., Elsbach & Flynn, 2013). Thus, individual identity work specifically affects team level outcomes.

Dual Identification addresses this issue of reduced cooperation and collaboration. It tries to foster the benefits of self-categorizing into two different groups (or identities) simultaneously. The induced dual categorization leads to a state in which both identities (i.e., both, the subordinate and the superordinate identity) are acknowledged and promoted (Hornsey & Hogg, 2000). Encouraging individuals to (re-)categorize at a superordinate level aims to re-introduce the former outgroup members as part of a new, more abstract, ingroup and therefore promotes the idea of sameness among these group members at the superordinate level. The self-categorization as an ingroup member enhances the similarity to other ingroup members (Turner & Reynolds, 2001) and extends trust to fellow ingroup members (Insko, Schopler, Hoyle, Dardis, & Graetz, 1990). Keeping the original group salient through the re-categorization process works to prevent perceived identity threat (Hornsey & Hogg, 2000). This way, as Ashforth and colleagues (2008) put it, "a strong superordinate identity mitigates ingroup bias by uniting groups under a common banner" (p. 349), without inducing identity threat and associated negative behaviours such as prejudice and discrimination.

It is this specific nature of Dual Identification - the concurrent experiencing both identities - that works to reduce ingroup bias (Dovidio et al., 1998), facilitating the creation of an environment of inclusion (Shore et al., 2011) and the development of social harmony (Hornsey & Hogg, 2000), thereby enhancing collaboration. Social inclusion is not only associated with positive consequences for individuals within organizations such as higher job satisfaction (Acquavita, Pittman, Gibbons, & Castellanos-Brown, 2009), and enhanced work attitudes and psychological health (Hitlan, Cliffton, & DeSoto, 2006). Further, social inclusion can enhance team engagement (Nembhard & Edmondson, 2006) and is found to be a prerequisite for employees eliciting their full contributions to their work team or their organisation (Ferdman & Sagiv, 2012). More specifically, social categorization in the context of Dual Identification in the workplace has been found to increase intergroup collaboration with expatriates (Leonardelli & Toh, 2011).

Paradox literature supports this, with findings that suggest a paradox strategy can enable enhanced integration and cooperation (e.g., Calabretta et al., 2017; Stadtler & Van Wassenhove, 2016). Calabretta and colleagues (2017) find that alternation of practices and adoption of a paradox perspective at a team level can help to integrate decision-making on both rationality and intuition in innovation teams. In a study of interprofessional collaboration in a health setting, Huq and colleagues (2017) note that interprofessional collaboration can itself be paradoxical due to the different ways of working that are engaged by the different groups of professionals. The research finds that a paradox perspective allows for the protection of the paradox (i.e., that both poles are important and equal) and suggests that "looking beyond the poles to focus on desired outcomes" (Huq et al., 2017, p. 529) can enable both/and outcomes for health patients.

Literature supports the view that identification can enable cooperation and harmonization in teams, and that management of paradoxes can enable collaboration. Thus:

Proposition 4: Dual Identification in designers will enhance collaboration in multi-functional innovation teams that include designers.

We propose that managing paradoxical identity tensions within the multi-functional team through Dual Identification will promote inclusion, increase ingroup bias at the superordinate abstract group level, and reduce intergroup prejudice and discrimination between designers and other innovation team members. We suggest that identifying at both, the concrete subordinate group level, and at the abstract superordinate group level, has particular relevance for designers because in addition to having designer-specific individual identity needs, their multi-functional innovation team must also operate as a collaborative team. As Calabretta and colleagues (2008) note in their study of design-oriented companies: "Team spirit is not simply a question of working together. It implies individuals' identification with the team as a whole, and with other members of the team" (Calabretta et al., 2008, p. 388). As tensions of similarity vs distinctiveness in individuals emerge, we argue that enacting Dual Identification will assist individuals to feel the certainty and security associated with the categorization process, and that this may subsequently enhance collaboration.

Future Research

In bringing together the literature on Dual Identification and paradox, we hope to inspire further insights in both areas of academic interest. While we have placed our research specifically in a design and innovation context with an understanding that designers have specific identity needs, we also see an opportunity for the cross-pollination of paradox and Dual Identification literatures to be applied to other types of multi-functional teams and/or identity contexts.

At this conceptual stage, findings are theoretical only, and further research is needed to empirically test our propositions, including our assertion of enhanced collaboration in this specific design and innovation context. Future research should concentrate on specific applications of Dual Identification through experimentation in order to assess the most effective way of activating dual identities in the workplace. While we suggest the use of consistent language and imagery, and prior research on Dual Identification has provided promising results through other strategies (Dovidio et al., 1998; Hornsey & Hogg, 2000) such as a memory game (Prasch et al., 2018), we acknowledge that other methods of generating salience in these identities may work just as effectively. We encourage scholars to draw on suggestions from both identity and paradox literatures to form their hypotheses. For example, could font type in written communications have any effect on inducing of Dual Identification?

Different methods should be empirically tested and compared their effectiveness. This way, design leaders could be presented with valuable tools to include in their management of multifunctional innovation teams. Future studies may also create other, context-specific methods to enable Dual Identification for example, within other workplace teams, sporting teams, or other group contexts. Further, through application and research in a variety of settings, scholars may also be able to determine how effective Dual Identification is as a paradox management strategy.

While our research currently highlights the role of design leaders, it could also be that future studies find that actors who are not leaders can play a vital role in enabling Dual Identification. For example, identity literature identifies "prototypical" group members (actors which display an embodiment of group norms; Hogg & Terry, 2000), and we note that, following a prototypical role model may also influence the adoption of Dual Identification in actors.

Conclusion

We seek to enhance collaboration in multi-functional innovation teams, through a greater understanding of the identity needs of designers. We propose that design leaders can engage the use of consistent language and accompanying visuals as an identity cue to enable Dual Identification in designers and manage paradoxical identity tensions of similarity vs distinctiveness. We suggest that design leaders play a key role in understanding the identity needs of designers, and that in doing so, they can enhance collaboration for improved innovation outcomes.

Through this work, we generate additional insights into both Dual Identification (and social identity) and paradox literatures. We hope to stimulate academic interest and discussion surrounding the intersection of these two areas, as well as inspire further empirical research which tests and refines our propositions.

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Design artefacts as flexible and persuasive tools for customer-centric innovation

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More organisations are adopting customer-centric innovation practices to increase business value; however, very little is known about the factors driving customer-centric innovation or the conditions under which innovation succeeds. Similarly, very little is known about the role of design artefacts as inputs in customer-centric innovation processes or as instruments that support the organisational change required for successful change. A practice-led case study was conducted to examine the role of design artefacts and to demonstrate how they are flexible and persuasive tools that mediate the social and intertwined demands of customer-centric innovation strategies. Five distinct roles of design artefacts are proposed and their value in contributing to innovation and organisational change are considered.

Keywords: design artefacts, design methods, customer-centricity, organisational change

Introduction

As a key strategic resource, the capacity to innovate has become increasingly important to commercial, non-commercial and government organisations globally. This valuable approach can improve people's wellbeing, their relationship with the environment, organisational efficacy and profitability. Much can be achieved by adopting a customer-centric approach to innovation; however, many challenges still remain (Bucolo, Wrigley & Matthews, 2012). Recent research has shown that this approach involves many aspects and relationships; for example, it can involve design processes (Dorst, 2011) and design mindsets (Schweitzer, Groeger & Sobel, 2016). Little is known about the role of design artefacts in supporting an organisation to be customer focused or the changes that need to be implemented when such a strategy is adopted.

Adding to the complexity of these issues, to date, definitions of artefacts have mostly been vague. Researchers widely agree that artefacts are essential to 'getting things done' in organisations (Knorr Cetina, 1997; Orlikowski, 2002); however, very little is known about how managers successfully use and produce design artefacts (both at the organisational and individual levels) when pursuing innovation and implementing any associated change processes. We define design artefacts as visual artefacts used within innovation and design processes and any visual objects towards which and with which individuals act. This includes only artefacts that have been made during the design process such as prototypes, customer journey maps and wire-frames and it does not include artefacts that constitute a final product or service.

We conducted a single instrumental case study (Stake, 1995) that sought to improve the ordering and activation services related to complex information technology and telecommunications products. We adopted

ethnographic and practice-led design research approaches to undertake an investigation of situated design practices in a complex practice context (Mafe & Brown, 2006). Our case study considered the role of design artefacts in relation to their social contexts. By doing so, we clarified the mediatory roles of design artefacts within customer-centric innovation processes and highlighted the potential of design artefacts to support organisational change.

Theoretical background

Customer-centricity and organisational change

Human-centred innovation is based upon 'customer insights' or the knowledge gained by interacting directly with consumers to understand their values and meaning-based needs (Beckman & Barry, 2007). In business practice, human-centred innovation' is also referred to as 'customer-centred innovation' or 'customer-centricity'. Design professionals have long used ethnographic research approaches within design practice; however, more recently, innovation and management writers have also advocated for the adoption of ethnographic approaches in relation to customer-centricity (Beckman & Barry, 2007; Liedtka & Ogilvie, 2011). Previous research has shown that design processes and artefacts are commonly applied within the business context and that design practices and tools add value to businesses (Leung et al., 2016). Numerous studies focusing on customer-centricity have shown that the application of design tools and methods (e.g., 'personas', 'prototyping', 'scenarios' and 'customer journey maps') are endemic in design practice. These valuable methods provide deep insights into customer needs and inform human-centred innovation processes (Manning, Bodine & Bernoff, 2012; Schrage, 2006). Further, customer-centricity is critical to gaining a competitive advantage in business (Galbraith, 2005; Manning, Bodine & Bernoff, 2012).

However, in both the design and business literature (and in practice), understandings of how customer-centricity is enabled within organisations are limited (Johnston & Kong, 2011). Adopting a customer-centric perspective, requires epistemological and attitudinal shifts (Dunne, 2011). Thus, if customer-centred innovation is to be achieved, organisational transformation is also required. This could include changes to culture, processes and structure that are both challenging and time consuming. Recent studies identified some of the relationships between design (thinking) practices and organisational change and culture (Buchanan, 2015; Elsbach & Stigliani, 2018). However, understandings of the role of design artefacts in facilitating changes towards customer-centricity remain limited.

Design artefacts as boundary objects

Design artefacts help to get things done. Previous research has shown that material artefacts play important mediatory and enabling roles in organisational and inter-organisational innovation processes (Rafaeli & Vinai-Yavetz, 2004a, 2006). The effects of different artefacts (e.g., Gantt charts, texts and documents, visual representations and drawings) have been analysed. Such artefacts can be used in organisational learning, knowledge and management (Hutchins, 1995; Wenger, 1998, 2000) or as collaboration enablers (Star and Griesemer, 1989), coordination devices (Henderson, 1991) and as socio-material objects that mediate the social and material nature of work practices (Orlikowski, 2002, 2006, 2007). However, previous studies have largely focused on how materiality and artefacts support product development processes.

Among people, artefacts facilitate knowledge sharing and transformation and play practical, political and persuasive roles (Kimble, Grenier & Goglio-Primard., 2010). The idea of an 'artefact as a boundary object' explains the different roles of artefacts and the implicit functions of an artefact in social mediation. Boundary objects refer to the brokering and boundary spanning capabilities of artefacts across functional domains within collaborative work (Star & Griesemer, 1989). Boundary objects create a shared language for individuals and allows individuals to represent their knowledge. Boundary objects also provide individuals with a concrete means for specifying and learning about any differences, dependencies and what is new across a given (knowledge) boundary. Additionally, boundary objects facilitate the process by which individuals transform the knowledge being used and apply what they know to transform existing problem-related knowledge (Carlile, 2006).

Carlile (2002) outlined the two key tenets of boundary object artefacts: i) boundary objects are practical, as they enable a shared means of representation and a specification of any differences at the boundary; and ii) boundary objects are political, as they facilitate knowledge transformation. Thus, if innovation requires

boundary spanning, the act of deciding which artefacts to share and with whom and when could be both a practical and political decision. Wenger (2000) conceptualised these decisions as brokering or processes of translation, coordination and alignment between perspectives. Brokers move knowledge from one place to another and bring back news from the forefront (Wenger, 2000).

Designers as knowledge brokers

Designers who create and employ artefacts can be considered 'knowledge brokers' (Hargadon & Sutton, 2000), who use boundary objects to broker customer-centric knowledge. Designers use artefacts as conscription devices (Henderson, 1999) to enlist participation in organisational settings. Wagner (2000) discussed the significant and persuasive roles of artefacts in collaborative work. Similarly, artefacts are also critical to customer-centric innovation contexts in which they function to mediate social and political processes and collective actions.

Understandings of the enabling roles of artefacts in organisational contexts is well established; however, understandings of the enabling roles of artefacts in organisations attempting to move towards customer-centricity remains limited and vague. Thus, this case study sought to determine if and how design artefacts could be used to support the organisational change required to design and deliver customer-centric products and services. To answer these questions, we adopted a theoretic perspective of design artefacts as boundary objects and acted from the understanding that the designer is the knowledge broker in the context of organisational change towards customer-centricity. We also examined the role of design artefacts as flexible tools that mediate the social and interlinked demands of innovation initiatives in a specific organisation.

Studying how designers (and non-designers) consider and use design artefacts will increase knowledge of the enabling and mediatory roles of both design practices and artefacts in complex social innovation contexts (the very situation that countless organisations are presently facing). The central objective of our research was to gain a better understanding of how design artefacts function to facilitate and motivate collective action and enable communication and transformation.

Methodology

A single in-depth case study was conducted to examine the role of design artefacts and understand whether and how they support customer-centric innovation. The organisation selected for the case study had a confident strategic intention to pursue customer-centricity. This allowed us to undertake a deep analysis of the contextual factors affecting the roles of a range of artefacts.

We also adopted a researcher-as-instrument (Robson, 1995) approach. Under this approach, the researcher was the lead designer of the case project and the researcher's relationships with those being investigated were examined (MacDonald, 1994). Multiple data collection methods and sources were employed, including participant observation, qualitative interviews, document collection and the use of thick descriptions (Geertz, 1973). Additional data sources included intranet and public website content, emails, field notes, physical artefacts, memorandums and artefacts produced by other designers for other projects.

Sampling was opportunistic (Miles & Huberman, 1994). This was not ideal; however, due to the covert nature of the study, it was the only approach available. The researcher's manager was aware of the study. The research was hired as a contractor and her manager felt that it was simpler to keep the study covert and anonymise all data. In the early phase, we had limited access to conduct interviews with diverse organisational members, most notably members of the senior leadership team. These interviews provided insights based on a restricted representation of perspectives. To gain further valuable insights, we also obtained additional perspectives from stakeholders at different levels of seniority, including general managers, mid-level managers, project leads, contractors and specialist permanent staff. At the end of the project we assumed an overt role. This allowed us to conduct further interviews with the participants of the final project presentation, who had been invited to participate in the study.

Semi-structured interview guides and a detailed research protocol (Yin, 2003) were used to conduct a total of 13 interviews over two years. The majority of interviews occurred within three months of the final delivery of the project results. Follow-up interviews were also conducted with three participants some five to six months after the project had been delivered.

The activities and contextual factors associated with the defined activity systems (i.e., the individual, team, project and organisational activities and contextual factors) were considered during data collection and analysis. Participants were asked to describe any challenges they experienced when undertaking their work activities. This question enabled participants to explicate any contradictions located within the different activity systems (Engeström, 1999). Data were collected and iteratively analysed over an 18-month period that comprised three distinct phases, each of which used different approaches. The reason there was a long duration for data collection was because the project took 12 months to get funded.

For the data analysis, a constructivist grounded theory approach was adopted (Mills, Bonner and Francis, 2006), as the study relied on predefined theoretical concepts. Different analytical procedures were applied to each phase of the research, including concurrent collection and the coding and double coding of data (Krefting, 1991). The researcher was the sole data analyst.

The case: Redesigning online order and activation processes

This case study was conducted at an Australian ASX-listed company with over 40,000 employees. The company offers a broad range of technology products and services. Two years before the project commenced, the company had appointed a chief executive officer who was committed to building a customer-centric organisation. The organisation were commonly employing human-centred design approaches for product and service development and had several dedicated design teams. While this context created favorable conditions for design experimentation, it also creates a limitation for replicability of the fi

The business strategy motivating this project was to improve the online ordering capability of a specific group of business-to-business customers, who were responsible for on selling products. The project team adopted a customer-centric approach to design new online ordering and activation services. The researcher was hired as a 'customer-centred design lead' to work with the internal user experience group for five months.

The objective of the project was to deliver a conceptual design, including wire-frames (i.e., blueprints or visual specifications for online services) to improve online ordering. The project deliverable would support the development of a business case study so that a project team could be established, and the solution brought to market.

The key sponsor of the project was the design director; however, there was an implied and strategic obligation to also connect with other stakeholders who would potentially fund and build the suggested solution. Given that the lead designer's tenure at the company was short, it was also important that the knowledge related to this project was codified and transferred in an accessible way.

- **The Listening Phase.** During this phase, the design team set out to i) understand the current processes for ordering and activating products as experienced by internal staff and customers; ii) consider existing challenges with internal systems that may be common to both staff and customer groups; iii) understand customer work contexts and their dependent organisational processes; and iv) understand customer challenges and needs. The team used 'affinity diagramming' to gain insights and show that the current ordering systems and processes required improvement.
- **The Defining Phase.** During this phase, the lead designer created artefacts for 'design synthesis' and 'reflection-in-action'. Specifically, the designer considered the information needs of different stakeholders and created distinct artefacts to satisfy specific information needs and preferences. During this phase, team members engaged in iterative sketching and conducted a workshop with 10 business customers, where participants reviewed and refined preliminary sketches for a web portal. The team then transformed the designs into more detailed wire-frames.
- **The Delivery Phase.** During this phrase, the project outcomes were shared in a meeting with 40 internal stakeholders via video and telephone conferences. The project deliverables were hosted on a website that could be accessed online during the meeting.

Table 1 summarises the different activities and artefacts associated with the different phases of the project and Table 2 lists the project artefacts as they were shared.

Table 1. Activities and artefacts delivered in different project phases.

PHASE	*ACTIVITY*	*ARTEFACTS*
Listening Phase	Stakeholder qualitative research	Research report
Defining Phase	Data synthesis and artefact creation Iterative sketching (wire-frames) Codesign workshop	Opportunity maps Personas Customer journey maps Research videos Infographic Function overview Wire-frames User stories Video prototype Future storyboard Quick Wins
Delivery Phase	Communication of findings and deliverables via email and a presentation	PowerPoint presentation HTML deliverables site

Table 2. Overview of project artefacts.

ARTEFACT	*DESCRIPTION*
Research report	The research report communicated the key insights about the user group mapped to the associated findings and recommendations. Insights comprised broad generalisations. The findings provided evidence of the insights. Additional information was provided and recommendations (e.g., suggestions of things to change or do) were made to address the insights and findings. The artefacts documented the findings and substantiated the design recommendations in a format common to the organisation.
Opportunity map	Visual maps were constructed to understand customer work activities. The initial freehand sketches were later translated into designed artefacts. One illustrates the activities of the customers and the other identifies high-level capabilities to support these activities, including a summary of the benefits to the organisation. Initially created as conceptual tools to consider and synthesis customer needs, these maps were used to document and communicate the work activities of customers and identify opportunities for service improvement.
Persona	Three personas were created to reflect three different customer types based on the type (and complexity) of the products sold. Personas were intended to inform future design work relating to both this initiative and these customers.
Customer journey maps	Data from the internal workshop and qualitative interviews were translated into customer journey maps, including maps of the tasks, artefacts, systems and tools used. Customers' needs, pain-points and opportunities were then mapped to the different stages of the customer journey. Three maps representing the ordering and activation processes for three distinct products communicated the complexity of the existing processes. The maps provided a framework for the organisation to reconsider associated processes and systems.
Infographic	The infographic translated complex quantitative data to a broad audience group in an accessible way. It presented the number of support calls made to the customer call centre, information about the associated revenue derived by the organisation in relation to each product and the number of customers per state. It illustrated statistics

ARTEFACT	*DESCRIPTION*
	by showing that i) the customer group contributed a significant amount of revenue to the organisation; and ii) if the organisation improved their ordering services, the call centres would become more efficient and the organisation's net revenue would consequently increase. This artefact was a persuasive artefact, as it illustrated the potential value of investing in a revised online ordering service.
Research video	Two 1.5-minute research videos were created on the qualitative research that was undertaken. Each video displayed 8–10 verbatim quotes from various staff and customer research participants. These videos sought to create empathy for customers and simply and persuasively communicate the issues consumers encountered when ordering products. The videos revealed issues with the current ordering processes and which tools were onerous.
Function overview	The function overview provided a brief summary of the functions for the recommended portal. It mapped opportunities identified in the opportunity maps. It sought to provide an easily digestible overview of the proposed organisation's service capabilities.
Wire-frames	A series of annotated wire-frames were delivered as a PDF file to visually communicate the features of the portal rather than specific patterns and interactions.
Video prototype	In the video prototype, a user called 'Janine' talked the audience through an animation of wire-frames, describing a proposed system in terms of its benefits. These benefits addressed many of the pain-points expressed by other artefacts (e.g., the journey maps and personas). The lead designer was of the view that wire-frames were not easily accessible to non-technical audiences. Thus, the video prototype was created to present the designs in an accessible way that was appropriate to a broad range of stakeholders.
User stories	Agile user stories (e.g., 'As a customer I can check the status of an order, so that I can arrange access for technicians installing network infrastructure') were set out in an Excel spread sheet to correspond with the features in the wire-frames. The user stories sought to communicate the scope of the design and required technical integration to enable the development of the project management staff.
Quick wins	In an Excel spread sheet, the quick wins (i.e., the actions that the organisation could implement immediately to improve the existing service for a group) were listed. All of these quick wins could be executed immediately and without funding.
Future storyboard	Two future storyboards (depicting the scenarios in use) showed a tracking feature and a mobile ordering process using a tablet. These artefacts communicate service concepts in relation to their use context.

Data Analysis and Propositions

We found that the use of design artefacts in customer-centric innovation activities leads to organisational change. Design artefacts play an important role in organisational change, support social mediation and are critical in enabling and mediating change. We contend that design artefacts have five significant and distinct socio-political and sociocultural roles. Specifically, we argue that design artefacts: i) act as customer empathy enablers; ii) act as collaboration facilitators and activators; iii) provide reflective sense-making frameworks; iv) are persuasive tools; and v) are design and customer-centric knowledge communicators. We explore each of these five roles and discuss their relationships with customer-centric innovation and organisational change in relation to the case study, making five propositions. These roles pertain to use by designers as well as other organisational members.

Proposition 1: Design artefacts function as customer empathy enablers

Participants in this study agreed that adopting a customer-centric perspective was vital to company processes; however, like participants in previous studies (e.g., Galbraith, 2005, Shah et al., 2006, Meyer & Schwager,

2007), the participants in the present study did perceive the shift towards customer-centricity as challenging. Participants also reported that creating project artefacts (e.g., personas), rather than writing bullet point lists for Power Point presentations, gave the customer research a human voice and face and communicated customers' frustrations and needs in an accessible and engaging way. Personas were considered particularly instructive in communicating information about customers' behaviours and qualitative and behavioural information from customers' perspectives.

When reviewing the videos created from customer interviews, another key artefact in the study, participants noted that they felt more directly engaged with the artefacts and unlike documents, which have to be read, it was impossible to scan videos. Videos evoked much more direct exposure to customer pain-points. Notably, the use of first person verbatim quotes facilitated customer empathy while the visual artefacts motivated sharing between formal and informal social networks. Thus, evidence was found for the effectiveness of design artefacts and their value in understanding customers and creating empathy. Additionally, participants noted that the engaging visual formats would be useful in aiding cultural change within the organisation.

Other authors have considered how design artefacts can evoke feelings of empathy (e.g. Van Rijn et al., 2011). However, in this case study, we found that organisational outcomes required the collective participation of many people and that empathy was not only valuable within the design team, but also affected people involved in other projects. Due to their aesthetic dimensions, design artefacts link with subjective emotions, empathy, intuition and judgement (Fulton Suri, 2008; Rafaeli & Vilnai-Yavetz, 2004b). Participants in the current study noted how the novel visual formats of the artefacts motivated them to share information with their colleagues. The rich visual design of the artefacts addressed a number of issues related to less engaging formats and encouraged feelings of customer empathy across broad organisational audiences.

Customer empathy encourages customer-centric judgements, behaviours and the advocacy required to implement innovative changes, such as changes to processes and organisational structures (Manning, Bodine and Bernoff, 2012). As a connectedness organising mechanism, empathy can assist staff members to recognise the interconnectedness and inter-relationships between collective actions (Pavlovich & Krahnke, 2012). Empathy also facilitates shared meanings that can create, sustain or change organisational cultures (Cook & Yarrow, 1993).

It is contended that design artefacts can motivate customer-centric collective actions by facilitating far-reaching empathy for customers and enabling customer-centric judgements and behaviours. Design artefacts can shift thinking from matters of sheer usability towards a deeper understanding of human dignity and thus positively affect the thoughts and actions of individuals (Buchanan, 2015) in support of customer-centric collective outcomes.

Proposition 2: Design artefacts facilitate and activate collaboration

Participants in this study reported that collaborations among cross-functional business groups were critical to innovation processes. In this case study, participation in the project activities was mostly voluntary; however, the design artefacts also activated the involvement of non-designers in the company. Many participants noted that encouraging other colleagues to contribute and their overall engagement with and advocacy for the innovation initiatives was both critical and challenging.

Artefacts, such as videos and presentations, were shared with managers from other areas to communicate issues related to poor customer experiences and gain their support. After the project was completed, some artefacts stimulated the interest of several other stakeholders in the project and its outcomes. This ultimately led to the development of more ideas and associated change processes.

Using the artefacts to activate collaboration and participation in the innovation context of the project was critical. Motivated by human agency (Maidique, 1980; Rogers, 1995), team members became change agents who enacted change by interacting and networking within and across the organisation. Thus, it appears that by creating empathy, the artefacts motivated and activated collaborations.

Thus, the artefacts mediated the dialogue between designers and other members of the organisation by codifying and communicating knowledge. Visual artefacts (e.g., customer journey maps) provided the bases for discussions about customer-centric changes beyond the project context. For example, one process improvement specialist stated that she would use artefacts within workshops as a 'springboard' for conversations about improvements related to other associated processes.

Artefacts transform understandings and actions by enabling people to identify contradictions and uncertainties related to organisational processes (Engeström, 2001). Artefacts are not merely static knowledge repositories (Carlile, 2002); rather, artefacts are dynamic and active tools. Individuals use 'artefacts of knowing' (Ewenstein and Whyte, 2007) to exemplify, translate and contribute to their understandings. When mediated by artefacts, knowledge and activity and communicative actions (Orlikowski, 2002) transform and facilitate innovation (Dasgupta & Gupta, 2009; du Plessis, 2007). Proposition 2 describes the mediatory and enabling role of artefacts.

Proposition 3: Design artefacts provide reflective sense-making frameworks

We observed that members of the project team used artefacts as reflective sense-making tools to understand, frame problems and communicate. Sense-making refers to the process by which individuals or groups make sense of information. The artefacts (e.g., the opportunity maps or journey maps) created for this project assisted non-design staff members to understand and appreciate new models for thinking about customers and the difficulties that customers face using the current products and services.

For example, the lead designer created opportunity maps and personas to help demonstrate the work practices of customers and conceptualise how the organisation could add value to these practises for customers. These artefacts were initially used to understand the context and needs of customers; however, they evolved throughout various consultations until they ultimately served as a framework for reflection and a synthesis of key customer tasks, needs and improvement opportunities. Thus, the artefacts became structures through which the design team could reflect and refine their understandings of the project. Similarly, the journey maps were used to combine different data into one visual artefact over time. This enabled the team to synthesise, consider and talk and gain insights into the data and allowed non-design staff members to understand current user experiences and related systems. The journey map was used by another staff member, working in an operational capacity, to 'springboard' conversation about process changes in workshops not related to the digital product.

The value of visual practices in sense-making and synthesis is well established (Kolko, 2010; Krippendorff, 1989). Such practices enhance sense-making processes by making the abstract more concrete, improving communication, building knowledge and enabling complex and non-tangible concepts to be understood (Michela and Floricel, 2012; Oster, 2009).

The visual artefacts in this study aided sense-making, shifted mental models and supported organisational change processes (Senge et al., 2005). Further, sharing within and between organisational networks led to collective sense-making (Orlikowski, 2002). The design artefacts provided cognitive frameworks to various actors, supported problem-framing processes (Beckman & Barry, 2007; Dorst, 2011) and enabled the organisation to identify and solve customer problems and innovate. Thus, as suggested by Proposition 3, artefacts are valuable 'things-to-think-with' (Brandt, 2007).

Proposition 4: Design artefacts play persuasive roles

In the case study, artefacts assumed an implicit persuasive role. From executives to the frontline staff delivering the products or services, from the staff involved with implementation to customers—every stakeholder needs to be engaged, informed or convinced in some way at some point. Team members employed artefacts as persuasive tools. For example, some team members used the artefacts to encourage senior executives to fund the project while others used the artefacts to support their recommendations.

Additionally, team members found that the artefacts were very effective in communicating key issues and complex financial information. For example, the infographic clearly showed the financial benefits related to funding the proposed platform while the videos provided evidence as to why the ordering service needed to be improved. Wagner (2000) suggests 'persuasive artefact', however, her observation is based on collaborative architectural work within a single community of practice. Conversely, in the present study, we observed that artefacts enable social mediations between communities of practice across long-term innovation initiatives.

This study also revealed how artefacts play political roles. It was challenging to engage different stakeholders early on in the project. One participant emphasised the importance of gaining support from the 'right' stakeholders to progress a project and noted that the videos had been very helpful in increasing the interests of stakeholders. Many reported that collaboration was challenging to orchestrate between different business

units within the organisation. The research videos were used to persuade an executive to prioritise this program and mandate that his staff engage with the design team. Thus, brokering artefacts to stakeholders at different times represents a political activity (Carlile, 2002; Kimble, Grenier & Goglio-Primard, 2010). It has been suggested that politics only play out during the final phases of a project (Carlile, 2004); however, we found that politics and the management of social relations were significant throughout the project. Thus, artefacts play important, persuasive roles in the innovation, design and implementation phases of projects. Artefacts also affect project advocacy, project continuation, consensus building, knowledge sharing and organisational change processes.

Proposition 5: Design artefacts effectively communicate customer-centric and design knowledge

In this case study, the project participants used artefacts to effectively communicate a customer-centric perspective. For example, the participants showed videos of customer interviews to executives, national sales staff and call centre representatives to demonstrate customers' perspectives. Both videos and personas were used to educate new staff about customer characteristics and needs. Further, even after the project had finished, members of the organisation continued to use the same artefacts to describe key customer attributes. Management theory supports the role of artefacts in organisational learning. Indeed, organisational learning often rests upon social processes that are mediated by artefacts (Boreham & Morgan, 2004; Weick & Roberts, 1993).

The artefacts were also used tactically (to explain the 'how') and strategically (to help individuals to envision 'what could be'). For example, a conceptual video prototype, which had been created to explain the design concept to staff members with no or limited technical knowledge, was later used to share a customer-centric vision to the organisation. Thus, artefacts can function to motivate action, enable strategy (Spee and Jarzabkowski, 2009) and bridge current and future states. Artefacts are often used to share a future vision, activate participation, collaboration, advocacy and internal alignment because of their engaging visual form. In the case study, the artefacts linked specific actions or outcomes to a broader strategic narrative.

When artefacts are shared voluntarily and talked about widely, they can become mechanisms to express culture and enact change (Carlile, 2006). For example, in this case study, participants recalled how they learnt about the project 'road show' via formal and informal networks. This illustrates the social character of knowledge sharing and the value of social networks in distributing knowledge within organisations (Dasgupta and Gupta, 2009; 1995; Lave & Wenger, 1991). Artefacts can become symbols of a new customer-centric culture (Boreham & Morgan, 2004) merely by being discussed. Thus, design artefacts appear to strengthen informal work relationships, organisational learning and cultural transformations towards customer-centricity.

Overall, we found that customer-centric knowledge, expressed via engaging and accessible design artefacts, provided the organisation with new and effective boundary objects, which allowed people to engage with, talk through and discuss customer-centricity. Thus, artefacts played enabling roles, acted as change agents and supported innovation and transformation.

Conclusion

This study sought to explore the value of design artefacts in creating customer-centric organisations. In this paper, five distinct roles of artefacts were considered. By virtue of their rich, visual, novel and engaging formats, artefacts are likely to be shared more easily in informal organisational arrangements (e.g., among cross-functional teams). Artefacts provide an accessible and applicable way to communicate tacit needs and other customer-centric insights. Artefacts inspire customer-centric behaviours and stimulate cultural shifts in organisations. Thus, our findings generally showed the value of design artefacts in customer-centric organisational change. However, further empirical research is required to validate the propositions developed in this paper and to determine the conditions under which design artefacts enable customer-centric organisational change.

Our research raises a number of questions about the factors and capabilities needed to transition to customer-centricity using design artefacts. Factors such as knowledge management capabilities, organisational culture and absorptive capacity (Cohen & Levinthal, 1990) could affect the ability of design artefacts to impact organisational transformations. Additionally, artefacts need to be recognised and promoted by leadership

(Aftab 2012). Executive support for the use of design artefacts shows their widespread use and effects (Bailey, 2012).

Organisations need to develop the necessary capabilities to use design artefacts as mediatory and enabling tools. Training and participation in design processes can facilitate familiarity with customer-centric design artefacts (Junginger, 2005). For example, this case study informed the creation of a pedagogical framework that was designed to support the development of design artefacts (Wechsler, 2017).

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Research Perspectives IN THE ERA OF Transformations

Exploring the Design Space of Innovation Canvases

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Designerly innovation tools, such as canvases, are widely used for facilitating team and collaboration processes. This paper outlines the potential design space of such innovation canvases. Based on a systematic analysis of 123 existing canvases we developed a morphological box that distinguishes between six different parameters identified as relevant: (1) addressed process step, (2) involved media, (3) sequence of use, (4) available instructions, (5) number of elements, and (6) design specifics, as well as possible choices among them. The analysis also yielded several research gaps. Furthermore, we present an in-depth discussion of the possible theoretical underpinnings of innovation canvases and summarize them in a theoretical framework. The results of this paper provide references for other researchers and practitioners to better understand working mechanisms and fields of application of existing canvases and for developing such visual innovation tools for their own purposes.

Keywords: Visual Innovation Tools, Canvas, Design Management, Innovation, Review Paper

Introduction

Since the introduction of the 'Business Model Generation' book in 2010 (Osterwalder & Pigneur, 2010), the related poster-based Business Model Canvas (BMC) is widely used in companies and startups for "describing, designing, challenging, inventing, and pivoting business models" in a co-creation approach (Strategyzer, n.d.). The Business Model Canvas is a poster-based graphical framework consisting of several boxes ('building blocks') that can be filled by the users according to printed prompts. The provided framework deconstructs the overly complex task of developing a business model into smaller components, which simplifies the process also for non-experts. This novel approach completely changed the way how business ideas and business plans are developed. Writing an entire business plan had been particularly challenging for startups and founders who did not have a business background, whereas the BMC provided some sort of guided shortcut.

We consider the Business Model Canvas a designerly innovation tool because (a) it guides the creation of something new—in this case an innovative business model, (b) it is presented in a designerly form—a graphical framework, and (c) it facilitates co-creation processes with different stakeholders or within diverse design teams—an approach typical for the design thinking and service design disciplines.

The Business Model Canvas has become a quasi-standard innovation tool for founders and innovators who want to flesh out their business ideas. According to the inventors, by today the Business Model Canvas is used by more than 5 million people worldwide (Strategyzer, n.d.). It comes as no surprise that the canvas approach has been picked up by innovators from various disciplines. As of today, Roberts (2016) has collected a total of

100 canvases for different purposes in his Blog. It seems that there exists a canvas for almost any business- or innovation-related activity.

We define a canvas as a two-dimensional, poster-based tool that guides a heterogenous team with a particular challenge or task. Typically, it is presented a graphical framework that decomposes a complex topic into several smaller clusters, and hence offers simplification and guidance. A canvas provides blank areas to be filled by the users, in order to invite co-creation activities and team work. However, the overview of 100 canvases collected by Roberts (2016) revealed that although many canvases follow the basic structure of the BMC, there exist minor or major differences in number of boxes, alignment, use of symbols or visual metaphors, use of color, provided instructions, and so on. This *design space* is the focus of our study. We define a design space as the conceptual solution space including various design parameters and the possible choices among them (Maclean & McKerlie, 1995).

However, relatively little research has been undertaken yet, to deconstruct the visual elements of a canvas and to explain their working mechanisms and theoretical underpinnings. Such information might help users identify the appropriate tool for their own innovation purposes and hence improve their innovation efforts. This paper tries to provide the readers with the required information for these tasks. Hence, the following research questions guided our study:

> *(1) What parameters and possible design choices (that is, the design space) exist for visual innovation canvases?*
>
> *(2) What are possible theoretical underpinnings that could explain the impact of particular canvas designs?*
>
> *(3) What research gaps can be found when looking at existing innovation canvases?*

We start this paper by presenting a brief overview of related work on visual canvases. Afterwards, we describe our methodological approach: We developed our data source of 123 canvases by expanding the existing list of 100 canvases (Roberts, 2016) through a systematic literature search to include also scientifically developed canvases. Subsequently, we describe the artefact analysis process of the included 123 canvases. The contribution of this paper is spread over the subsequent three sections: (1) The section *Design Space of Innovation Canvases* presents a morphological box that outlines the design space of visual canvases, according to six emerging categories. This morphological box was derived iteratively by a systematic artefact analysis of 123 existing canvases. (2) In the section *Canvas Analysis Results* we report on insights gained from the quantitative analysis of the 123 canvases and present several identified research gaps. (3) To illustrate the possible benefits and working mechanisms of a canvas, we present a *Theoretical Framework of Canvases* that constitutes a bricolage of related theories that form the theoretical underpinning of the impact and usefulness of visual canvases. We conclude by discussing the limitations of this work and potentials for future research.

Related Work

Many visual innovation tools follow the example of the Business Model Canvas (Osterwalder & Pigneur, 2010) and present a one-page, poster-based canvas with several graphical boxes and prompts to be filled with specific information, either handwritten or using sticky notes. They are often intended for collaborative team work (involving approximately 5–6 people) and displayed wall-mounted. Often, they are accompanied by printed instructions—in the case of the Business Model Canvas, the users are offered an entire book (Osterwalder & Pigneur, 2010), explaining the usage of the canvas in detail. When looking at other innovation tools there are several that also follow a canvas-approach and a similar layout as the Business Model Canvas but address different topics. For example, the Project Canvas (Habermann, 2014) was developed to strategically plan a project, Business Model You (Clark, Osterwalder, & Pigneur, 2012) facilitates some sort of self-reflected career planning, The Team Alignment Map (Avdiji, Elikan, Missonier, & Pigneur, 2018; 'Team Alignment Map', n.d.) facilitates team building, and the Value Proposition Canvas (Osterwalder, Pigneur, Bernarda, & Smith, 2014) focuses on identifying user needs and matching the benefits of the service or product.

In the design field, graphical frameworks and poster-based canvases are commonly used tools for example to elaborate intangible services, such as Service Blueprints (Shostack, 1984), or to map user journeys. Some approaches expand the canvas paradigm further in various directions. For example Joyce and Paquin (2016)

added several vertical and horizontal layers to the Business Model Canvas in order to expand its scope. But there are also visual innovation tools that follow a completely different layout and involve different media. For example, Lego® Serious Play (Lego Serious Play, 2006; Kristiansen & Rasmussen, 2014) makes use of Lego bricks in order to build three-dimensional representations of business ideas or other mental models, working with metaphors. Usually it needs a trained facilitator to guide the very flexible approach. The method does not provide templates or canvases but rather suggests to work in three-dimensional metaphors and spontaneously create one's own canvas, if required. SAP Mosaic (SAP AppHaus, n.d.) lets users create their own canvas on brown paper. Some tools also involve other media, such as digital extensions, stickers, or inspirational card sets.

For the user this broad variety of existing canvases and other innovation tools can be quite confusing. It might be difficult to choose the appropriate tool for one's own purpose, and even more challenging to develop one's own tool, if an appropriate solution is not yet existing or if a customized tool appears to be necessary. Avdiji, Elikan, Missonier and Pigneur (2018) suggest three principles for developing visual canvases, such as the Business Model Canvas, namely (1) ontology-creation, (2) creating a shared visualization, and (3) provide collaboration possibilities. However, they do not provide any particular guidance on how to exactly design those tools. Eppler and his colleagues (Martin J. Eppler, 2003; Martin J. Eppler & Hoffmann, 2013; Martin J. Eppler & Kernbach, 2016) presented various research studies on visual representations with a particular focus on digitally enhanced visual tools. Eppler (Martin J. Eppler, 2003) discussed the advantages of visual metaphors in templates for the communication of knowledge. Eppler and Kernbach (2016) introduced the term 'Dynagram' for dynamic, software-based diagrams that facilitate team interactions in design thinking processes. Specifically, they investigate a diagram's capability to capture knowledge, to facilitate team discussions, and to provide added value in the joint analysis. Eppler and Hoffmann (2013) presented a set of visual solutions for developing business models, found in literature. To the best of our knowledge there exists no systematic overview of different parameters for visual canvases, which we present in this paper. Our suggested morphological box can be considered a foundation for the future development of canvases by outlining the relevant parameters and possible design options

Methodology

Data Source of 123 Canvases

The sample of 123 canvases that were included for our analysis were selected based on a three-step search process, as shown in Figure 1: First, we included the 100 canvases provided in the 'Canvas Collection' by Roberts (2016), which he collected based on a co-creation approach together with the readers of his Blog. Second, we conducted a systematic literature search within the Scopus database with the search terms "Canvas AND innovat*", which resulted in a total of 315 sources. Through this procedure we wanted to identify additional innovation-related canvases that were discussed (but not developed) by the scientific community. In a third step, we conducted another literature search in the Scopus database with the search term „Canvas AND Introduc*", which returned 393 sources. Through this step we wanted to identify additional canvases that were newly developed by the scientific community.

The resulting 708 additional sources were narrowed down to 49 through discipline filtering within Scopus and through title- and abstract-based analysis (selection criteria A). We excluded non-related disciplines (such as medicine, music, or chemistry), sources that addressed canvases in a metaphorical, artistic, or archaeological sense (e.g. "painting on a blank canvas") , as well as sources that discussed canvases in different media ("human skin as a canvas for tattoos", "textiles as canvas for embroidery", "digital canvases", etc.). This step left us with 20 sources, which were then analysed through full-text analysis (selection criteria B). Here, we excluded sources that simply applied existing canvases such as the BMC (e.g. as a case study), as well as sources that misleadingly labelled other types of diagrams as canvases (e.g. simple metrices or synthesis models that were not intended for poster-based printouts and collaborative activities). Any variation of an existing canvas was considered a new one. An additional co-citation analysis yielded in another 7 sources that were included. Finally, we excluded 4 redundant papers from all three steps (selection criteria C). this entire process yielded in 123 canvases that were included in our final analysis. Figure 1 illustrates our systematic search and analysis funnel.

Artefact Analysis

Subsequently, we followed a systematic artefact analysis process as suggested by Froschauer and Lueger (Froschauer, 2009; Froschauer & Lueger, 2016), which consists of three steps: (1) Descriptive analysis of the artefact (materiality, inner structure, and conditions for existence), (2) Analysis of embedded meaning in the organisation (social relevance, contextual analysis), and (3) reconstruction of underlying organisational structures (production, effects and functions, use). In the first step we analysed the visible structure and appearance of the 123 canvases (number of elements, layout, colours, etc.). In the second step we analysed the artefact in terms of its social context and meaning. This step involved interpretations of assumed usage scenarios, based on given instructions (if any), and the canvas title. More specifically, we located the intended usage of the artefact in one particular stage of the innovation process. In the third step, we analysed potential team behaviour and motivations through the canvas, based on visible prompts, trigger questions, and visual metaphors (if any). Insights about the production process of the canvas could be inferred through the presence of supplementary publications (if any). If a production date was mentioned on the canvas or in the publication, this was recorded as well.

The artefact analysis was conducted by two researchers in an iterative process. While going through the list of 123 canvases we coded each canvas according to emerging categories. These categories were recorded in a table and updated iteratively, whenever a new category emerged. Any disagreements between the two researchers were discussed until an agreement was found.

The artefact analysis revealed that several canvases were not related to any innovation activities or processes. Instead, they addressed general managerial issues, such as project planning, team building, or change management, as well as other topics unrelated to innovation, such as ethics. We excluded a total of 55 canvases that addressed such unrelated areas from our final evaluation, because we were particularly interested in the capabilities of a canvas to facilitate *innovation* processes. Figure 1 illustrates the entire literature search and analysis funnel.

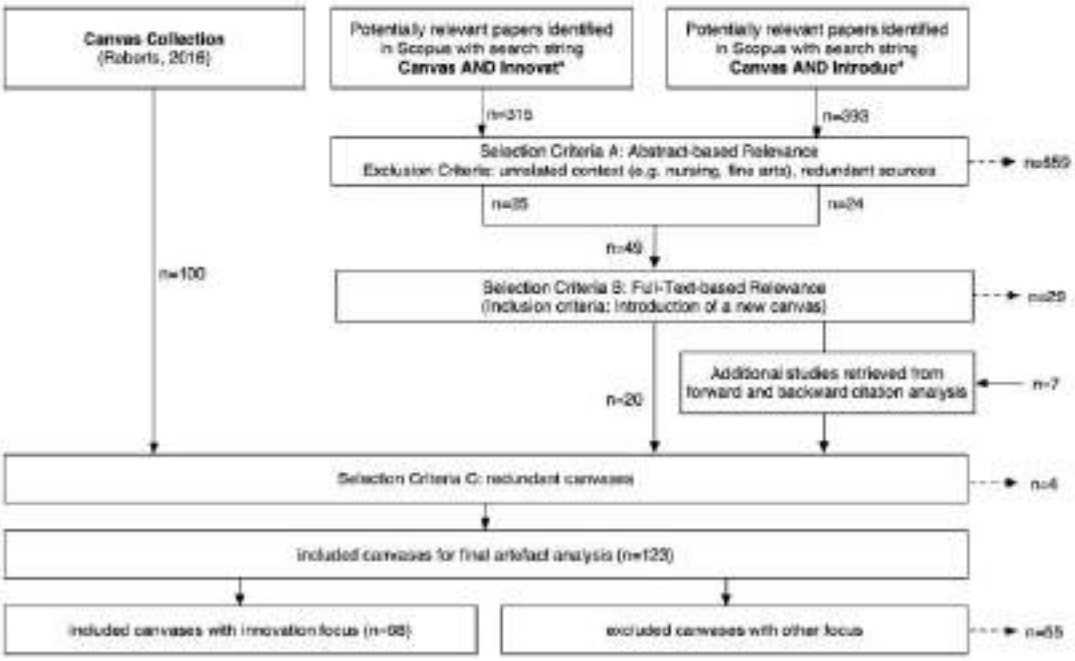

Figure 1: Illustration of the search and analysis process.

In the following section, we summarize the resulting insights from the artefact analysis of 68 innovation-related canvases in a framework. The emerging categories identified as relevant were aligned in a morphological box that constitutes the *Design Space of Innovation Canvases*. It can be used to analyse and localise an existing canvas, or to develop ideas for a new canvas design.

The Design Space of Innovation Canvases

This section presents the design space of visual innovation canvases as a framework outlining six design parameters: (1) the addressed step within the innovation process, (2) involved media, (3) sequence of use, (4) provided instructions, (5) number of elements, and (6) design specifics. These categories were developed iteratively by extracting the respective occurrences from the analyzed 123 canvases. Figure 2 shows the framework as a morphological box that outlines the design space of visual canvases and serves as a tool to guide canvas-related design decisions. The six categories are described in the following subsections.

Parameter	Possible Choices								
Process Step	FFE Research	FFE Synthesis	FFE Ideation	NPD Refining	NPD Prototype	NPD Test	C Assessment	C Business Model	C Sales
Media	Handwriting/Sketching		Post-it		Stickers		Cards	Computer Support	
Sequence	Numbers			Arrows			None		
Instructions	None		Printed within Element		Printed outside Element			Supplementary Guide	
Elements	3–6		7–8		Exactly 9		10–14	15+	
Design Specifics	Icons		Checklists		Color-Code		Visual Metaphor	Integrated Framework	

Figure 2: Morphological box, outlining the different categories that constitute the design space of visual canvases

Step of the Innovation Process

The first category locates the canvas within one or more process step of the innovation process. According to Koen et al. (2002) the innovation process can be divided into three phases: the fuzzy front end (FFE), the new product development (NPD), and the commercialization (C) of the innovation. Each phase is characterized by several sub-steps that could be facilitated through a visual innovation tool. According to this, we distinguish between nine process steps. Within the FFE phase we define (1) research, (2) analysis and synthesis, and (3) ideation; within the NPD phase we define (4) idea refinement and selection, (5) idea prototyping, and (6) evaluation and iteration of a developed solution; and within the commercialization phase we define (7) risk assessment, (8) business model generation, and (9) sales and marketing. This list does not imply that the process steps are to be executed consecutively. Instead, they can also include iteration loops, as suggested for example by the design thinking process (e.g. Brown, 2008). In that case, switching between canvases to elaborate different steps of the process, is possible and encouraged. Nevertheless, it is important for the tool to clearly address one or several process steps in order to communicate to the users, when to use the tool for what purpose. Also, the targeted process step might determine specific design decisions of the tool. For example, research or ideation tools will need empty spaces to be filled with insights or ideas by the users, whereas analysis or evaluation tools will need a more structured presetting like checkboxes or assessment frameworks.

Media / Additional Input

This category distinguishes between different media input. The simplest form of working with a canvas would be to write or sketch manually into the given areas. However, many canvases allow to use more flexible post-it notes and hence provide boxes that match the standardized post-it size. Only a few canvases provide additional tools, such as exemplary pictures, stickers, card sets with trigger questions, or the like. Another form of media support could be digital enhancement. Some canvases provide a digital counterpart or extension, to allow customizing of labels or remote team work.

Suggested Sequence

This category includes three possible options: Some canvases suggested a specific sequence of filling the different areas by either providing (1) strict numbers, or (2) more subtle graphical indicators, such as arrows or hierarchical flow charts. (3) Other canvases did not suggest any particular order but rather a flexible and spontaneous sequence, as the participants would see fit.

Instructions

Most innovation canvases need some sort of instructions. These could be (1) printed within the boxes itself, (2) added as a legend outside the canvas elements, or (3) provided as separate guidelines, for example as printed brochures or books, or as a video tutorial.

Number of Elements

Many canvases follow the example of the BMC and provide exactly 9 elements, either as building blocks or other shapes, each addressing one issue within the overarching canvas topic. Other canvases address simpler topics, and hence limit the number of elements, whereas canvases for more complex issues need more elements. The range spans from a minimum of 3 to a maximum of 28. In the morphological box we decided to provide five clusters, according to the identified distribution outlined in our analysis (see subsequent section, Figure 5).

Design Specifics

The analyzed innovation canvases involved various design elements: (1) Icons and symbols provide a visual reference and help to support the meaning of specific canvas areas. (2) Checklists, checkboxes, and rating scales invite the assessment of existing solutions as well categorical or ordinal input. (3) A color code (for example through the use of colored Post-It notes, stickers, or colored areas on the canvas) might add meaning and structure to the entered data. (4) Visual metaphors can activate a specific mind-set or motivate participation. Moreover, they might help users to better understand the goal of the canvas and provide connections between the individual elements. (5) Integrated (subordinate) graphical frameworks provide structures that can help organize information within or in between elements.

Figure 3 illustrates the applicability of the morphological box by exemplarily mapping it to the Business Model Canvas. The used choices of the BMC are marked in dark grey. Similarly, the reader can use the morphological box to analyze any other existing canvas, as well as for selecting possible options when designing a new one.

Parameter	Possible Choices								
Process Step	FFE Research	FFE Synthesis	FFE Ideation	NPD Refining	NPD Prototype	NPD Test	C Assessment	C Business Model	C Sales
Media	Handwriting/Sketching		Post-it		Stickers		Cards	Computer Support	
Sequence	Numbers			Arrows				None	
Instructions	None		Printed within Element		Printed outside Element			Supplementary Guide	
Elements	3–6		7–8		Exactly 9		10–14	15+	
Design Specifics	Icons		Checklists		Color-Code		Visual Metaphor	Integrated Framework	

Figure 3: The design space of the Business Model Canvas (respective design choices marked in grey).

Canvas Analysis Results

The following section presents selected insights from the artefact analysis. Figure 4 shows a bar chart outlining the addressed process steps within the innovation process, or other addressed aspects, respectively. It reveals that 68 of the analysed canvases are intended to facilitate some steps of the innovation process. Most of them support the development of business models (n=24) and the idea refinement phase (n=24), followed by synthesis/analysis canvases (n=13) and canvases addressing the sales/marketing stage (n=12). Only a few canvases addressed the research phase (n=3), risk assessment (n=2), ideation (n=8), prototyping (n= 5) and test/iteration (n=8), which shows a persisting potential for new tools in these areas. For the subsequent analyses we include only the 68 innovation-related canvases and exclude the remaining 55 unrelated sources.

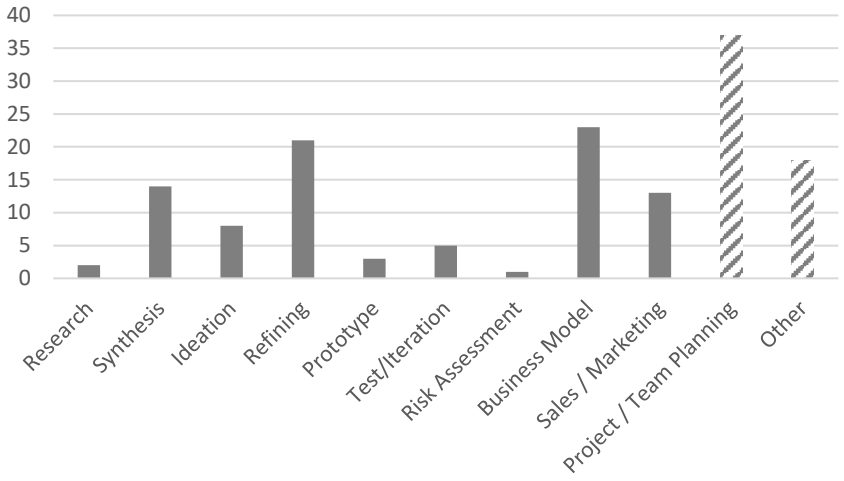

Figure 4: Distribution of canvases addressing different process steps; more than one possible (n=123).

Figure 5 shows the distribution of the number of building blocks or other elements on the different canvases. It illustrates that most canvases follow the example of the BMC with exactly nine elements. The maximum number of elements on one canvas was 28 (the "Big Idea Canvas", the minimum number was 3 (the "Requirements Engineering Canvas").

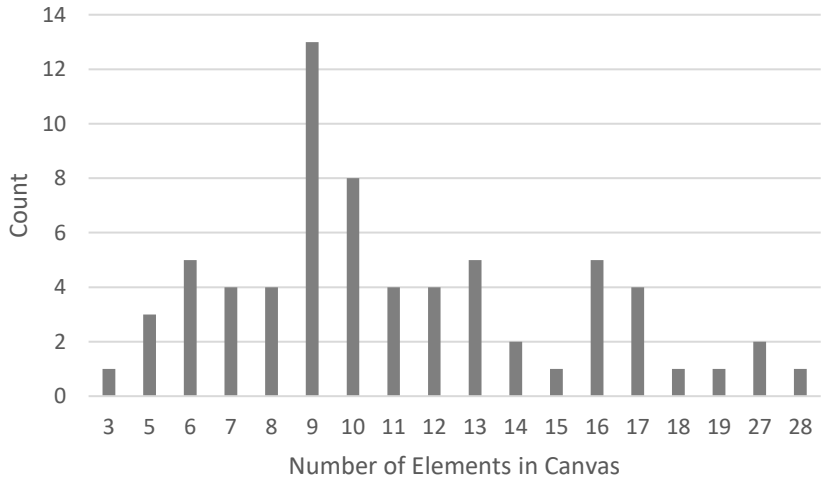

Figure 5: Number of elements on the different canvases (n=68, innovation canvases only).

Figure 6 illustrates the average number of elements on a canvas according to the targeted process step. It becomes evident that some tasks might be more complex and hence require more elements, such as the Testing/Iteration phase (average number of elements = 15), whereas other tasks seem to be less complex and manage with fewer elements, such as the Research or Risk Assessment phases (average number of elements = 7).

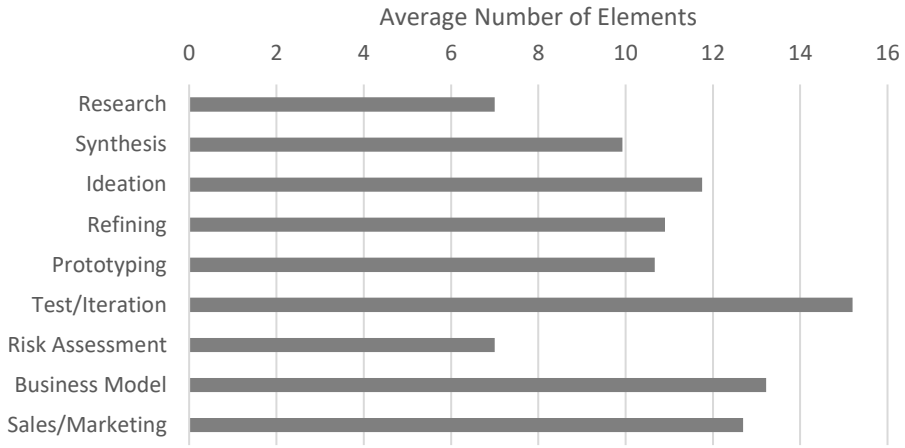

Figure 6: Average number of elements according to the addressed process step (n=68, innovation canvases only).

The following other insights could be derived through our analysis: A sequential order was only suggested on roughly one third of the innovation canvases (n=21). Half of the innovation canvases made use of icons or symbols (n=34) whereas the rest did not make use of any visual support. The potentials of color-coding and visual metaphors seemed to be not utilized to their full potentials (use of color-coding: n=18; use of visual metaphors: n=7). While the vast majority of canvases was using the standard rectangular building blocks (n=57), 11 canvases abstain from the typical building block structure and use other shapes, ranging from abstract diamonds, pie elements or (semi) circles, to concrete figures like a bridge or a face. 27 canvases showed a combination of rectangular boxes and other shapes. Some canvases also incorporated subtle structuring elements, such as arrows indicating a specific direction of use, or process maps that suggested a particular arrangement of data.

All these aspects warrant further investigation and consideration. The possible impact of variations in color-coding, visual metaphors, sequences, or instructions could be investigated through experimental studies. The analysis of any correlations between aspects (e.g. the appearance of particular design characteristics in different process steps) also warrants further investigation and is dedicated to future work.

A Theoretical Framework of Canvases

As pointed out by Avdiji et al. (2018), most developments of visual canvases are not following a scientific process but serve more a trial and error approach. In an application situation it might be sufficient to know what kind of tool is working in which context and under which conditions. However, if we want to know why one tool works in one situation and not in another we need to find out more about causal relationships of tools and human behavior. There is not one single theory but rather an abundance of theories on human behavior, developed from different disciplines with different foci, such as psychology, sociology, ethnography, and many more. In addition, different units of analysis such as individuals, groups, and organizations need to be addressed. Based on this 'bricolage of existing theories', we claim three inter-connected theoretical frameworks contributing to building the skeleton to understand, explain, and predict human behavior.

In the following subsection we extend this theoretical framework by seven possible functions or working mechanisms of a visual canvas. Figure 7 juxtaposes these functions with the existing theories in a framework, consisting of 3 main categories and 7 subcategories. Additional literature is presented that might be able to explain those suggested working mechanisms of an innovation canvas.

Figure 7: Theoretical Framework of innovation canvases; outlining the possible working mechanisms.

Cognitive-Perceptual Level of Information Processing.

This level includes memory, learning, and knowledge acquisition, as well as cognitive biases such as fixation, which is the inappropriate repetition of existing solutions (Purcell & Gero, 1996; Cardoso & Badke-Schaub, 2011). Dalsgaard (2017) provided a framework of 'instruments of inquiry', in which he outlined that tools or instruments can guide the designers' perception and understanding of design problems and solutions.

(1) Extended memory. The visual canvas can serve as an extended memory. Knowledge and information can be captured and visually stored. The externalization of previously tacit (design) knowledge on a canvas facilitates knowledge exchange between team members and facilitates memorization of relevant information (Müller & Thoring, 2010). Moreover, a canvas can serve as some kind of checklist that ensures that no step will be forgotten (Gawande, 2010).

(2) Thinking facilitator. The visual canvas can act as a facilitator for the thinking process, for example, by providing a step-by-step instruction when to do what. In this case, the tool should provide clear guidelines, such as a numbered order of subsequent steps. Similarly, it can be a source of inspiration, for example by providing trigger questions or exemplary solutions. However, one should be aware that such inspirations can also limit or manipulate the creative output of the users, which can lead to fixation (Purcell & Gero, 1996). Moreover, a canvas might act as an 'eye-contact deflector' (Kajimura & Nomura, 2016) and that way protect certain cognitive control processes from turning off during group work. Furthermore, according to the Dreyfus and Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 1980), templates and step-by-step instructions can be useful for novices whereas experts often prefer an intuitive approach to problem solving. As Liedtka (2018) pointed out „structure and linearity help managers try and adjust to […] new behaviors", which she called "the beauty of structure".

Emotional-Motivational Level of the Individual Needs.

The emotional-motivational level of individual needs includes the mutual influence of persons how to feel accepted, and also the need for control. For an overview of individual needs structure, Maslow's motivation theory (Maslow, 1943), and 'motivation theory reconsidered' (Landy & Becker, 1987) can serve as a reference.

(3) Platform for ideas. A visual canvas can serve as a platform for ideas and insights by providing (empty) space(s). People often express a tendency to fill a given space to make it look complete, a phenomenon similar to the 'Zeigarnik effect' (Zeigarnik, 1938), which suggests that people feel the urgency to complete an unfinished task. If, for example, a canvas provides a fixed number of boxes to be filled, the user might want to fill all of these boxes. Hence, the size of the tool itself might also determine the amount of output. The rectangular shape of building blocks can be easily filled with post-it notes, whereas differently shaped areas might hinder this attempt.

(4) Motivator. A well-designed visual canvas might be able to increase individual motivation. It can encourage people to share their ideas and insights and increase engagement and commitment. For example, a canvas might be able to motivate all participants to share their ideas, also those who are shy or reluctant. This assumption can be supported, for example, by studies suggesting that brainwriting outperforms brainstorming (Heslin, 2009). If the tool itself demonstrates some designerly effort, the chances are high that the users will also spend their own effort when filling it. The co-created output might also increase loyalty towards the team and the result, because one might better relate to the jointly developed solution. When designing a visual tool, you might want to consider options to engage all involved participants, for example by providing dedicated space per participant, or by assigning specific team roles.

Social Influence and Mutual Interaction.

The level of social influence (Flache et al., 2017) and mutual interaction includes the communication of and within the team. Here, all three streams come together—the individual need for control meets the need for a shared understanding in the team and the exchange of information according to the respective goal of the innovation tools.

(5) Shared mental model. The visual canvas can facilitate the creation of a shared mental model. According to Badke-Schaub et al. (2007) mental models are simplified (not necessarily accurate) representations of the real world in our heads. If a team performs on a joint innovation project, a common understanding and a synchronized mental model is crucial for the project success. A visual tool can facilitate the creation and balancing of such a shared mental model.

(6) Boundary object. A visual canvas can facilitate team discussions and serve as a boundary object. Boundary objects are information that are plastic enough to be adapted and interpreted differently by different communities, but robust enough to maintain informational integrity (Star & Griesemer, 1989). They are standardized forms that provide a shared format for solving problems across different functional settings (Carlile, 2002) and hence support distributed cognition by eliciting and capturing tacit knowledge through interactions with the object (Henderson, 1991). A visual canvas represents such a standardized form that can help a team to produce records of mental thought outside of the individual memory, by providing means for others to interact, critic, and build upon the ideas, and by establishing a common language of understanding (Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005). This can allow knowledge sharing and coordination of a discussion in heterogeneous teams, even without consensus (Bechky, 2003), by allowing sketching and visual framing of concepts that can then be discussed. Moreover, giving and receiving explanations (Ross & Cousins, 1995) through interaction with a canvas might be able to enhance mutual understanding of the problem.

(7) Presentation and communication tool. The visual canvas can be used as a presentation or communication tool, for example to justify an idea towards clients, co-workers, or superiors. In this case, the visual tool should provide a clear structure, outlining possible benefits, and encourage legibility (e.g. of handwritten notes). Moreover, a canvas can facilitate storytelling and hence foster the exchange of organizational knowledge (Connell, Klein, & Meyer, 2004). Team discussions along a visual collaboration tool can facilitate abductive inference (Lombrozo, 2012), which is the main component for innovation. At the same time, a visual canvas can gather people together and involve different stakeholders in workshop settings. According to Conversation Theory (Pask, 1976), participants engage in conversation where everyone finds a ‘corner’ (a building block within the canvas) and a space for getting to say (or teach) something to the group. Participants are not only filling boxes, but learning from the group and encouraged to teach something back to the group.

Discussion

Implications

As outlined above, visual innovation canvases can provide various benefits. They can facilitate information processing, individual motivation, and team interaction. A canvas might increase the quantity of a team’s output as well as their time-efficiency. Visual structures and prompts can invite participation and reduce unnecessary discussions on what strategy to pursue (because this is already suggested by the tool). Complex tasks are simplified, which facilitates thinking processes. Interdisciplinary teams, who do not have a common understanding and possibly different levels of expertise, might find a canvas helpful to facilitate communication and foster engagement. The same applies for presenting concepts to clients or other stakeholders.

However, the vast choice of existing canvases might overstrain the user. The question, which of the existing tools would be the right choice for a specific purpose, how to use those tools, or how to adapt them for one’s own requirements, might become a challenge. Sometimes it might be inevitable to design a new visual tool, because an adequate solution is not yet available. Although there exist many canvases for various aspects, our analysis showed that the available tools for particular tasks of the innovation process (e.g. research, risk assessment, etc.) are limited. Consequently, with regards to our research questions stated earlier, this paper provides the following theoretical and practical implications:

(1) The presented morphological box outlines the relevant parameters that mark the possible design space of visual canvases, and hence provide a guidance for other researchers and practitioners to either select or design an innovation canvas. It helps the users to identify which aspects are relevant for their task and compare these with existing canvases. When designing a new canvas, they can select from the provided parameters and compose them into a desired template for their own purposes.

(2) The presented theoretical framework of visual canvases provides helpful insights on the working mechanisms and theoretical underpinning of canvases that allow for a goal-oriented and appropriate application and development of canvases.

(3) The results of the canvas analysis yielded rich insights on existing research gaps that could be tackled in future research.

Risks and Challenges

Despite the apparent popularity of visual innovation tools and their helpful benefits that we discussed in this paper, we would like to pose some critical thoughts. Developing a visual canvas requires a lot of skills in terms of both, conceptual and designerly expertise. Avdiji et al. (2018) expressed their concern about the lack of scientific rigor for the development of many visual canvases that are available today. Our systematic literature search showed, though, that a multitude of canvases is in fact scientifically developed, evaluated, and published in peer-reviewed sources. Nevertheless, we want to emphasize that a reflective development of a canvas, possibly involving an evaluation study following an action research approach (Lewin, 1946), can secure a rigorous foundation. For a well-grounded conceptual base for developing such visual tools, we refer the reader to Kolko's work on visual synthesis models (Kolko, 2011). Adding to that, we would like to express our concerns about the possible lack of aesthetics and design expertise for some existing visual tools. The list of 100 visual canvases collected by Roberts (2016) reveals the oversimplified design of some of these canvases, partly neglecting basic design rules that could be found, for example, in the seminal works of Tufte (1990, 2001) and Bertin (2011), or in the work of Moody (2009). Bresciani and Eppler (2015) outlined several pitfalls of visual representations, for example, over-complexity or over-simplification, as well as misleading or cryptic decoding challenges. Furthermore, we see a tendency—especially in the design thinking field—of what we like to call 'templatism'—the overly use of templates for almost any given task without questioning or reflecting on its appropriateness. This might be reflected by the illusion that the right tool would magically solve the problem without any additional effort of its users—a phenomenon called the "Candy Man effect, where executives longing for easy, sure-fired innovation" (Barry, 2017). We argue that a template can only guide a thoughtful process but cannot compensate for a possible lack of conceptual underpinning and careful research. Finally, we would like to emphasize the risk of fixation effects when relying heavily on visual innovation tools. The concept of fixation describes inappropriate repetition of existing solutions; (e.g. Purcell & Gero, 1996; Cardoso & Badke-Schaub, 2011). Rigid structures of a visual tool might limit the creativity of the users and lead to foreseeable or biased results.

Limitations and Future Work

One limitation of this study is that it partly relies on the rather arbitrary canvas collection by Roberts (2016). However, to the best of our knowledge, there exists no other compilation of canvases, yet. We expanded the existing canvas collection through a systematic literature search, which yielded our final list of 123 included canvases. We argue that this number of analyzed sources was sufficient to develop a theoretical framework and to derive criteria for canvas designs, even if the list of included canvases might not be exhaustive.

Potentials for future research can be found in exploring the opportunities of digitally enhanced canvases. Digitally supported tools might allow for easy individualization and mass-tailoring of visual tools. Also, team-based discussions with a large number of participants, time-delayed and/or simultaneous discussions, and remote interactions would be possible through digital facilitation. Comi and Eppler (2011) demonstrated in an experimental study that software-supported visual facilitation outperforms poster-based collaboration in terms of team performance and participants' satisfaction with the inter-organizational meetings. Similar results were presented by Eppler, Öste and Bresciani (2013). These studies warrant further research into developing software-based visual innovation tools.

Furthermore, additional research is needed to investigate the conceptual impact of innovation canvases. The question whether such tools actually improve innovation processes and the outcome's quality, is not yet fully

answered. However, the evaluation of the effectiveness of the 123 analysed canvases is beyond the scope of this paper and will be tackled in future work.

Finally, we want to distill the insights of this study into some basic design principles for developing innovation canvases. This would extend the presented morphological box and theoretical framework towards a more practical tool for applied research and practice.

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Storytelling and Low-Resolution Prototypes for Innovative Simulated Experiences in User-Centered Research

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This article discusses the use of low-resolution prototypes and storytelling as tools for planning and building simulated interactive experiences as a part of an exploratory method of user-centered research. We contextualize the concept of low-resolution prototyping and storytelling, present its insertion in the method and discuss its relevance to design user-centered experiences. The results suggest that using low-resolution prototypes and storytelling to create immersive experiences to validate products/services enable a deep understanding about users, which is an important perspective to design driven-innovation, considering that people do not buy products and services, but meanings. The combination of both tools gives the researchers a qualified amount of data that covers what the user consciously speaks, automatically does and unconsciously expresses. Using the proposed method companies will be able to identify the value perceived by customers, in order to create a better experience.

Keywords: design research, user experience, low-resolution prototypes, storytelling

Introduction

In the context of experience, Design has the purpose to enable the conditions for creating experiences in a planned way. The understanding of how experiences occur and how objects become emotional triggers opens space for new product design opportunities that are meaningful and relevant in people's lives (Forlizzi, Disalvo, & Hanington, 2003). Considering the relationship between people and the products and services they consume, the experience will draw in the emotions, beliefs, and expectations that occur before, during and after consumption (Chammas, Quaresma, & Mont'alvão, 2015).

In order to design experiences, it is necessary to involve the users in the design process, not only by questioning them about their needs and motivations but also by providing an environment in which they can imagine themselves in future scenarios related to the project's context. By actively involving customers in the innovation process, it is possible to get specific information about needs and desires, in order to translate this into products insights (Kaplan & Haenlein, 2006). But the more innovative these products are, the more they will challenge the organization's ability to take them further (Carlgren, Elmquist, & Rauth, 2016).

To do so, low-resolution prototypes - physical representations of early conceptual models (Kaya, Alacam, Findik, & Balcisoy, 2018) - enable the creation of a complete simulation environment where users can interact with the product or service that is being designed, validated or tested, and freely express their perceptions. In

this way, the researcher can dialogue, question and observe conscious and unconscious behaviors that could generate insights for the project. In order to be immersive, this simulation must be planned and applied based on narratives that describe the universe of the project and integrate the hypotheses to be confirmed. When consumers are living the experience, more-original ideas can be discovered (Liedtka, 2018).

Therefore, this article discusses the use of storytelling and low-resolution prototypes (also called low-fidelity prototyping) as tools for planning and building simulated interactive experiences as a part of an exploratory method of user-centered research. This method was conceived and applied during joint investigations executed by HP Inc. Brazil R&D Center and Tecnopuc Crialab, the creativity laboratory of the Pontifical Catholic University of Rio Grande do Sul - Brazil. This method is oriented to the initial stages of the product development process, and allows users to imagine themselves in a future context through fictitious environments and scenarios in the scope of ideation. In this article, we intend to contextualize the concept of storytelling and low-resolution prototyping, to present the method, to discuss how storytelling and low-resolution prototyping can help create a better experience, and finally to discuss its relevance to design user-centered experiences.

Low-resolution prototypes for simulated experiences

Prototyping is an activity that has received considerable attention in the product development process since the adoption of Design Thinking in several business areas (Elveruma, Weloa, & Tronvoll, 2016). The understanding of the design process in the business and development domains has been extended, so using low-resolution prototypes in the early stages of design has become an important practice. In contrast to the traditional role of the prototype in engineering processes, the prototype in the design process, especially of products, has a more exploratory role (Elveruma *et al.,* 2016).

Using prototypes, designers and project teams create concrete representations of design concepts, taking them out of the conceptual space of their minds and materializing them beyond graphical representations. These prototypes, even when done in a rudimentary way, facilitate the communication of concepts and ideas, both among the design team and with users and stakeholders (Orr, 2015). These traditional prototypes can serve many useful purposes in product development processes, but since they often require a high commitment of financial, human, and time resources, they are often seen as an obstacle to final production (Savoia, 2011; Orr, 2015). Its use can help to test and validate the potential market of new ideas in a concrete and objective way; however, it is common to invest weeks, months or years and large amounts of financial resources, which makes this process difficult, expensive and time-consuming.

Low-resolution prototypes, on the other hand, involve fewer costs and reduced time to obtain the necessary information that will allow the project to move to the next phase (Figure 1). In order to achieve a good physical representation of an idea, the tools and materials used to prototype must be simple to use and easy to manipulate (Kaya *et al.,* 2018). Constructed with basic materials (from cardboard to bottle caps), these materialized concepts have many benefits: for Pernice (2016), with low-resolution prototyping, more time can be spent exploring interactions with the product/service, without technical restrictions. In addition, necessary changes are made faster so it's possible to quickly perform several test sessions and apply adjustments needed to re-test the product/service in iterative cycles. Low-resolution prototypes also exert less pressure on users. As the product/service is not yet concluded, users do not feel the obligation to be successful in the tests and are more likely to express any negative reactions. This effect also applies to the design team; necessary changes in the product/service are made more naturally since it is understood that the project is still under construction and can be modified (Pernice, 2016).

Referring to low-resolution prototypes, Savoia (2011) brings the concept of "pretotyping". For this author, between abstract ideas and suitable prototypes there are the pretotypes, low-resolution prototypes that are still in the initial phase, and that help to collect valuable market data and product/service usage information for decision-making regarding the continuity of the project, for a fraction of the cost of prototypes, since they can be developed in a few hours, using few resources. The pretotypes allow design teams to fail quickly so a quick recovery can be achieved with enough time, money, energy and enthusiasm to explore new adjustments in the project until achieving a model that really has value for people (Savoia, 2011).

Figure 1: Example of product low-resolution pretotype. source: the authors.

According to Orr (2015), the prototype can be categorized into three different groups: prototypes of adjustment, prototypes of shape or prototypes of function. Adjustment prototypes are designed to test fittings, assemblies, and manufacturing peculiarities. The shape prototypes are intended to test the aesthetics of final products. Finally, function prototypes are developed to test specific product and/or system functionalities. These three categories are not exclusive, because in many projects it is necessary to test more than one dimension of the product simultaneously. However, from an experience perspective, it is understood that the interaction between the user and a product/service transcends its form and function, and also involves environmental aspects, senses, motor and mental abilities, intentions, expectations, desires, values and previous experiences (Freire, 2009). Experience is the result of the interaction between people, products, and the context in which this interaction takes place - and must be functional, determined, engaging, attractive, and memorable. Thus, in the context of this research, a fourth category of prototypes is also visualized: the prototypes for the conception of experiments (Figure 2).

Figure 2: Example of low-resolution prototypes. source: the authors.

In this process, using a low-resolution prototype creates a easily simulated environment in which the user has the experience of using the product/service being designed, validated, or tested. Through narratives that report the different situations of use that are previewed in the project, during the experience simulation the user can freely make decisions, perform actions and manifest their perceptions. To discuss the construction of these narratives, it is interesting to start with an overview of concepts and applications of storytelling.

Storytelling as the driver of experiences simulations

Stories are a natural and flexible way of communicating. Its effectiveness ranges from its use in teaching, as a means to help people to remember information, to a good form of entertainment (Quesenbery & Brooks, 2010). Stories are told through the generations to educate, inspire and motivate. They reflect how people usually tell things about themselves, about other people, places, cultures, and experiences. Telling (and listening) stories naturally makes people more receptive to new ideas and perspectives (Beverland, 2009).

The use of stories as communication means is not limited to the personal level. At the professional level, whether for teachers, organizational leaders or scientists, there are many ways and opportunities to use storytelling. In a classroom, stories can be used to explain the content in a playful and didactic way. In a judgment, a story can be told by a lawyer as a means of promoting jury empathy and exposing the defense view (Meyer, 2014). In Design, storytelling is used as a method to elaborate usage scenarios, for the creation of personas and as part of other tools used in projects that involve the user experience (Quesenbery & Brooks, 2010; Frandoloso, Gonçalves, & Fialho, 2017).

For Quesenbery and Brooks (2010), stories have many applications in the design of experiences: they can describe a context, such as stories that tell a person's journey; they can illustrate problems and pain points, explaining why a new experience is needed; or they can launch points for a discussion, explore design concepts and describe the impact of new projects (Quesenbery & Brooks, 2010). When used in experience simulations with low-resolution prototypes, they are written to describe a context or situation of use of a product and/or a service. In this case, the narratives help in understanding the circumstances and variables related to the project, since they not only describe a sequence of events but also help to explain the reasons and motivations of these events.

Because they have a particular structure that describes cause-and-effect relationships between events that occur in a particular period, impacting specific people (Dahlstrom, 2014), narratives are important tools to interact with users. Good storytelling is interactive; it is like a conversation in which the storyteller and audience participate together, and are engaged to the point to feel part of the narrative. In addition, storytelling does not bring too much detail - on the contrary, it purposely leaves gaps that will be filled by the viewer's imagination, so that it builds up parts of the story (Quesenbery & Brooks, 2010). This active and dynamic aspects of storytelling make it essential for the design of experiences.

Considering these concepts, in the following pages we discuss how low-resolution prototyping and storytelling can be applied in a user-centered research method, as important tools used to create the stories that will be told to users and experienced by them in interactive experiences simulations, in the context of products and/or services development projects.

Low-resolution prototyping and storytelling for user-centered research

As user experience becomes central to the design process, it is necessary to establish means by which designers and users can act as equal partners, which impacts not only the results of the design process but also the design goals. In order to design new products and services, users' participation is essential, so they can contribute with their vision about what is being developed and act as collaborators in the design process. So, under these premises, Tecnopuc Crialab's design team developed a user-centered design research method[1] focused - but not restricted - on the initial stages of a technological product/service development process. This method was created in collaboration with HP Brazil R&D, in order to involve users in some stages of the development process and to encourage them to become co-creators in the design process (Figure 3).

[1] *The complete method was published in the Brazilian journal Human Factor Design (HFD, v.8, n.15, p. 98-113, March 2019).*

Considering our goal with this article, we will briefly explain the method and then focus on the role of low-resolution prototype and storytelling.

Figure 3: Complete diagram of user-centered research method. source: the authors.

About the Method

The method comprises four phases: Context, Plan, Action, and Analysis. The first phase, CONTEXT, is about understanding the project environment. It defines the research main goal and the directions to be followed in order to make the experience happen. Every process should start with a contextualization because it allows us to understand the project universe and the user profile, who will be the main actor in this process. As in our experience design, management and development teams will work together, decisions regarding this phase must be made in a joint effort. This initial phase is also important to clarify the research context, which can be driven by the idea of a product to be developed, by a product to be validated or a launched product to be evaluated.

According to Pine and Gilmore (1998), the potential commercial success of product/services depends, in addition to other factors, on the experiences it provides - and therefore understanding the consumer needs and their motivations is essential to create meaningful and memorable experiences. In order to do that, we carry out desk research (exploratory research in academic bases and websites in order to investigate cultural, behavioral and market aspects related to the project) and we create personas, user journeys and empathy maps.

As we are using a user-centered approach, we need tools that are focused on explaining and detailing the user's profile and needs related to the product or service. Because of their fictitious, specific, concrete representations of target user's characteristic (Pruitt & Adlin, 2006) personas potentially can help address some of the issues with current user-centered approaches (Miaskiewicz & Kozar, 2011). Also, user journeys and empathy maps can help us immerse on the user's world so we can create a meaningful experience for the user. Based on this, we define the research hypotheses that will be validated with the experiment application. The CONTEXT stage creates the necessary basis for the following method phases since it gathers all the information necessary for the effective design of the experiment.

The PLAN phase consists of planning the simulated experience to be applied. In this phase, the low-resolution prototype and storytelling will have an important role. We start this phase writing the narrative that is going to guide the experience (storytelling), based on the hypotheses, behavior settings (Wicker, 1987), and technologies previously defined, and we consolidate it as text or as a storyboard. How the storytelling will be built-up is also an important aspect to be considered. In our experience working with different teams, with different backgrounds, storyboards tend to help put everyone on the same page and focus on planning the same experience.

With the narratives already defined, the scripts and the protocols must be prepared. They consist in each step the researcher must take to conduct the experiment: this includes welcome the participants and explain how the experiment will be, ask them to sign the image use authorization (or any other document), make initial questions, propose the tasks that the participant should perform, observe it, and make the final questions. Our goal is to compare people's behavior during the experiment and find patterns in their behavior in order to generate products/services insights. To be able to do that, in the scripts, every step must be clear and detailed, including the researcher's lines and the questions that will be done before, during and/or after the experiment

in a semi-structured script. It is also relevant to consider support tools to the interviews that are going to be used in specific points of the interaction. These tools can be used by the participant and the researcher together, helping the user to imagine hypothetical scenarios and to demonstrate their thoughts, opinions, and feelings. Some examples of support tools are paper cards with future scenarios, image sorting (Kumar, 2013), emotional response test (Memoria, 2006; Meurer, 2014), among others.

After the scripts, we initiate the construction of the environment where the experience simulation is going to happen, building the low-resolution prototypes (Figure 4). We need to make the conceptual representation of the product/service tangible to be tested or validated. Also, to be able to create an immersive and playful experience that will stimulate the user's imagination for future scenarios where they perform the requested actions. The low-resolution prototype is done considering the narratives that were previously created.

With the scenarios built, we start the participant's call to action. The users are recruited considering the profile defined in the CONTEXT phase. The recruitment does not necessarily need to be started at this stage but must be finalized before starting the next step.

The third phase of the method, ACTION, aims the experiment application. In this phase, a pilot with a few users is initially applied, to verify the research protocols and all the operations. Once this verification is done, the experiment will be applied according to the participants' schedules. We usually apply it in short iteration rounds, so we can make protocols reviews and, if necessary, apply new pilots. Possible adjustments may occur in these reevaluation steps and we should consider that in the final analyses. Throughout the application rounds, it is also important to make sure that all the media are being recorded, so all the experiences can be analyzed at the end of the research.

Figure 4: Examples of experience simulation using low-resolution scenario and product prototyping. source: the authors.

The last phase of the method, ANALYSIS, refers to the analysis of the data collected with the application of the simulation of the experience. The data collected is analyzed qualitatively because it allows the description of the complexity of the phenomena related to the subject of study (Flick, 2009; Gibbs, 2009). In this phase, all audios are transcribed and snapshots of recorded videos are selected. We strongly suggested the use of two video cameras to record the user in different angles. This preparation of data is important to posteriorly cross texts from the transcriptions and images from videos.

Then, the shreds of evidence collected with different media are crossed and categorized. Then, the results are analyzed. By the end of the analysis, results are compiled and design principles are generated. Design principles propose to transform insights into project recommendations and indicators/guidelines for the development of a solution related to the experience that is being designed (Kumar, 2013).

By using this structure, this method allows constant iterations along its application and predicts these iterations especially in its central phases – plan and action. Enabling iterations means that the plan of the experience can be reviewed at any moment, which will impact in the simulation of the experience simulation with the users, which can result in a new process of investigation. This new investigation can be of a new premise to be explored, or about a reformulated old one. The method, that is user-centered and developed in

the context of experience design, is oriented to design research processes with great potential of participation of designers, other team members, and users, and qualifies the stages of an investigation and problem definition in projects.

Storytelling and Low-resolution prototype for Innovative Simulated Experiences

As mentioned, the low-resolution prototype and storytelling will play an important role in the PLAN phase of the proposed method. This phase starts with narrative writing using the information gathered in the previous phase. This previous information is essential to bring meaning to the story. To write the narrative we needed to establish some directions. So, we reviewed the branding storytelling framework from Smith (2012). As Smith's framework is focused on creating branding narratives, we adapted it to focus on the simulation of experiences (Figure 5). As the original framework, ours consists of three stages: environment, experience, and outcomes.

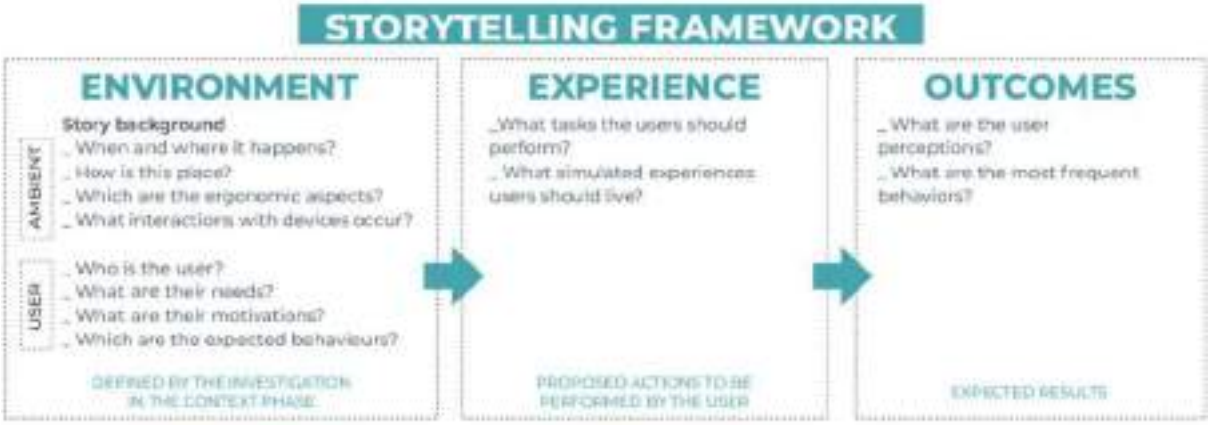

Figure 5: Storytelling framework, adapted from Smith (2012). source: the authors.

On the ENVIRONMENT stage, the goal is to define the experiment background. Every experiment we planned, we had to make related decisions about where the story will be placed and who are the users that will interact with it. In order to do that, we planned considering two main aspects: ambient and user. In the ambient phase, we answer questions like when and where the experiment happens? How is this place? Which are the ergonomic aspects? What interactions occur? But we also needed to have a better understanding of the user who will be interacting in this space. For that, we answer questions like who is the user? What are their needs? What are their motivations? Which are the expected behaviors?

Having all these answers makes it possible for us to visualize what needed to be done and start designing the first sketch (Figure 6). Besides telling the atmosphere of the story, this information also defines exactly what is going to be built: what kind of devices, how many of them, what the ideal distribution of elements to compose the environment, and other needed information. In addition, in this stage, we gather the information regarding the user profile (as their needs, motivations and expected behaviors that were previously investigated) to address it in the tasks that users are going to perform in the simulated experience. The user profile is also considered for the recruitment of participants who will be invited to the experience.

Figure 6: Sketch for an ambient with low-resolution prototypes. source: the authors.

On the EXPERIENCE stage, we define the tasks that users are going to perform in the experience. These tasks can be very detailed (when the intention is to test the relevance of a product and/or service, or its usability), or can be very broad (when the intention is to understand behaviors or cultural aspects). These tasks can be consolidated as text and/or storyboards, and are the base to the scripts and protocols that are followed by the researcher to conduct the experience. If in the ENVIRONMENT phase we are focused on the context of the narrative, the experience phase is related to the action step, where the user is the center of it. Based on Smith's (2012) framework, we also separate the defining tasks step from the contextualization one when designing narratives. So, decisions made on the environment phase will guide the tasks definition, but only after finishing the environment phase is it possible to define coherent and consistent tasks for the user. In our experience, the second stage will demand not only general storytelling knowledge to be accomplished but also a deep understanding of the user and the story you want them to experience.

Finally, the OUTCOMES stage consists of the end of the experience. In Smith's (2012) original framework, the end of the narrative presents the story's main point, but because we are focusing on understanding experiences, the end of the story is determined by the user. How they decide to end the experience is an important result and can help us confirm or refute a hypothesis. Based on the research goal, it is possible to define expected results, especially when the intention is to validate an idea, a product and/or a service. In this case, there is an expected result that, if attended, the hypotheses are confirmed. On the other hand, if the expected results are contradictory, the hypotheses are refused and new hypotheses can be defined.

As the results are uncertain, we must emphasize that the narrative is not immutable, and can be adapted and reviewed as much as necessary. The narrative aims to tell the stories that will be experienced by users, and that simulates the context where the user is going to use the real product and/or service in the future. When it is well explored, it captures and maintains the user's attention and generates interest and enthusiasm. Because of that, it must be detailed enough to help the user to go deep into the immersion - so it must include the product and/or service to be tested and all its context of use (Denning, 2005).

Figure 7: Construction of the ambient where the experience simulation is going to occur. source: the authors.

Although the storytelling can be an important player when building experiences for users, it cannot do everything by itself. Besides creating a consistent narrative, in order to have users completely immersed in an experience, it is necessary to build scenarios to make them feel that they are truly living and making the tasks we need them to perform. Also, it may be risky to make project decisions based only on user interaction with the product prototype without an understanding of the context of use of the product - that is why the prototyping of the scenario is essential for the completeness of the experience and the identification of the contextual factors that direct the use of the product.

The low-resolution prototyping of the product/service is necessary not only to test functionalities, ergonomic issues and other aspects of the product itself but also to investigate the meaning this product has to the user and how relevant it is in the user's life. As the low-resolution prototypes has the advantage of bringing a playful aspect to the experience, the user feels more comfortable doing the simulations and easily talks about their perceptions, motivations, and concerns. So, after creating the experience narrative, we build scenarios, devices, and what else is necessary to make the story happens. As in this phase, we already have protocols and scripts done, we need to think about how to make the planned flow possible and what kind of scenario will be assembled.

In our past experiences using this method, most of the time our focus is on testing technologies and understanding how people interact with it. So, we need to build an environment where these products would really take place. For us, this is where the storytelling makes sense. All the interaction we planned is tested when a user interacts with a real size prototype and express their behaviors, beliefs, doubts, and concerns about the product/service they are testing.

Using low-resolution prototypes at this point of our method allows us to make users live the interaction in a simulated environment where they feel free to express themselves. As said before, because we are using simple and cheap materials, interacting in a simulated environment, the participants do not feel the pressure to like the product or any resentfulness in telling what they are really thinking. These insights are very valuable when defining projects directions.

Simultaneously with the low-resolution prototype construction, we define the media recording set - that can be in video, audio, and photography, for example. It is interesting to do that while the prototypes are made, to choose the best angles to position the cameras aiming for a better recording of facial and body expressions of

participants, but also to not make the user uncomfortable with being recorded. This material will be really important when the analyses phase starts.

The use of narratives and low-resolution prototypes allows us to make more certain decisions when it comes to product/services directions. We know it is possible to make products validation only using storyboards (or any other method), but in order to simulate the real experience, low-resolution prototypes are necessary. People can imagine scenarios and tell how they would feel. However, living a simulated experience will get deeper on feelings and behavior, because the participants are not thinking about what they would do in a hypothetical situation. In this case, the participants are living it, and behaving in a really close way to how they would do in a real situation.

Findings and discussion

In eight applications with this method, it was possible to collect feedback from 180 participants about their perceptions and feelings. On that, 75% of participants reported they enjoyed immersing themselves in experience simulations to evaluate them. The fictitious built scenario and products, the script (storytelling) conducted by the researcher and the clear willingness of the researcher for the user's contribution in imagining, were mentioned as facilitators for evaluating the experience. Besides that, 60% of the participants mentioned that despite being a visibly fictitious ambient, the environment gave them a good sense of reality.

We noticed that the playful aspect of low-resolution prototyping allowed the user to feel more at ease to express their perceptions and opinions, without suffering unconscious influences derived from brands or products already known by him. By simulating interactions with simple prototypes, the comments made by the participants become more spontaneous, without much prior elaboration before the speech, and therefore more reliable to their feelings and opinions. Moreover, the recognition of the real environment associated to the playfulness of its look helped them to imagine unknown situations. One of the participants said *"It was beyond my expectations, I was really able to feel in a real environment, in my own bathroom, and I felt stimulated to imagine interactions I don't have nowadays"*. Another one said *"I felt I was immersed in a real situation that felt concrete, even though I was simulating technological interactions with pen and paper"*.

There are probably two main reasons for this. The first one is connected to the playfulness of the scenario, which gives people the feeling that this is a product under construction and they can really contribute to it. The second reason is related to user's ideation. Because they are not in a real environment, they are not limited by what already exists or it is possible to create. One of the participants mentioned that there is a lot of difference between simulating it in a real environment or in one made of cardboard. He felt freer to express his ideas because everything was possible, an argument already brought by Savoia (2011), when he approaches the concept of pretotyping.

The use of storytelling to predefine narratives aims to tell stories that will be experienced by users in a relevant way to assist them in their immersion on the simulated experience, involving the interaction with the product being validated and sharing ideas and knowledge in a persuasive way. In this sense, storytelling is essential for the experience to take place in depth. When the storytelling is followed by low-resolution prototypes it makes it possible for participants to really immerse on the experiment. The big advantage of it is to let the user finish the story that is being told. When they are performing the activities, they can imagine this situation in their daily lives, and express how they would behave and feel when actually using these concepts (or future products) that are being validated. For Liedtka (2018) this is probably the surest route to win consumers support and involve them in the process of generating ideas, in order to improve solutions.

It was also noticed that the use of low-resolution prototyping brings advantages even before the stage of application of the simulations with users. Considering that this is a quick way of materializing ideas, the design of prototypes helps design teams to see more clearly the product/service they are designing once they "build to think". In this way, when building the prototype, the designers can imagine different situations of use that can interfere in the experience of the user, being possible to ponder possible qualities of the prototypes. The act of building becomes part of the process of ideation. Still, from this perspective, the low-resolution prototyping is advantageous within the proposed method because it allows numerous iterative cycles. Paraphrasing Savoia (2011), one can thus fail faster, recover quickly, make necessary adjustments and restart the experiment cycle - and with this process, find out what the real value that the product or service in question has for the users.

Finally, one of the interviewees stated that even though he was working in technology, the experience was valuable to make him think about things that are indirectly related to the interaction, such as issues related to privacy, trust and data storage that could influence features in the product development process. So, the creation of basic, low-cost artifacts that will capture the essential features of users experience results in more-accurate assessments of value, because helping people “pre-experience” something can stimulate this type of feeling (Liedtka, 2018).

Final considerations

The use of narratives, prototypes, and simulations are important factors in the process of getting the user immersed in the experience, which leads to co-creation since it encourages the user to talk more about their perceptions, opinions, feelings, and ideas. As people are driven by a fear of mistakes, they focus more on preventing errors than on seizing opportunities (Liedtka, 2018). So, living experiences in simulated environments can output that. Besides that, low-resolution prototypes represent low costs in terms of material and technological resources, which enable new applications of the experience simulation whenever necessary in the product/service development process, making it easier for the whole team to restart when necessary.

As for the context of the application of low-resolution prototyping, this has been used in investigations in the field of technological products, which have physical objects and different environments of use. However, the potential for the tool is also perceived in the context of service design, with the same intention of simulating experiences. In addition, even though prototyping was described as a tool to be used specifically in the “plan” and “action” phases of the presented method (when the simulation of the experience is constructed and applied), it is strongly recommended to be used in other phases of the method. Considering the previously mentioned premise of "build to think", prototyping can be used in other phases where it is necessary to ideate about the problem or make representations that help the design team think or present a concept.

Moreover, we can highlight storytelling as an important tool used in conjunction with prototypes. Scripts are elaborated to all moments of user participation in the simulation, from the arrival of the user to the research site until their exit, in a dynamic and active way. They are used as interactive guidelines for the interactions and happen during the simulation like a conversation between the researcher and the user, which is engaged to the point that he or she feels part of the narrative. These guidelines purposely do not bring too much detail, so the user will fill the gaps with their own imagination, adding to the story pieces of evidence that will influence the design of the experience. The combination of both tools gives the researchers a qualified amount of data that covers what the users consciously speak, automatically does and unconsciously expresses.

It is understood that within the presented method, the construction of prototypes of products and its environments have important sub-phases that can still be explored in future studies. The application of different techniques for the construction of narratives, and the insertion of new tools to support research still present potential for study and detailing in future publications. Also, we can go further on understanding the differences in having a narrative that the user can finish when experimenting or have a complete narrative with the end already defined previously by the researcher.

Involving the participant in the low-resolution prototyping construction could also be a research phase. This would make co-creation reality in different phases of the method and not only the results that come from the experiment would have the users look, but the whole planned experience. Although this method has been used several times in the context of our projects, there is still space for more testing. More methods and tools can be incorporated into each phase. However, we claim that the application of our method can definitely be a first step to co-create and get insights for projects in different areas. It can be used by small companies and in projects with low budget and short time.

Finally, design role as a main contributor for innovation is a clear point (Acklin, 2010; Bertola, Vacca, Colombi, Iannilli, & Augello, 2016; Brigitte Borja de Mozota, 2015; de Goey, Hilletofth, & Eriksson, 2017; Kumar, 2009; Liu, Liu, & Zhang, 2018; Moroni, Arruda, and Araujo, 2015; Tidd and Bessant, 2013; Verganti, 2006; von Stamm, 2003), and design-driven innovation involves an understanding that people do not buy products and services, but meanings (Verganti, 2006). In this context, using a user-centered research method is an easy way to complete the task of finding meanings. Using the proposed method, companies will be able to identify the value perceived by customers, and by iteration phases, create a better experience.

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Research Perspectives IN THE ERA OF Transformations

Service Design Creating Value for Industrial Corporates through AI Proofs of Concept

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The field of service design has set practices that are useful during servitization transformations intended to help businesses respond to customers' rising expectations regarding the value of the service experience itself. As businesses increasingly pursue service development alongside product development, they need new ways of working and of evaluating solutions. Simultaneously, technological advances open avenues to new services and ways of interacting with customers. This paper draws on two workshop case studies of artificial intelligence (AI) assistant projects to examine service design in the industrial context. Through these case studies, the paper illustrates how proof of concept (PoC) is used at different project stages and explores how service design can support creation of PoCs in large industrial corporate contexts. The findings reveal the aspects of PoC as embodied experiencing of intangible AI concepts, the creation of PoCs through conversations, and the role of PoCs in industrial service design process.

Keywords: industrial service design, proof of concept, AI assistants, embodiment, corporate context

Introduction

Service design plays an ever-increasing role in industrial corporate contexts. This paper explores how service design can add value by creating proofs of concept (PoCs). A PoC is 'evidence, typically deriving from an experiment or pilot project, which demonstrates that a design concept, business proposal, etc. is feasible'.[1] As a way of concretising early-stage ideas, PoCs play an important role in the industrial service design process, helping to communicate the intangible value of service concepts. This paper asks how service design contributes to creating PoCs in industrial corporate contexts.

Service design has become increasingly important in industries that previously focused on manufacturing, reflecting the long-term trend of economies that focus on the exchange of services beyond exchange of physical goods (Vargo & Lusch, 2004, 10). This shift affects companies' production, strategies and structures, and many organizations have begun to expand their businesses by offering product-related services and gaining increasing revenues from service business (Lightfoot, Baines & Smart, 2013). For companies engaged in such change, service design introduces design thinking and processes to the development processes, products and services of the company as well as to the company's employees. The use of design has evolved in industrial contexts beyond actual product or service design to become one of the skills required for multi-professional innovation and for running a service business. The role of design is important in contributing

[1] https://en.oxforddictionaries.com/definition/proof_of_concept

facilitatory methods that enable teams to use creative confidence and expertise when creating new service-driven solutions.

With advances in 'servitization' (e.g. Lay, 2014) and 'servitizing' (Gray, 2013), companies must transition to delivering services successfully through product-service systems (PSS; e.g. Guidat et al., 2014). Creating valuable offerings within this context requires organizations to change their business models, processes and procedures as well as shifting the mind set of their employees and the nature of their relationships with customers and suppliers (Roy & Baxter, 2009) towards service-oriented innovation. Service design practices support and co-create this change; the service designer must synthesize solutions based on comparison of different needs, points of view and socio-cultural models (Morelli, 2003).

The concurrent development areas of service design are often complex and abstract, even in industrial contexts where services are connected to a physical product. It can be challenging to track and quantify services that are experienced subjectively (e.g. Meyer & Schwager, 2007), and methods of understanding user experiences in non-numeric ways can support the development and evaluation of service offerings. The availability of many competing services means that customers increasingly expect both high-quality content and interaction and around-the-clock convenient service access. Digital service channels allow companies to continuously serve customers, and advances in technologies like artificial intelligence (AI) make it possible to engage users in conversation with no actual human involvement on the service provider side. The intangible nature of AI-enabled conversational service interfaces, such as AI assistants, requires service value creation to take on new forms. Service design methods used for concretizing and making it possible to experience such intangible solutions are important means for developing concepts for new technologically enabled services that can be tested and evaluated.

As industry's use of service design increases, new ways of understanding the design process are needed to support implementation and maintenance of services in different organizational departments. One of the challenges relates to how newly generated ideas, concepts and solutions can be communicated, shared and implemented more efficiently and transparently in large, multinational and department-focused companies. One way of supporting service design in such contexts is the execution and use of PoCs. PoCs can be used in different phases of the service design process, from ideation to testing, to demonstrate the value of a product or service (Rauth et al. 2014).

The remainder of this paper is organized as follows. First, the paper presents an overview of the current state of service design work in large industrial corporations. Then, the paper introduces findings from two workshop case studies that consider the creation of PoCs in AI assistant design projects. By focusing on service design methods, the paper discusses the two case studies as examples of how PoCs have been used at different stages of the industrial service design process. The first workshop case study illustrates how embodiment and drama may be used to develop a PoC AI that is intended to create a new type of customer-AI interaction. Specifically, the case study explores voice interaction and conversational interface as a means of proving a concept's viability. The second workshop case study also utilizes AI as a base technology: a PoC of a chatbot is tested via involvement of potential users. Three main topics emerge from the analysis of these two workshop case studies and are presented in the findings: embodiment in experiencing the intangibility of AI assistants, service value through conversations, and PoCs in the industrial service design process. The paper concludes with lessons learned from the case studies and reflects them to define the role of service design in industrial contexts.

Service Design in Industry

Industrial service design refers to service design practiced in an industrial context, often inside an organization. According to Miettinen (2016), 'industrial service design is embedded in existing corporate structures and processes', where the service designer negotiates and initiates service design within the frame and constraints set by the organization. Industrial service design supports transformation towards more agile working methods and an iterative process for service development, enabling the organization to meet increasing demands from customers and the service market. To enable this, service design thinking must be a cross-cutting process that supports lowering of silos and flattening of hierarchies.

Beyond the traditional 'double diamond' model of the design process, Miettinen (2016) identified the following steps in the industrial service design process: (1) the pre-process, including strategic thinking and internal marketing; (2) running pilots with the team; and (3) scaling up the service solution. Service design in

the industrial context must be highly adaptable to find its way into the everyday practices and processes of existing design and innovation teams. The adaptation of service design in an organization is needed to support human-centred thinking and the creation of customer-oriented service journeys.

In industrial contexts, the service design process rarely begins from a predefined brief; rather, it typically involves a process of strategic thinking and collaboration within the organization, culminating in a project description. Before a project gets underway, it must be aligned with internal stakeholders and decision makers. This commonly involves presenting the project's goals and objectives, as well as outlining the resources required, to groups of stakeholders before a decision is made to proceed with the project. For this purpose, it is also helpful to be able to demonstrate that the project has business potential and can address real needs.

In seeking project approval, service designers often initiate PoCs or pilots to demonstrate the viability and feasibility of a topic, idea or concept. During piloting, it is important to refer to the original strategic alignment and planning to ensure that the project is moving in the right direction. The scope of a pilot or PoC can vary: PoCs are often small-scale or short-term efforts that enable the team to assess certain features of the project, while a pilot often follows more detailed concept development. Pilots are usually a test phase involving a limited number of users and often a limited set of service features. PoCs and pilots enable the team to identify both limitations and opportunities for development and support refinement before scaling up to a public customer solution.

Depending on the organization, scaling up may include internal processes such as IT development and data security. For the service designer, it is important to know the required steps inside the organization in order to successfully scale the service and launch it for customers and responsible business units. Beyond individual services, the challenge is often to see the big picture of individual service actions as a sequence of touchpoints that may seem disconnected from an industry perspective but make more sense as a single process for the customer. According to Miettinen (2016), a 'sequence of well-designed actions constructs a unified service experience', and a customer experience framework can be used to develop services and touchpoints within a unified service system.

AI Assistants

AI has been in development since the 1950s, but advances in AI in the past decade have made it more visible to the general public. While AI still exhibits a rather narrow definition of intelligence, it has proven valuable in the field of digital services. AI streamlines the analysis of large amounts of data and provides new ways for humans and machines to interact, such as AI assistants.

An AI assistant is a virtual system that utilizes AI technology to understand a customer's request based on written or spoken words. The assistant can also function as a service interface (Shevat, 2017) to support users in everyday tasks (Jolley, 2016; Afshar, 2017). The technology underlying AI is used to understand human behaviour and needs, and to allow the AI assistant to communicate responses back to users via conversations using natural language. As AI assistants such as Siri from Apple and Alexa from Amazon have begun to infiltrate the market in recent years, brand and service interaction is transitioning from touch-based interactions with applications towards conversational interaction (Gartner, 2016).

An AI assistant can take many forms and play many roles in delivery of a digital service. Frontend services can be facilitated through an AI assistant interface that is in direct contact with users, simplifying user tasks such as getting info on your next trip[2], ordering items[3] or organizing meetings[4]. In other cases, an AI assistant can be a backend resource, for example by assisting a human service agent in accessing relevant information, carrying out rapid analysis or giving suggestions on service actions based on accessible data (Gartner, 2019).

Regardless of the role, each type of AI assistant has a clearly defined purpose with regard to how it contributes value to a service. To achieve its purpose, an AI assistant requires a certain level of intelligence and ability that allows it to understand the user's need and respond to that need accordingly. Creating an AI assistant involves multiple aspects beyond the technology. An AI assistant commonly comprises selected service functions, the

[2] Many travel agencies such as Expedia and airlines like KLM have a chatbot for providing travel information to their customers.

[3] For example, Amazon Alexa.

[4] For example, x.ai (https://x.ai).

information provided or collected, frontend customer interface(s) including voice, text and visuals, and the assistant's character as well as the required technology and intelligence in the backend. As an AI assistant is likely to be seen as the voice of a brand, it is important to consider what expectations and meanings it creates for the brand. In other words, an AI assistant's character and behaviour are likely to influence how the brand is seen by customers.

Designing the assistant's character includes defining its personality, behaviour, appearance and tone of voice. In many cases, the assistant is also given a name and a backstory that defines who it is and how it behaves. All the designed aspects of an AI assistant are eventually communicated to users primarily through conversations. Compared to other digital service interfaces, such as websites, apps or display screens, an AI assistant relies primarily on spoken or written language.

Research methods and data

The research data come from two workshop case studies and includes images, field notes and documented personal reflections of the authors as service designers in the workshops. Both of the workshops were held with one large international organization but each had a different focus in terms of purpose, process, outcomes and people involved. The workshops were facilitated by service designers; Case Study 1 was run by internal service designers, while Case Study 2 included external service design support.

Table 1: Description of workshop case studies

	Case Study 1	*Case Study 2*
Focus	Future-oriented concept for AI assistant	AI assistant for customer service using a chatbot
Workshop description	1 day 12 participants Internal	1 day 6 users External
Workshop aim	Ideation and development of a concept	Testing of initial version of AI assistant with potential customers
Key methods	Personas Future visioning Role-play	Usability testing
Purpose of PoC	To prove the potential of new business areas	To prove user acceptance and to collect feedback for further development

- Case Study 1 focused on the creation of a future-oriented concept for an AI assistant. The workshop was constructed around a common view of a service landscape and future scenarios in order to explore the boundaries and possibilities of solutions that the case organization might offer to their customers. The content of the envisaged solution was created through customer journey enactment and mapping.
- Case Study 2 was a customer workshop held as part of a project to develop an AI assistant. Six potential customers were invited to participate in the workshop to test the initial concept by exploring content areas covered by the assistant and trying out the conversation interface. The workshop was an important step in proving that the concept could meet customer expectations so that a finished product could be developed.

As this paper's primary concern is to analyse workshop processes in order to study the constructs that constitute a proof of concept in an industrial service design context and AI-enabled services, further detail about the content and topics of the projects is not of immediate relevance. This also preserves the confidentiality of the workshop content and outcomes. The following three sections describe the findings emerging from analysis of the workshop case studies and discuss the roles and aims of the PoCs in each workshop.

Findings

Embodiment in experiencing the intangibility of AI assistants

The goal of the first workshop was to better understand users in future service settings where an AI personal assistant can enable new types of services. The workshop initially adopted an ecosystem perspective to develop a common vision of the scope of service opportunities the company might seize within the projected timeframe. Based on three future scenarios, this service ecosystem (Banoun et al., 2016) was used to frame ideation of the assistant and the customer services it might offer. Common methods of enhancing the exploration of possibilities for service interactions include experience prototyping (e.g. Buchenau & Fulton Suri, 2000; Rontti, 2016), role-playing (e.g. Iacucci, Kuutti, & Ranta, 2000), bodystorming (e.g. Oulasvirta et al., 2002) and service prototyping (e.g. Blomkvist, 2014; Rontti et al., 2012; Miettinen et al., 2012).

The method of role-play was used in the workshop in combination with pre-defined persona profiles (Blomqwist, 2002). The characteristics of the personas guided the workshop participants to take on roles as users in the role-play and explore through embodiment the actions and reactions the user might have in the future service situation. As a starting point for ideation, participants listed possible tasks that the persona might undertake in their everyday life. The tasks were then taken into the SINCO (Service Innovation Corner) service stage (Miettinen, Kuure, Rontti, & Lindström, 2012), using digital backgrounds, sounds and physical props to set a scene for a service situation. While situations from the customer journey were acted out, one participant would adopt the role of the AI assistant and would be visible to the 'customer' only through its voice and selected visual cues. The insights and ideas developed through this enactment were collected and used to generate a user journey map (Temkin, 2010) showing possible user actions, the function of each service, and the interaction between the user and the AI assistant.

Embodied design methods were instrumental in understanding the interactions and proving the value of the service from a customer perspective. Technologies people use in their everyday activities fundamentally shape how those activities might be done, and it is thus critical for designers and participants to understand those practices (Robertson & Simonsen, 2012). Although the workshop was internal to the development team and actual potential users were not involved, the enactment of service situations enabled the participants to adopt the user's point of view and thus experience the service situations from the user's perspective. Role-playing is widely recognized as a powerful method for observing and discovering aspects and elements of service (Buchenau & Fulton Suri, 2000). However, empathizing with someone else's role differs from using experience prototyping to experience the service subjectively for oneself (Miettinen et al., 2012). Previous studies have also confirmed that it is beneficial to involve company representatives directly in acting out new service concepts. This deepens their insight into the new idea and into the user experience, enabling them to evaluate the service experience from the user's point of view rather than as an outsider.

In AI assistant services where service content may only be expressed through language, it becomes crucial to involve the user in the design and development process. Creating a PoC for the assistant is one way to collect relevant user feedback to enable an incremental and iterative design and development process. As an element of service delivery, an AI assistant is likely to appear somewhat abstract, and without a concrete embodiment of the solution, it may be difficult to convey what it might be like to interact with such a service entity. In this case, the embodied service situations can be considered as proofs of concept. The workshop focused on potential services five or more years in the future based on assumptions of certain improvements in AI technology. Therefore, participants also had the freedom to imagine interactions that current technology might not yet support. Because the technology does not yet exist, it was considered more efficient to first prototype and evaluate the interaction through human-to-human role-play. This kind of exploration leaves space for improvisation and new findings, which human-centred service design encourages (Penin & Tonkinwise, 2009).

Service Value through Conversations

The second workshop was part of the process of designing an AI assistant for customer service support. The overall process followed the steps of use case definition for the assistant and design of the assistant's personality. The use cases were transformed into conversation flows in a website chat window that used the final technology but did not include the final user interface (UI) design. Six potential users were invited to the workshop to test the initial version of the assistant and to offer feedback to inform future development. The

test version of the assistant included AI skills for natural language understanding and processing, enabling the assistant to understand the user's needs and match those needs to defined responses or specific conversation flows. Six different use cases were included in the conversation content that underwent usability testing.

The aim of the workshop was to evaluate the service value an AI assistant can bring to users in the form of language. Character design elements, such as personality and traits, were included in the proof of concept along with the conversation content. The participants were asked to provide feedback on how they perceived the assistant's appearance and personality—for example, its level of politeness and use of words—and the value of the content it provides. Using laptops, participants tested the assistant on a test website through a chat window. Before starting the interaction with the assistant, a service scenario with a specific user goal was explained to the participants; they were then asked to start a text chat conversation with the assistant in whatever way they considered appropriate to the situation. The conversations were logged, and later in the workshop, the conversations were analysed and discussed together with the participants.

Providing service content purely through machine-generated conversation is still a rather new format for service providers. In order to test and evaluate the value of such service content, a PoC with the actual technology provided a means of communicating the content to users and receiving their feedback. The tests revealed the limitations in the content and conversation flows but also confirmed customers' willingness to interact with an AI assistant when it offers them concrete value. This might include simplifying a service process, taking over tasks that would otherwise require more effort on the part of the customer or providing easy access to information that might not otherwise be available to the customer.

PoCs in the Industrial Service Design Process

PoCs can serve multiple purposes in the service design process. In the first case study, a PoC was used as a form of ideation together with embodied design methods; it was also used to provide evidence of the intangible value of the AI assistant. The workshop was located in the discovery phase of the service design process and was used to collect more information about the possibilities of a service area that could be covered by an AI assistant in the defined future setting. As the workshop was also intended to communicate the potential value of the project to internal stakeholders, it can be also connected to the 'pre-process phase of strategic thinking and internal marketing' identified by Miettinen (2016) as one of the characteristic steps of the industrial service design process.

PoCs can support internal team communication. Design activities involve not just thinking or pure creativity but also communicating what design is or what it could be in ways that are understandable to others (Knight, 2012). Industrial service design supports understanding user actions and technologies in actual settings collaboratively and pragmatically rather than through abstractions. This supports mutual learning (Kuure & Miettinen, 2013) and idea sharing. Through improvisation and spontaneity, service design can work as 'communicative activities in ordinary conversation inside the organisations´ (Larsen & Friis, 2005). In the workshops, the use of PoCs that could be experienced allowed the participants to work from the same page, enabling easier, faster team work. After the workshop, the PoCs were also used in internal communication in the company to help other stakeholders understand the aims of the project and to generate the support needed to gain management approval to continue the project.

PoCs are often used as fast, efficient small-scale tests. They do not need to be publicized but can remain internal to the organization and can be used to further define the future direction of service development. Therefore, they are also useful prior to larger scale pilots that require the service to be in a close-to-finished state and that require a larger group of users involved in the testing. Running pilots is one of the characteristics of industrial service design processes (Miettinen, 2016), and this is where the second workshop case study can be located.

When the service is delivered through a conversational interface with an AI, the ability to experience the PoC is important in understanding how the service answers the needs of the user, how the value is created and delivered, and how the interaction fits as a service action with the larger view of the service journey the organization provides to their customers. An AI assistant can be seen as a single service touchpoint that complements the other steps in the service journey. By keeping in mind the larger picture, including the connections to other service actions, throughout the service design process, designers can ensure that the AI assistant has an established and verified place in the service offered to the customer.

Discussion

The workshop case studies show that PoCs serve different purposes at different stages of the industrial service design process, allowing the investigation, for instance, of customer needs, business potential, technical feasibility or the match between content and user expectations. Among the benefits of using a PoC in this context is that it provides early feedback from users or internal stakeholders about whether the project is going in the right direction. A PoC also makes the design target more concrete by giving it a functional form, whether through role-play or using the actual technology; such concretization enables stakeholders to discuss and evaluate the idea, concept, vision or strategy that the PoC represents. The case studies and the use of service design to illustrate these features in PoCs are a valuable contribution to industrial service design research (Miettinen, 2016). Further, including PoCs in the service design process adds value to experience prototyping (Buchenau & Fulton Suri, 2000).

Clearly, design PoCs also have some limitations. As they often demonstrate only one part of a wider solution, it is arguable whether a design PoC provides a sufficient basis for decision making. One PoC alone may not prove the case for an entire project, making it crucial to understand how and why the PoC is created in the first place. Especially in industrial contexts, winning the support of partners and internal sponsors is crucial for project continuity (Miettinen, 2016). To secure support for a project, it is essential to know what speaks to the relevant audience.

Depending on the decision makers and the design process stage, the focus of PoCs must be adjusted to acquire the insights needed at that particular step in the design process. At the outset, customer feedback on the initial idea may be the most worthwhile first step; PoCs with preliminary UI ideas can help to trigger customer comments and feedback. At the development stage, a technical PoC integrating a 'click dummy' prototype may offer more insights for addressing development backlogs. In many cases, a PoC is also used simply to assess the adaptability of existing technologies or service solutions to the concept.

Use of a PoC in industrial service design is an iterative process, and several PoCs may be needed before reaching a final concept and implementing the solution. Ultimately, based on the project stage, the project team must define the aim of the PoC, how it should be built to achieve that aim and how success of the results will be measured. As noted above, creating PoCs can be a crucial step in ensuring project continuity as it can provide concrete proof of areas of opportunity. Nevertheless, a PoC may not be comprehensive in itself, and combining it with other forms of insight such as customer testing, market research or business analysis can provide the information needed for decision making in relation to project direction and further development.

A variety of skills are needed to develop PoCs appropriate to the project stage. In addition to service design skills, technical expertise is necessary to create PoCs of the requisite quality, especially for digital service channels. A good sense of what is technically possible and the best means of achieving project goals with the available tools and skills is also important. What can reasonably be tested, what form of PoC best fits the project stage, and how to connect the process of creating a PoC to the existing organizational processes should be determined through collaboration and discussion among the project-owning business unit, service designers and technical experts.

Conclusions

Proofs of concept play an important role in AI assistant design projects, as they allow evaluating, testing and communicating the value of services. Service design supports the creation of design PoCs by incorporating the views of different stakeholders into clear goals through concretization and visualization and by facilitating collaboration among involved teams and experts. By introducing service design methods for ideation, prototyping and testing, insights and learnings from PoCs can help designers articulate concrete opportunity areas, development requirements or action plans for a project's next steps.

Depending on the intended purpose, a PoC may be more technical; in such cases, the role of service design is to keep the customer viewpoint in mind, avoiding technology-first development that risks developing solutions with no clear usability target. The strengths of service design include an understanding of customer needs and expectations, and the ability to utilize that knowledge to evaluate PoC outcomes plays an important role in clarifying insights and incorporating them into the project's next iteration.

Drawing on two examples of the use of PoCs in AI assistant projects, this paper illustrates how the purpose of a PoC can vary according to the project stage and goals. There is a tradition of utilizing PoCs in fields such as

business and IT development; in industrial contexts, where projects are often interdisciplinary, it may likewise be useful to have a tool that has a common meaning for everyone. At the same time, the tool can be used in different ways, and service design can open new opportunities by introducing methodologies such as embodiment to deliver concrete and meaningful outcomes without significant investments of time and money.

As the data set of the paper is limited to two case studies, further research is needed to show the full potential of using PoCs in the design of AI-enabled services in industrial contexts. However, the research shows the value of AI PoCs in the discovery, ideation and testing phases of AI assistant projects. PoCs can concretize intangible AIs and allow users and stakeholders to better understand the meaning of conversational service delivery. They can also point the way to further development directions for the solution. In the future, AI PoCs might also support earlier and more direct involvement of users in industrial service design projects through digital channels, thus overcoming the organizational boundaries that typically exist today.

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Disruptive Innovation Ecosystems: Reconceptualising Innovation Ecosystems

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Ecosystems are valuable in creating diverse and collaborative environments that enable businesses to innovate in ways that are much more difficult without them. However, business managers can be reluctant to participate in building ecosystems mainly due to lack of understanding. Specifically, businesses can be uncomfortable sharing resources, data, intellectual property and secrets with other ecosystem actors. Drawing on inter-disciplinary perspectives from literature, we use a 'design focused ecosystem thinking' to propose a new type of Disruptive Innovation Ecosystem (DIE). Firstly, we discuss the significance of adopting innovation ecosystems to create shared value. Secondly, we conceptualize a new type of DIE and propose steps on how DIEs can be created and fostered. Finally, we discuss DIE roles in relation to Amazon, Apple, Uber, and Siemens ecosystem cases. This paper offers a new type of DIE design process which may be leveraged by businesses towards building sustainable innovation ecosystems.

Keywords: Innovation ecosystem, Disruptive Innovation, Disruptive Innovation Ecosystem, Design, Shared Value

Introduction

The word 'ecosystem' originates from the domain of biology, and it defines the interaction and interdependence of living organisms within their environment (Jucevičius & Grumadaitė, 2014; Ferdinand & Meyer, 2017; Su, Zheng & Chen, 2018). In business, an ecosystem is defined as a network of actors who are guided by shared goals to create market and customer-focused solutions (Lyman, Ref & Wright, 2018). Recently, business and innovation literature has started to use 'ecosystems' as metaphors to explain the process of innovation (Shaw & Allen, 2016), subsequently leading to the ubiquitous use of the term 'innovation ecosystems' which means the constellation of actors connected in a web-like system to co-create, deliver and appropriate value (Hwang & Horowitt, 2012; Iansiti & Levien, 2004; Rabelo & Bernus, 2015; Tsujimoto, Kajikawa, Tomita & Matsumoto, 2017; Lyman et al., 2018; Russell & Smorodinskaya, 2018; Dedehayir & Seppänen, 2015; Dedehayir, Ortt & Seppanen, 2017).

Innovation ecosystem actors collaborate to offer innovations in the form of new systems, new products, technologies and services to customers. Wal-Mart, Amazon, ALIBABA, Apple, eBay, Google, and Microsoft are some of the few examples of firms who successfully applied the concept of innovation ecosystems in the past (Lyman et al., 2018). The internet makes it easier for larger and denser innovation ecosystems to grow in ways that were more difficult without the internet (Rong, Hu, Lin & Shi, 2015; Zhongmin, 2018; Wu, Wu & Si, 2016; Yan & Guan, 2018). In the context of this study, we discuss innovation ecosystems as systems of shared value

creation. However, before we discuss innovation ecosystems lets look at how Chesbrough, Vanhaverbeke, and West (2008) describe open innovations:

> *The use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. (Chesbrough et al., 2008, p. 2).*

Chesbrough et al., (2008) claim that opening the innovation process by leveraging information flows from outside firm boundaries and sharing data with other actors and or competitors can profit the firm, and Cruickshank (2014) expand on the claims by signaling the significance of managing information flows to increase profit. Consequently, opening the innovation process to create shared value is achieved through innovation ecosystems. Best and Koria (2017) posit that shared value is the unexpected solutions arising from innovation ecosystems. We continue from the latter perspective and Rabelo and Bernus (2015) innovation ecosystem life cycle processes. To support these ongoing works of building sustainable innovation ecosystems, we follow a design focused ecosystem thinking to develop a new kind of DIE associated with mutual survival of innovation ecosystem actors within disruptive environments. Disruptive innovation occurs when established customers of mainstream products, services or systems leave and start using a different offering, often produced by a less established company (Valkokari, Seppanen, Mantyla & Jylha-Ollila, 2017; Christensen, Raynor & Mcdonald, 2015; Christensen, 2013; 1997).

Ecosystems empower businesses to innovate together to create shared value (Lyman et al., 2018; Senyo, Liu & Effah, 2019; Adner, 2017; Russell and Smorodinskaya, 2018; Bosch and Olsson, 2018). However, as higher numbers of actors become interconnected, interrelationships can become unclear and evolve in unpredictable ways (Gomes, Facin, Salerno & Ikenami, 2016). Real-world ecosystems provide a milieu of interconnected actors where businesses can leverage vast resources to create new offerings. Nevertheless, how designers and business leaders use innovation ecosystems to develop sustainable offerings is less understood (Shaw & Allen, 2016; Lyman et al., 2018). Specifically, managing disruptive innovations within ecosystems remain a significant challenge (Gomes et al., 2016; Dedehayir et al., 2017; Valkokari et al., 2017). It is essential to discuss the emergence and role of innovation ecosystems within business growth (Mortati & Cruickshank, 2011), and towards the delivery of disruptive innovations (Dedehayir, Mäkinen, & Roland, 2016). Best and koria (2017) opened a conversation around how silent designers may help create unexpected solutions from ecosystem ambiguities. These ambiguities are opportunities that are difficult to find through linear systems or models (Best & Koria, 2017; Lester & Piore, 2004).

While organizations are generally set up to create profits as their primary function (Russell & Smorodinskaya, 2018), throughout this paper, we emphasize that shared value associated with mutual survival of ecosystem actors is becoming crucial. Organizations and governments make huge investments across the globe towards the development of innovation ecosystems, but there is a dramatic shortfall in achieving set targets (Rabelo & Bernus, 2015). These shortfalls are partly ascribed to actor's insufficient readiness and lack of knowledge and awareness about operating within ecosystems (Lyman et al., 2018; Rabelo & Bernus, 2015; Iansiti & Levien, 2004). Since ecosystems are regarded as 'new thinking' for value creation in today's interconnected world (Russell & Smorodinskaya, 2018; Lyman et al., 2018), it is urgent to comprehend the process of innovation ecosystems in creating and delivering shared value. Lyman et al., (2018) and Senyo et al., (2019) observe that though some business managers appreciate the significance of adopting ecosystems, they can be reluctant to participate due to fear of relinquishing control and sharing resource, data and intellectual property with other actors or competitors.

This paper discusses some major innovation ecosystem challenges and conceptualizes a new type of disruptive innovation ecosystem (DIE), which may be a fundamental design process for DIEs. Secondly, we propose steps on how DIEs can be created and fostered. Through the ecosystem approach, we posit how DIEs may be fostered to emerge and create viable connections amongst entities by drawing insights from literature on ecosystem emergence and disruptive innovation (Gawer & Cusumano, 2014; Dedehayir et al., 2016; Iansiti & Levien, 2004; Adner & Kapoor, 2016; Adner, 2017; Christensen, Raynor & Mcdonald, 2017; Valkokari et al., 2017). Thirdly, we discuss and visualise ecosystem roles by using Amazon, Apple, Uber and Siemens innovation ecosystem case studies.

This paper is divided into four sections. The second section discusses innovation ecosystems and disruptive innovation concepts. The third section proposes a new DIE and visualises DIE roles. In the last section, we outline the main conclusions and future direction of the study.

Innovation Ecosystems and Disruptive Innovations

Challenges of designing viable innovation ecosystems

Innovation ecosystems can be useful for developing creative solutions to problems. However, thriving ecosystems often emerge organically and can be difficult to build from scratch. It would be vital to be able to design and build them from scratch, but the dynamics and behavior of innovation ecosystems can be difficult to understand (Roundy, Bradshaw & Brockman, 2018). To appreciate the structure of innovation ecosystems, it is generally explained in terms of either hub-centered star structures as shown in Figure 1(A), or flat mesh-like structures as shown in Figure 1(B) and are further elaborated in previous literature (Mazhelis, Luoma & Warma, 2012). This typology defines the power diffusion and challenges associated with managing connections within the ecosystem network roles which will be discussed thoroughly in the third section of this paper.

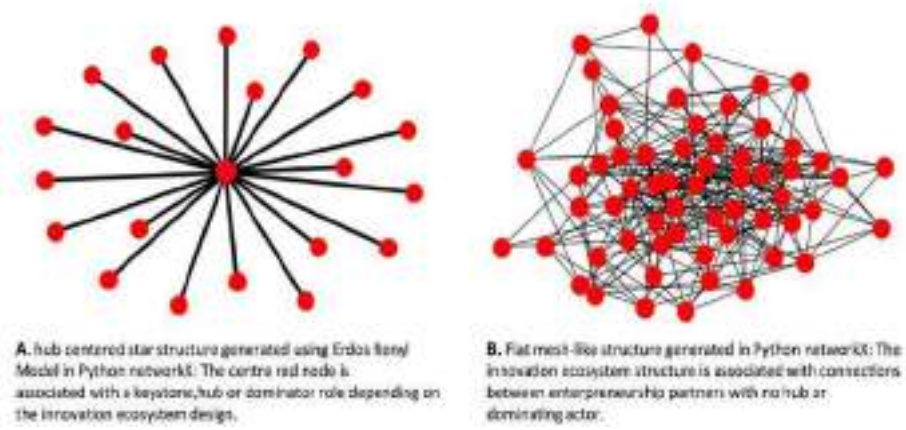

Figure 1: A typological visualization of innovation ecosystems: Showing A (star-shaped structure) and B (flat mesh-like structure).

Meanwhile, the openness of innovation ecosystems is usually seen as a management challenge more especially when dealing with many actors possessing different characteristics (Masys & Bennett, 2016), and contrasting socioeconomic and leadership models (Barile, Lusch,Reynoso, Saviano & Spohrer, 2016; Russell & Smorodinskaya, 2018; Mortati & Cruickshank, 2012). However, Best and koria (2017) argue that designers may leverage from these supposedly problematic areas of innovation ecosystems to create unexpected solutions and improve ecosystem adaptability. Adaptability in the context of our study means the ability of the innovation ecosystem to adjust to new conditions imposed by the external environmental forces. Innovation ecosystems are exposed to rapidly changing environmental factors (Hwang & Horowitt, 2012; Iansiti & Levien, 2004), and characterized by ambiguities (Ferdinand & Meyer, 2017; Best & Koria, 2017).

It is difficult for leading and incumbent firms to evolve their innovation ecosystems and re-design their systems to cope with disruptive innovation, some examples of failed ecosystems include Intel (Iyer, Lee & Venkatraman, 2006), IBM (Christensen, 1997) and Nokia (Iyer et al., 2006). The challenges affecting the evolution of business ecosystems also affect the development of innovation ecosystems, albeit more ambiguous. The ambiguity of innovation ecosystems is partly explained in Christensen's case study writings (Christensen, 2014; Christensen, 2013; 1997), though the author's theory is inclined towards creating firms competitive advantage instead of innovation ecosystems shared value creation. Christensen (1997) explains that incumbent firms fail to respond promptly to disruptions thus allowing entrants to grow and ultimately taking their customers. Market disruptions challenge the business as usual ecosystems, in most cases causing the ecosystem networks to collapse when faced with entrant disruptive ecosystems (Christensen et al., 2015). The impact of entrant disruption to actors connected to incumbent ecosystems seems to be unclear from Christensen's description (Dedehayir et al., 2017).

While innovation ecosystem challenges are well acknowledged in management research (Dedehayir et al., 2016; Lenkenhoff et al., 2018), disruptive innovation ecosystems related problems are less discussed and less

predictable (Dedehayir et al., 2017), although we argue that they are more intricate due to the complex nitty-gritty of managing disruptive innovations and innovation ecosystems. Hwang and Horowitt (2012) claim that innovation ecosystems need not be forced to exist, but rather emerge from a designed and shaped environment where they may thrive. The design and form of Innovation ecosystems are likened to the rainforest which does not predetermine the new biological species but provides the right environmental factors to foster emergence (Hwang & Horowitt, 2012; Shaw & Allen, 2016). Howkins share the same view and apply it to the emergence of creative ecologies (Howkins, 2010).

Identifying the right environmental factors for the design and formation of viable innovation ecosystems is one of the primary challenge confronting ecosystem designers today, just as it is challenging to plan for disruptive technologies (Christensen, 1997). In order to build successful innovation ecosystems, we need to consider the interdependence and interconnectedness of actors, individual actor models, strategic roles, evolution process, actor heterogeneity, and environmental factors. These are vital precursors for designing viable innovation ecosystems. These precursors may shift the attention from managing competition to coopetition as observed in (Isckia & Lescop, 2009; Ferdinand and Meyer, 2017).

To optimize shared value within innovation ecosystems, the theory of weak ties albeit old (Granovetter, 1973), may aid innovation and creativity within ecosystems. Mixing unreliable ties (weak ties) with reliable and established ties (strong ties) may provide new avenues for disruptive innovation (Cruickshank, 2010). The theory suggests that actors who are weakly linked to a network are most likely to provide the most valuable information for innovation as shown in Figure 2. However, in practice, weak nodes in networks are usually forgotten or ignored, but Hwang and Horowitt (2012) buttress that Google and Facebook were not distinguishable from weed in a rainforest or unwanted trees a few years ago, but today they are the most valuable amongst the search engines and social media platforms respectively. As shown in Figure 2, Ignoring the weak ties between IE-A and IE-C may lead to insufficient use of high-value data from both communities. Finding useful ways to take advantage of weak ties in designing innovation ecosystems is a great challenge and opportunity for designers.

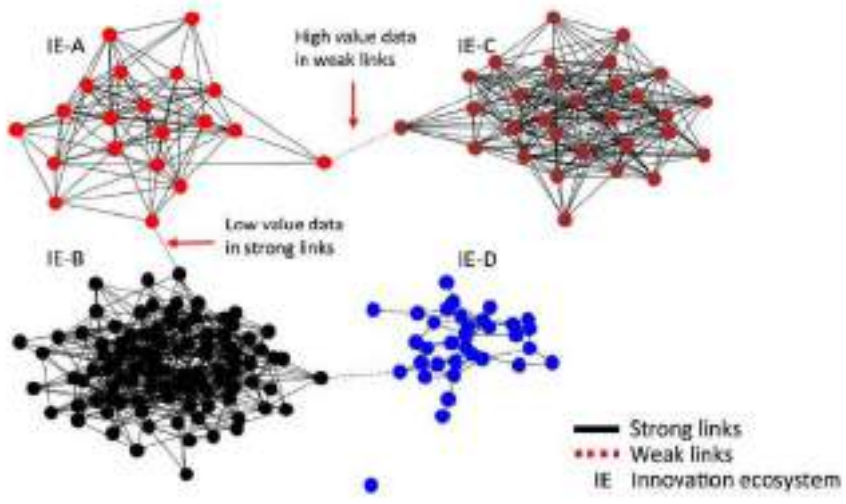

Figure 2: Visualisation of weak ties vs. strong ties: IE-A link to IE-C represents a weak tie which connects to information outside immediate group, hence, high-value data for innovation. IE- A link to IE-B represent a strong tie which connects actors to data within the group, thus present low-value data for innovation.

To address the challenges, we propose a new kind of 'disruptive innovation ecosystem (DIE),' which is a combination of disruptive innovation and innovation ecosystem constructs.

Disruptive Innovation Ecosystems (DIEs)

What is a DIE?

'Disruptive innovation ecosystem (DIE)' is proposed here as an innovation ecosystem capable of delivering disruptive innovations. James F. Moore was the first author to coin the term 'business ecosystem' which

according to Su et al., (2018) and, Gratacap and Isckia (2013) have been extensively applied to innovation management research in the past. Moore's concept of business ecosystems has continually evolved into explaining social networks and community structures (Ansari, Garud & Kumaraswamy, 2016; Su et al., 2018; Elena & Avasilcai, 2016; Gratacap & Isckia, 2013). Today, understanding interrelationships within SMEs, digital spaces, government policies, communities, and prosumers may be critical than ever before. Businesses are slowly harnessing the power of ecosystems in developing their business models (Lyman et al., 2018). Examples of bubbling disruptive innovation ecosystems are Uber and Lyft in the taxi business, Airbnb and Breather in hotel business (Libert, Wind & Fenley, 2014; Smith, 2016), and Apple iPhone in the smartphone business (Valkokari et al., 2017).

Though the theory of disruptive innovations continues to be explored in business management, business managers and strategists remain unaware of the possible remedies of disruptive threats in their incumbent innovation ecosystems (Christensen et al., 2015; Lyman et al., 2018; Khanagha, Ramezan, Mihalache & Volberda, 2018). While it is difficult to prescribe what needs to be done to tackle the disruptive threats from entrants' ecosystems as argued in (Ozalp, Cennamo & Gawer, 2018; Dedehayir et al., 2017), Christensen et al., (2015) suggests that instead of incumbent firms competing directly with entrant firms, they may consider forming separate divisions to explore new disruptive models. Furthermore, Khanagha et al., (2018) suggest experimentations with disruptive innovations. We submit that experimenting with DIEs requires a design process and designers to build the process. Who are these designers?, How can they design DIEs?, What roles may DIE actors assume?

Designers of DIEs

Designers are divergent thinkers (Hernández, Cooper, Tether & Murphy, 2018), and dealing with ecosystems is a problem of a divergent nature where designers may provide solutions to build sustainable DIEs. Therefore, a DIE designer maybe anyone with a divergent mindset, willing to look beyond the boundaries of a system towards creating customer experiences by leveraging DIE ambiguities. When designing DIEs, one cannot just look at individual actions, the designer influences the design of the holistic DIE environment and form that connects the actors to the same objective, attract new actors and ultimately enable DIE to emerge and thrive. The designer may be the brain behind innovation ecosystems, clusters, value networks, and other social network structures. Building this kind of DIE is not easy. Researchers previously proposed business ecosystem designs but to no definite agreeable structure (Gomes et al., 2016; Rabelo & Bernus, 2015; Valkokari et al., 2017), and developed tools for modelling innovation ecosystems (Walrave, Talmar, Podoynitsyna, Romme & Verbong, 2018; Talmar, Walrave, Podoynitsyna, Holmstrom & Romme, 2018). Challenges associated with DIE ambiguities may be addressed by following a DIE design process to create unexpected solutions. As shown in Figure 3, designers may use weak ties between communities of DIEs to leverage these relationship properties or recipes of design to create new solutions. For example, IE-F is weakly connected to IE-D, the two communities may use the weak tie as a bridge to leverage information on both sides to create new offerings.

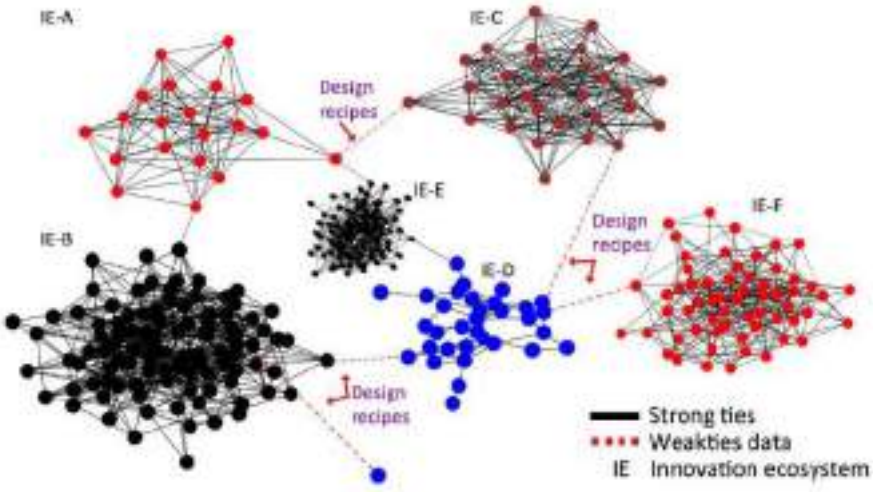

Figure 3: Showing innovation ecosystem community (A, B, C, D, E, F) weak ties and where designers of DIEs may leverage ambiguous data of weak ties to identify design recipes for innovation.

Designing DIEs

Design is the process that transforms new ideas and technologies into new usable systems, products, and services for customers (Hernández et al., 2018). Customers in case of DIEs may include co-innovators, distributors, retailers, end customers and others who are part of the DIE. Since design science is seen as a tool to gain competitive advantage in new radical innovations (Laureate & Spence, 2017), it can help the ecosystem actors to work collaboratively past specific firm challenges to ecosystems (Lockwood, 2018). Considering there is nothing like a single recipe for a thriving innovation ecosystem (Rabelo & Bernus, 2015), designing this kind of DIE embodies a creative process based on shared value to create, develop and define new products, services or systems that represents change. This may be a laborious exercise since innovation ecosystems do not have a formal structure of operation (Dedehayir et al., 2016). To constantly redesign shared value within Innovation ecosystems, we visualize the ideal ecosystem design approach shown in Figure 4 to aid the process of developing DIEs.

We draw insights from the fundamentals of open systems (Input-process-output) and show how this axiom interrelate with DIE factors. These interrelations may lead to unpredictable and unexpected DIE outputs. Understanding these interrelationships and environmental factors is crucial to DIE design process. As shown in Figure 4, DIE business models are interlinked to the DIE vision through customer demands and market needs. Market needs, DIE data, DIE network interrelationships, DIE shared vision, DIE material, and information flows are all crucial precursors for the design of viable DIEs. During the implementation stage, DIEs evolve in different shapes and forms depending on the disruptive innovations, value streams, new technology, information exchange, the culture of actors, talents and other factors as shown in Figure 4. Since DIEs form is evolving rapidly, it is challenging to develop a one size fit-all perspective. Our approach emphasizes understanding inputs, process, and environmental factors, which self-organize and evolve with time. Therefore, we argue that what is paramount is to position the designer at the early stages of DIE initiation, to influence the DIE evolution, management and sustainability.

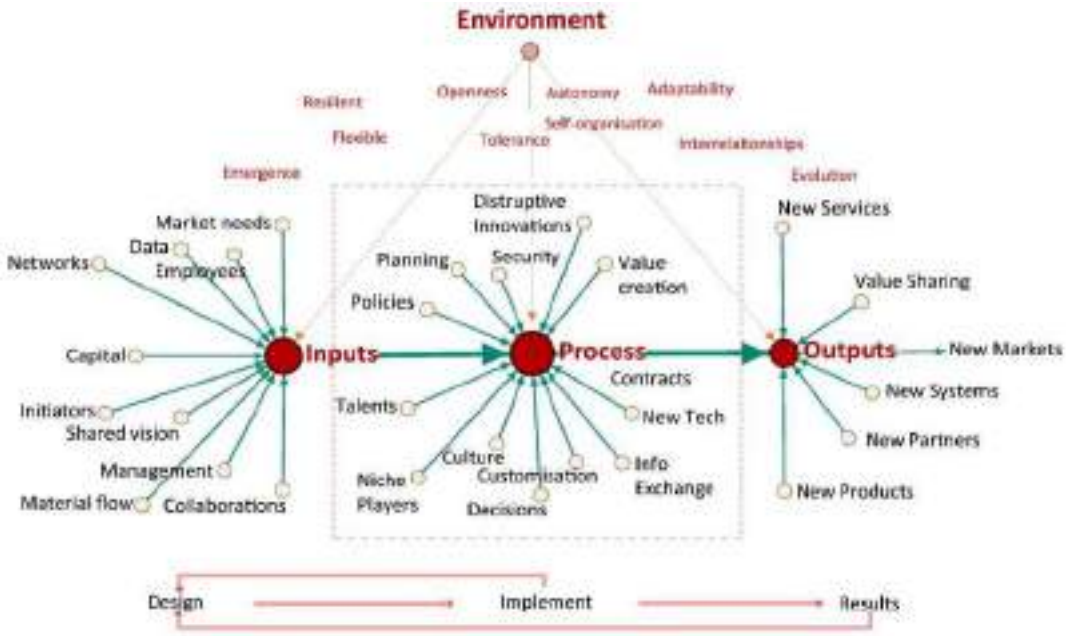

Figure 4: Ecosystem design approach: Showing Inputs, processes, environmental factors leading to DIE outputs.

Actors aiming to start DIEs are confronted with many questions such as how to start, whom to begin with and when to start. These questions cannot be answered through a literature review alone. The openness of DIEs makes them fuzzy to design just like developing ecosystems as noted in (Dedehayir et al., 2016), hence the need to understand the evolution stages and factors that are likely to shape and influence the design of DIEs. Moore (1993) proposed a four-phase life cycle (birth, expansion, leadership, and self-renewal) in developing business ecosystems, which was later expanded by Rong, Liu, and Shi (2011) as follows; 1. Emergence, 2. Diversifying, 3. Converging, 4. Consolidating, 5. Renewing. We propose DIE design process stages and visualize the model as shown in Figure 5.

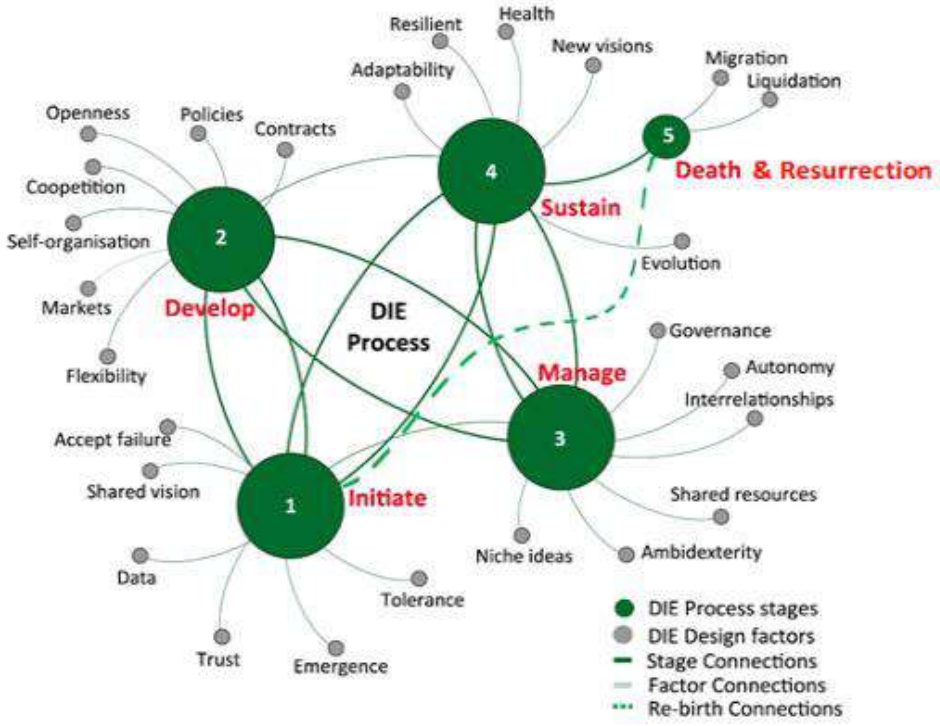

Figure 1: DIE process: Showing the non-linear interconnections between stages: 1. Initiation (information flow; 1-2 ,1-4, 1-3, 1-5), 2. Development (information flow; 2-1, 2-3, 2-4), 3. Management(information flow; 3-2, 3-4), 4. Sustainability (4-1, 4-3, 4-5) and 5. Death and resurrection (information flow; 5-1).

DIE Initiation

As astutely argued by Christensen (1997), established firms usually wait for disruptive technology to be established in mainstream markets. In the past, IBM waited carefully for the unfolding of the market (Moore, 1993), but today it may be risky to wait. Therefore, the first consideration for DIEs design is to initiate the value proposition around the emerging new market needs. Defining value proposition is meant to initiate the process of collaboration as outlined in (Adner, 2017). The ecosystem initiators actuate the process of coalescence. It is at this initiation stage that trust, tolerance, data sharing, emergence, and shared visions are cultivated to build open connections as shown in Figure 5.

The value proposition is based on information flow, money, interrelationships and materials as described in (Parolini, 1999). Just like the flow of nutrients in the rainforest (Shaw & Allen, 2016; Hwang & Horowitt, 2012), we argue that data flow is the resource that links stakeholders of the DIEs. It is crucial at the initiation stage to establish potential roles or nodes in the DIE structure. Some researchers suggested actors who may be essential at this early stage of building innovation ecosystems such as Suppliers, manufacturers, users, universities and research centers, entrepreneurs, regulators (Cusumano & Gawer, 2003; Li & Garnsey, 2014; Dedehayir et al., 2016; Rabelo & Bernus, 2015).

We propose that the design of DIEs may be approached from the main players who possess a shared vision complemented by other actors. The leader may recruit actors and ensure their autonomy and diversity of ideas. The initiator may offer some incentives to attract more actors to the DIE. Moore (1993) defines the initiation stage as the birth stage, Rabelo and Bernus (2015) identify this stage as the seed phase. We emphasize that this initiation stage cultivates a nourishing environment for adaptable DIEs to emerge.

We argue that the use of weak ties to increase the network density may also increase interaction within DIEs, hence increasing disruptive innovation streams. Weak ties connect actors of differing capabilities, unlike strong ties as shown in Figure 3 above. The amorphous bridges created by weak ties (Baer, 2010), are valuable to the design of DIEs because they may increase network density and access to information outside core actors. The increase in density of non-linear interrelationships is proportional to an increase in ecosystem

efficiency (Ivanova & Leydesdorff, 2015). It is not about choosing the right actors during the design process but rather stimulating DIE environment, just like in nurturing the rainforest as observed in (Hwang & Horowitt, 2012). The initiation stage is more about defining the DIE vision, business case, market roadmap based on the critical environmental factors shown in Figure 5.

DIE Development

We expect the initiated DIE to expand in terms of coopetition dynamics. Instead of competing with new DIEs it may be fruitful to explore weak ties to bridge the information gap between the DIEs and foster coopetition. The development of DIEs can be supported by friendly government policies at this stage to enhance coopetition and information exchange between actors. Searching for new territories to create and capture new markets by recruiting niche players may further develop the DIE network. To attract new players, DIE actors may establish unambiguous value creation and appropriation guidelines which are open and public following suggestions from (Rong et al., 2015; Dedehayir et al., 2016). Though these suggestions are not designed explicitly for disruptive environments, we argue that they apply to the development stage of DIEs. Open relational contracts for shared value are encouraged to lessen conflicts and disgruntlement within DIEs.

DIEs may attract new players by first growing demand for their niche products and services. This may be possible through the design of innovation ecosystems. At this point, disruptive players can be recruited to expand the niche creating streams. Developing DIEs may involve planning, testing and piloting in the market. To grow the market, the DIE architecture is designed for future scaling and evolvability. Therefore it must be flexible and adaptable to environmental changes which are often unpredictable and ambiguous. DIE designers may also consider third-party opportunities to develop the ecosystem. Amazon benefits a lot from third-party proceeds due to its open ecosystem architecture (Isckia, 2009).

DIE Management

Detailed literature investigated by Gomes et al. (2016) indicates challenges in the management of disruptive innovations within ecosystems. We posit that a design-focused approach can help manage DIEs. In Lyman et al., (2018), 50 % of managers believe that they do not have the capacity to manage business ecosystems. The autonomy of actors to operate in multiple and horizontal ways enabled by shared assets may limit linear management tendencies as demonstrated in (Lyman et al., 2018; Iansiti & Levien, 2004; Power & Jerjian, 2001; Gemici & Alpkan, 2015). Management in DIEs implies, inter alia, the coordinated sharing of resources as opposed to hierarchical coordination. Sharing of DIE resources lead to the creation of shared value. The main players may directly coordinate by initializing niche and smart technologies and influencing DIE actors to innovate through a shared vision. Linear management styles are discouraged at this stage because DIEs are intended to create unexpected opportunities horizontally.

Management of DIEs may focus on nurturing the DIE environment to accommodate the heterogeneity of business models. The firm focused business ecosystem concept such as Moore (1993) at this stage emphasizes control of value streams, which may not be an ideal strategy for managing innovation ecosystems in today's business milieu. Blackberry ecosystem's collapse is attributed to lack of designing an effective strategy to manage its innovation ecosystem (Jacobides, 2013). We propose a ‘win-win’ kind of collaborative activities and strongly discourage ‘big brother’ mentality in sharing resources for innovation. This can be achieved through an elaborate strategic DIE role structure.

DIE Sustainability

At this stage, DIE actors may decide to revamp the activities of the network in line with new visions to tackle new disruptions which may be affecting the health and adaptability of the DIE as shown in Figure 5. The DIE is expected to ail with time and become less efficient. DIEs can resuscitate ailing networks by recruiting niche actors in their systems, who can be used to experiment on disruptive innovations until value interrelationships are fully developed. The theory of weak ties may be useful in expanding nodes towards actors outside the DIE community to increase information pathways for innovation or design recipes as shown in Figure 3 above. We reiterate that weak ties may increase the DIE resilience and adaptation leading to sustainability of disruptive innovations, in fact utilising weak tie data reduces destructive competition and increases shared value amongst heterogeneous communities.

DIE Death and resurrection

If DIEs fail to sustain its shared value at stage 4, it may cease to exist as a DIE by either a large part of the actors migrating to other DIEs or liquidating as individual entities, pulling others along with them. To survive the storms from competing ecosystems, DIEs may seek to slow the growth of new ecosystems by negotiating to collaborate partly or wholly, or worst-case scenario re-structure their DIE architectures to accommodate new players. However, the death of one DIE may lead to the emergence of another as shown by the dotted line in Figure 5 (relationship 5-1). Competition within DIE actors may lead to the destruction of the entire DIE and resurrection of a new type of DIE. DIEs may be dominated by either a keystone, dominator, hub landlord or niche actor. In the following section, we explore and visualise these DIE roles in detail.

Strategic roles in DIEs

Even though ecosystem roles are sometimes naturally emergent rather than prescribed (Dedehayir et al., 2016), it is crucial to understand the actor's roles in developing and sustaining DIEs. This can be achieved by understanding individual DIE actor capabilities they contribute towards shared value. Additionally, the power dynamics between actors need to be established to characterize DIE interconnections. To discuss the DIE roles, we re-imagine Iansiti and Levien (2004) strategic roles (Keystones, Dominators, hub landlord, and niche players) and generate visualizations to represent DIE roles. We then discuss Amazon, Apple, Uber, and Siemens case studies as examples of DIEs. We use graph visualisations to represent abstract properties like relationships, power, and interactions between DIE actors in a simple way to aid quick understanding of roles.

We use python tools to produce graph visualisations using random comma-separated values (CSV) data to facilitate ease of comparing main roles within DIEs following the visualisation framework as shown in Figure 6. Python libraries dedicated to graph visualisation such as Matplotlib, NumPy, and Networkx are used to demonstrate how actors (nodes) relate (edges) to each other in terms of position, connection and influence. CSV data is created depending on the description of each DIE role (keystones, dominators, hub landlords, and niche players) to represent nodes and edges of graphs. Larger nodes and higher connections represent more importance and influence in DIE network graph.

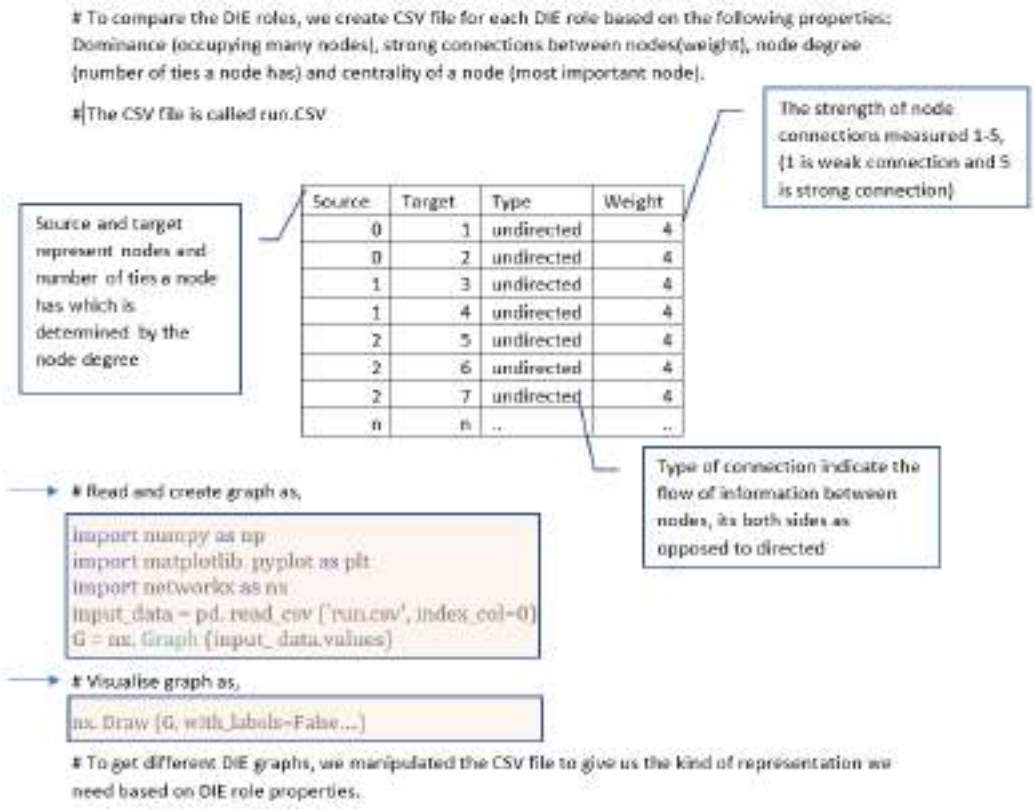

Figure 2: DIE visualization framework showing the basic procedure taken to visualize actors' roles using CSV data and represent their difference in terms of node importance, connection and influence.

DIE Keystones

A keystone is an important and influential node that promotes stability, health and shared resources with other DIE actors. Just like in the context of business ecosystems (Rong et al., 2015; Iansiti & Levien, 2004; Hwang & Horowitt, 2012), DIEs cultivate co-evolution, creativity, and innovation by providing an open innovation environment. Removing the keystone node shown in Figure 7 may negatively affect the shared value. As shown in Figure 7, Keystones are represented in large nodes and edges occupying few positions in DIE networks. The remaining positions (small nodes and edges) are available to be occupied by other actors, thus dispersing power and authority across the network. By occupying the central positions, keystone nodes support innovations through the provision of DIE resources. Keystone node is trustworthy and has a good market reputation (Isckia & Lescop, 2009).

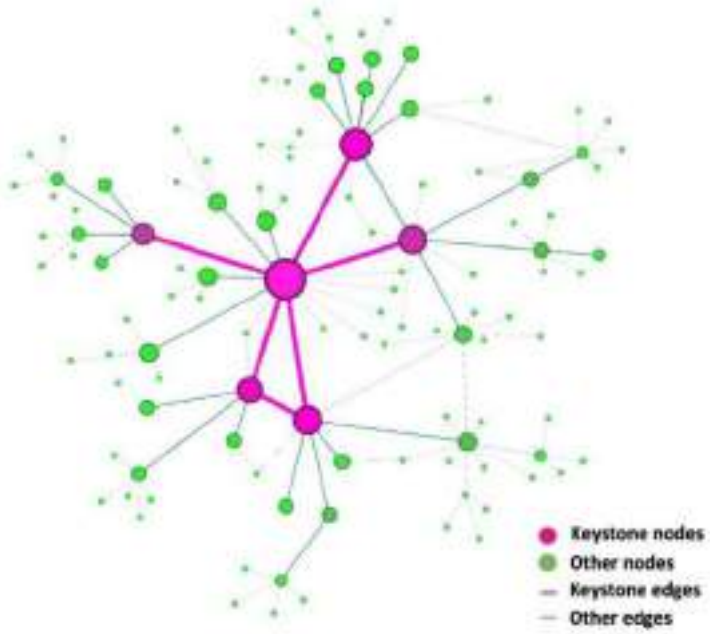

Figure 3: Visualization of a DIE Keystone role: Keystone positions occupy the center nodes and connect through keystone edges to the rest of the network. Keystone positions are few in the network to lessen control and dominance.

Amazon as a keystone

The growth of Amazon is attributed to its innovation ecosystem (Isckia & Lescop, 2009). Amazon as a keystone focuses on creating opportunities for other actors to access and leverage unlimited resources (Mazhelis et al., 2012; Gratacap & Isckia, 2013), without contributing to huge platform-specific investments (Zhu & Liu, 2018). Amazon maintains the autonomy of its partners pricing policies unlike other platform leaders such as Wal-Mart and Apple (Moore, 1996; Zhu & Liu, 2018). Amazon integrates niche players within its ecosystem platforms as thus creating more value through web services and e-business incubation (Isckia & Lescop, 2009). Amazon has an excellent reputation for sacrificing profit for growth by fostering open-innovation within third-party players (Zhu & Liu, 2018). Therefore, Amazon appears to be a good example of a DIE keystone actor.

DIE Dominators

Dominators are DIE actors who have high control of value creation and capture streams in the network. Dominators are distinguished from Keystones through metrics of physical size as shown in Figure 8, one dominating actor occupying all positions indicated in large nodes (dominating nodes) in the network. Unlike keystones, dominators stifle diversity by the massive presence in the network and control most of the innovation streams (Dedehayir et al., 2016). Consequently, dominators within the DIE network may create and extract most of the value, thus starving its ecosystem. The behavior of dominators may limit the DIE to respond to external shocks and may eventually collapse the entire DIE.

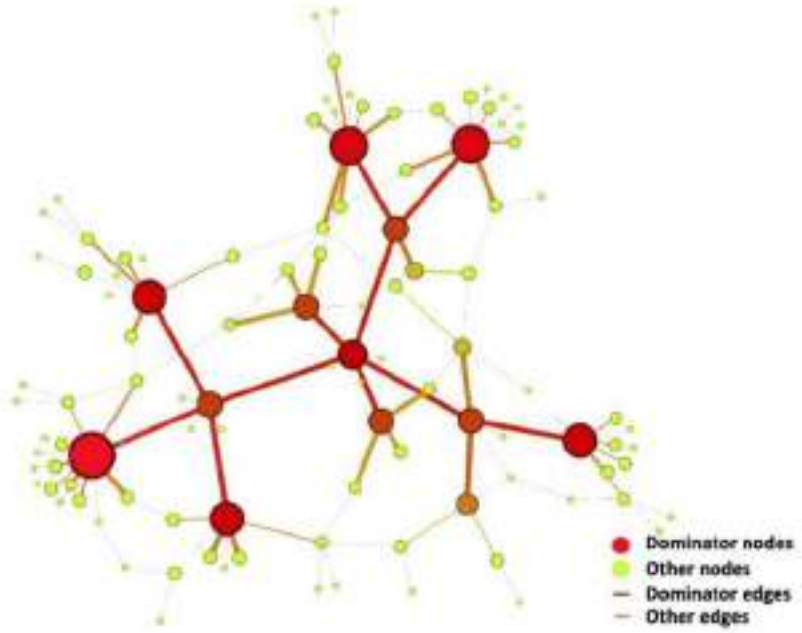

Figure 4: Visualization of a DIE Dominator role: Dominator positions occupy the large nodes and connect through thick edges to the rest of the network. Dominator positions are many in the network to increase control and dominance.

Apple as a dominator

Unlike Amazon, we observe that Apple maybe extracting more value from the ecosystem by dominating its innovation networks. This is seen in (Valkokari, 2015; Jacobides, 2013) as a dominating factor. Apple maybe controlling the ecosystem by inhabiting value creating nodes as shown in Figure 8. Distinct from the Amazon ecosystem, Apple has been consistently reluctant to share value with others through licensing third-party developers. Though the company recently started supporting third-party apps, Apple continues to thwart third-party efforts by continually releasing new operating systems (Zhu & Liu, 2018; Song, 2010), whereas Amazon encourages the growth of third-party players. Though Apple has managed to navigate the disruptions in the smartphone business while maintaining a moat on its incumbent services (Back, 2014), it may be beneficial to open its innovation ecosystem further to support and create shared value to guarantee Apple DIE sustainability.

DIE Hub Landlords

Hub landlords are DIE actors who invest in value extraction only. As shown in Figure 9 hub landlords occupy few nodes in the entire innovation ecosystem shown in large nodes and thick edges. Actors holding hub positions are often faced with temptations to exploit their central hub position for short term gain to the detriment of other actors (Iyer et al., 2006). Dominators control value creation and capture most of it whereas hub landlords choose not to participate in the value creation, instead eschews control of networks and invest in value extraction only as elaborated in (Song, 2010), eventually turning successful keystones into hub landlords.

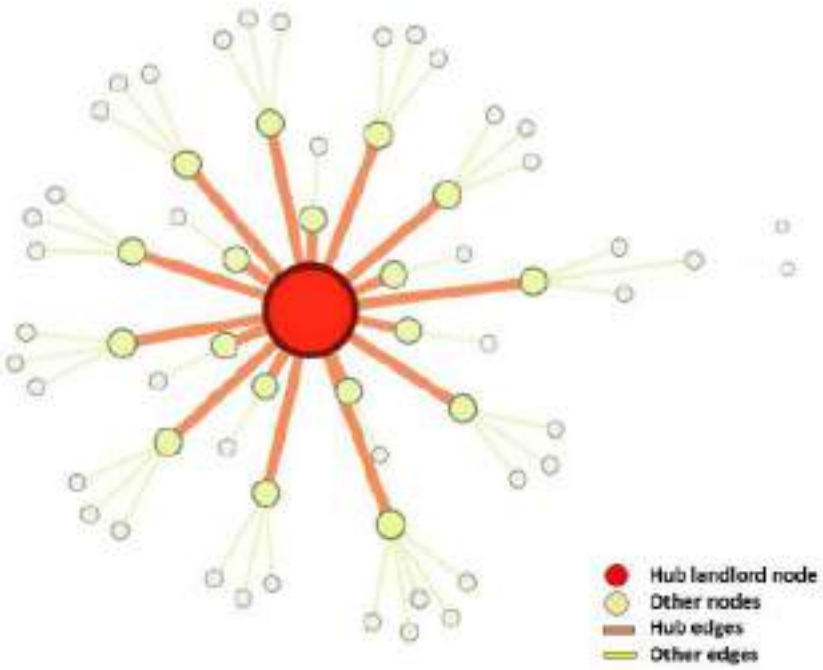

Figure 5: Visualization of a DIE Hub landlord role: Hub landlord positions are few in the network to avoid control of value creation but increase value extraction as shown by its position in the network and value extraction edges.

Uber as a Hub landlord

Uber relies on other people's automobiles by merely providing the hauling app to facilitate the sharing of actors' assets (Libert et al., 2014). Uber leverages dormant automobiles into valuable assets for drivers and riders (Smith, 2016). However, most of the value generated by drivers and customers are reported to be going towards Uber (Bensinger, 2017; Berger, Chen & Frey, 2018). Consequently, drivers and riders appear to be resentful over Uber's value extraction and its inability to improve their well-being within the ecosystem (Ridester, 2018; Bensinger, 2017). Uber appears to be benefiting immensely from its ecosystem (Hall, Palsson & Price, 2018; Farrell & Bensinger, 2018).

Since Uber is not yet a public entity, its pricing algorithm is not publicly shared (Jiao, 2018), and it remains unclear as to how much is the actual unit cost per ride (Mims, 2017). Bensinger (2017) note that it is possible for Uber to lower fixed fees and commission charges to boost driver's income. To sustain its ecosystem, Uber may need to look at its fixed costs and commission, and factor in maintenance costs, road charges and other charges associated with the drivers to turn it into a keystone player.

DIE Niche

While keystones provide a platform for innovation, niche players add value to the platforms by innovating (Rong et al., 2015). As shown in Figure 10, niche players have a meager physical presence in the DIE network yet collectively can create high-value solutions. Keystones rely on the presence of niche players to remain attractive to new actors. Niche players develop unique products and services different from what others do by leveraging resources provided by keystone players (Galateanu & Avasilcai, 2016).

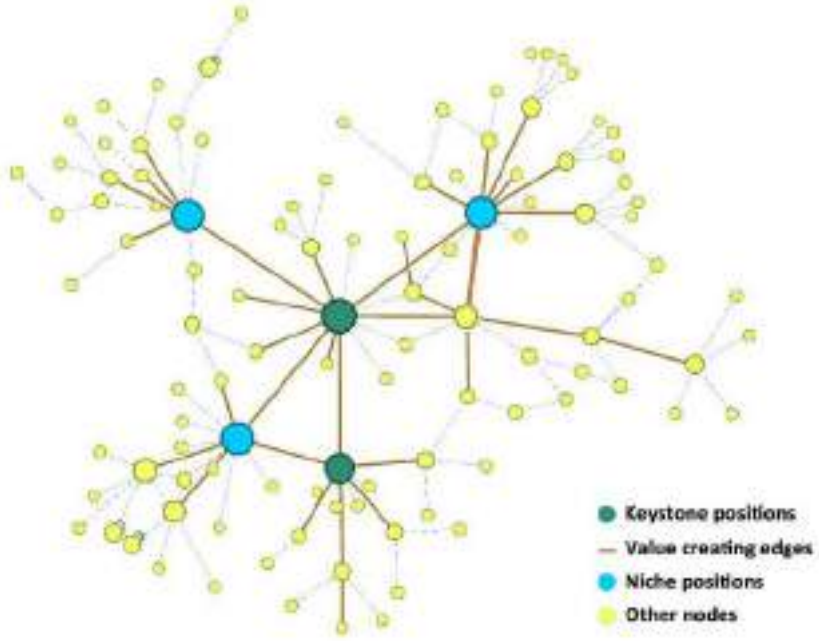

Figure 6: Visualization of a DIE Niche role: Niche positions occupy the nodes located at the busiest points in the network. Niche positions are few in the network to contribute to innovation and creativity.

Siemens as a Niche

Adidas and Siemens are working towards forming something which may be likened to DIE niche service, to build an intelligent manufacturing speed factory. The factory is intended to make use of the power of customization in manufacturing shoes faster than using traditional or conventional methods (Lyman et al., 2018). Adidas as a keystone is leveraging the specialized services of Siemens within its ecosystem to transform their factory. By digitizing the factory, the DIE may produce new technological innovations and customizations faster than ever before as noted in (Adidas, Siemens Partner in Digital Production, 2017). In the Adidas speed factory DIE, Siemens occupies a niche position.

Conclusions

This discussion paper has two significant contributions. Firstly, it adds to the discussion of ecosystems as a new strategy to promote disruptive innovations by reconceptualizing a new type of DIE. Secondly, it visualizes and compares strategic ecosystem roles with case studies. Through these contributions, we explained how DIEs could be created and fostered. We identified the following steps as key towards designing viable DIEs; 1. Initiate, 2. Develop, 3. Manage, 4. Sustain, 5. Death and resurrection. The study positions a designer as the key actor in the development of a viable DIE.

The practical implications of understanding DIEs and positioning designers within the DIE design process may aid continuous re-design of DIEs to suit the ever-changing economic reforms in policy, SMEs business models, school's curriculum, entrepreneurs and individual businesses. Understanding design and emergence conditions may help enterprises to better leverage DIEs in creating sustainable solutions. This paper provides a lens for future empirical research strategies and methods. The limitation of this study is that it is based on a conceptual discourse merely focusing on theoretical discussions with no practical examination.

Further work is now needed to explore current DIEs to establish how ecologies are likely to influence change in future business models, particularly in developing nations. It would be interesting to provide an empirical investigation on how DIEs are designed, evolved, managed and sustained to contribute to shared value. To develop our work on DIEs, we will be engaging with businesses in developed and developing nations to support our new DIE concept with empirical work.

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Research Perspectives IN THE ERA OF Transformations

Unlocking the Potential of the Salesperson in the Virtual Fitting Room: Enhancing the Online Retail Experience for Fashion Brands

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In the last decade, online shopping has become increasingly popular, as evidenced in the global growth of e-commerce and m-commerce. Alongside these developments, it is important to ensure customer satisfaction and requirements. The integration of smart technologies with service design and applications introducing the virtual fitting room are on the increase and are contributing to the fierce competition between online retailers. However, there is little understanding about the most effective way to use this technology and how it can transform services touchpoints, particularly for fashion brands. Considering this, the current study compares and contrasts virtual fitting room models found in the literature with examples from popular websites. This paper introduces the concept of the salesperson in the virtual fitting room and provides recommendations as to how this can be explored in the future, from a design perspective.

Keywords: Virtual Fitting Room, Salesperson, Service Dominant Logic, Fashion Brands

Introduction

In the last decade, online shopping has become increasingly popular, as evidenced in the global growth of e-commerce and m-commerce. Alongside these developments, it is important to ensure customer satisfaction. Applications introducing the virtual fitting room have been on the rise nourishing the fierce competition between online retailers. Today, consumers can try clothes on from their homes, without having to go into a physical store. This provides another layer of complexity for the overall consumer experience on e-commerce websites. Systems like triMirror[1], for example, provide a personalised experience for consumers, allowing them to try clothes on a 3D avatar with the same body features as the consumer.

Online shopping offers a dominant alternative to traditional retail shopping, rendering imperative for online retailers to seek ways to improve customer experiences (Mallapragada, Chandukala and Liu, 2016). Improving the customer experiences online can be particularly challenging for fashion brands, where the product aesthetics and product fit matter. Recent literature identified wrong size or bad fit of online cloths as key obstacles to online shopping (Liu, Burns and Hou, 2013; Syazwan, Noraidah and Tengku, 2018). One way of improving customer experiences for fashion brands would be to introduce virtual technology systems that would allow customers to virtually try on the selected garments. This idea, however, presents a number of

challenges as virtual systems need to be useful and easy to use in order to create positive customer experiences (Kang, 2014).

Considering these trends in shopping and the current challenges posed by 3D virtual rooms, the aim of this paper is to make recommendations to fashion retailers to integrate virtual rooms into their services. It focuses specifically on the role of the sales person who is crucial for improving the quality of the shopping experience, as it is the sales person who can also co-create with the customer (Le Meunier-FitzHugh, Baumann, Palmer and Wilson, 2011). Although online fashion retailers use 3D fitting rooms on their websites, there is little reflection on and research into how they can be improved and what could make consumers use this type of tool. For example, have the fashion brands developed strategies to use 3D virtual fitting rooms, and if so, how can they be improved, both of which are research questions that guide this study.

Following an in-depth literature review, this paper compares and contrasts virtual fitting rooms from the marketing literature and websites that work closely with fashion brands, such as; *Metail*, *Model my Outfit*, *3d-a-porter*, *SenseMi, triMirror*. The contribution of this paper is a critical review of the literature in this area and recommendations for the application of 3D virtual fitting rooms in fashion service design, including a discussion on the role of the salesperson in this context.

Literature Review

The 3D Virtual Fitting Room

Although the 3D technology had a slow start in the fashion industry and only in the last few years fashion brands have made efforts to adopt this technology in retailing (Clarke and Wilhelm, 2011), nowadays, most of the virtual fitting rooms seek to incorporate 3D technology. The 3D technique provides a 360 degree view of the model and aims to increase customised demand (Olaru, Spanachi, Filipescu and Salistean, 2014) and improve efficiency in the purchasing process (Lee, Ma, and Choi, 2013). The virtual 3D fitting room constitutes an interactive platform between the fashion brand and the customer that aims to reduce the bad fit rate and enhance overall confidence and satisfaction in the purchasing process (Lee et al., 2013).

Different from 2D environments that are flat by nature, 3D worlds provide another dimension of interaction (depth); this tends to be associated with the perception of realism since our world is 3D by nature (Cao, 2014). If applied in interactive media, 3D has the potential to change consumers perceptions. For instance, high realism perceptions tend to influence brand preferences positively (Grigorovici and Constantin, 2004).

The virtual fitting system allows customers to select and virtually try on different clothes. Customers simply need to create a private profile and add their body measurements or choose an avatar close to their body type. Studies have shown that compared with traditional stores, online retailers that use virtual technology tools are able to increase interaction on their website and increase online apparel sales (Lee et al., 2013). However, at the same time, having a 3D fitting room in the website does not imply that consumers would have an enjoyable experience. It is possible that consumers are not familiar with the technology, thus the use of the virtual fitting room is simply depends on the actual usefulness of the tool (Kang 2014). Consumers would use the virtual fitting room with a purpose (to buy the product), and not because it could be enjoyable. The use of the virtual fitting room may also depend on the customers level of ego involvement. Customers with a high level of ego involvement are found more inclined to use the virtual fitting room (Kang, 2014). Similarly, in a recent study on the use of virtual fitting rooms on fashion brand websites, (Beck and Crie, 2018) found virtual fitting rooms to significantly increase customers intention to buy the product and customers intention to demonstrate superiority through the quality experience created by this tool. On the basis of all the above considerations, using the virtual fitting rooms to create compelling brand experiences for the fashion customers can be considered crucial in the online setting.

Brand experiences

The proliferation of brands in the marketplace has increased customers choice set of brand options. Nowadays customers are empowered to choose among various brand options and have ample options to switch. In this competitive and dynamic environment one of the key concerns for marketers is how to design brand strategies that build and support brand commitment. Past literature has examined various drivers of brand commitment, but much of the recent literature has focused on brand experience as a key driver of brand commitment (Brakus, Schmitt, Zarantonello, 2009; Das, Agarwal, Malhotra and Varshneya, 2019). Brand

experience provides critical points of interaction for multisensory stimulations that can engage customers with a brand (Das et al., 2019).

Brand experiences are also defined as "subjective, internal consumer responses (sensations, feelings, and cognitions) and behavioural responses evoked by brand-related stimuli that are part of the brand's design and identity, packaging, communications and environments" (Brakus et al., 2009, p.53). In other words, brand experiences are the outcome of consumers perceptual or behavioural interactions with various brand stimuli such as logos, colour, packaging and advertisements (Das et al., 2019). Brand experiences can also lead to pleasurable behavioural and attitudinal outcomes i.e., high perceived brand value, brand endorsement, brand commitment (Brakus et al., 2009) aversion from switching to alternative brands (Chaudhuri and Holbrook, 2001), repeat purchase and habitual behaviour (Zarantonello and Schmitt, 2010). Intuitively, a positive brand experience would lead to brand commitment (Das et al., 2019). However, there are arguments in the literature to suggest that the relationship is mediated by cognitive and affective aspects (e.g., relationship quality, credibility and emotions) (Francisco -Maffezzolli et al., 2014). In a recent study on the antecedents to brand commitment in the apparel industry, (Das et al., 2019) found brand passion to mediate the relationship between brand experience and brand commitment. Based on the attachment-aversion theory the more the perceived brand and self-distance and the notable the brand meaning is the more consumers feel connected to the brand (Das et al., 2019), which can in turn lead to a stronger need for attachment with the brand i.e., brand passion (Albert, Merunka and Valette-Florence, 2013).

Since brand experience is about creating multisensorial experiences through different stimulations (Das et al., 2019), it provides ways for consumers to engage with the brand. Thus, 3D virtual fitting environments could provide more in-depth experiences for consumers. In fact, developing customer engagement opportunities is crucial to improve the quality of online shopping (Ha and Stoel, 2012). This can also improve the experience consumers have with the brand. For instance, interactivity, presence and immersion can influence brand experience (Mollen and Wilson, 2010). However, this does not mean that high interactive websites would necessarily be engaging for consumers. As stated by Mollen and Wilson (2010), a website can have many interactive features, but if it is not relevant for the consumer, it will not create consumer engagement. Thus, 3D virtual rooms need to have a clear purpose.

There is also an opportunity for fashion brands to explore consumer satisfaction in online environments. In his principal work on the cognitive antecedents and consequences of satisfaction decisions, Oliver (1980), define satisfaction as customers psychological response following the post-purchase experience of the product compared with the pre-purchase expectations. Thus, narrowing the gap between what customers perceive and what customers expect is a key point to achieve the success in online retailing. Fierce competition between online stores, makes it necessary for retailers to look for a new breakthrough and make some changes that can not only attract potential customers but also minimize companies' cost. Thus, by adding more multisensorial layers of interaction could impact the quality of the shopping experience.

Quality of the Shopping Experience

A large body of previous literature shows the importance of understanding customers individual needs as well as their attitudes and satisfaction level with online purchasing (Mosteller, Donthu, and Eroglu, 2014). Many people have been dissatisfied with their online shopping experience mainly due to the bad fit of the clothes following the purchase (Cordier et al., 2003; Liu et al., 2013). A key element to attract more customers to meet their individual satisfaction and finally develop their intention of online shopping is to increase the quality of their shopping experiences (Ha and Stoel, 2012). The quality of online shopping is defined as consumers' attitudes and viewpoints on what e-retailers provide them both in product and service (Ha and Stoel, 2012; Shiau and Luo, 2012). Past studies have focused on the use of virtual technology to reinforce consumers' purchasing intention. For instance, Lau et al., (2013) have found a positive relationship between the attraction to the site and the use of virtual technology. Virtual technology was found to significantly change the online experience from the in-store experience. The focus on the quality of experience is fundamental since the interactive element of 3D virtual fitting rooms alone is not enough to convey consumer engagement (Mollen and Wilson, 2010; Kang, 2014). In order to improve the use of 3D virtual fitting rooms, service providers need to consider a combination of usefulness with consumer perceived value. For instance, online retailers could reinforce "good value for money", by providing price comparisons within the 3D virtual fitting room (Kang, 2014). Another way to improve service quality using virtual technologies online is through the use of chronological interactions. This perspective coined as *narrative experience* could influence consumers through content, graphic style and navigation structure (Huang and Liu, 2014). In fact the way the information is

presented to the consumer through different types of media influences the way consumers search for information (Klein, 1998). Thus, if searching for information takes time and effort and if the media is not accessible, then it would ultimately influence consumer decision-making in a negative way. Thus, if by using a 3D virtual fitting room it is not possible to find relevant information and if the experience is not seamless, then consumers would not perceive it as beneficial. Therefore, the quality of the shopping experience is related to both pragmatic and hedonic aspects of the service. That is, the features of the service (through characteristics like content, presentation, functionality and interactivity) would evoke both pragmatic and hedonic perceptions (Hassenzahl, 2005). For instance, pragmatic aspects are utilitarian and related to the manipulation of the service/product, whereas hedonic aspects are related to pleasure and attributes such as stimulation, identification and evocation (of memories) (Hassenzahl, 2005). This means that for an effective use of 3D Virtual Fitting Rooms in fashion websites and mobile apps, usability and pleasurable experiences should be key challenges. However, this might be attached to the familiarity with the device and context. For example, consumers might shop via mobile/tablets or using a computer desk at home (or work). Thus, these variables are also important to consider.

From a service design perspective, it is crucial to consider experiential touchpoints points. In this case, there are three spaces that compose service experience: backstage, frontstage (or frontline) and auditorium (the actual customer experience and customers) (Zomerdijk and Voss, 2010). In this case, the frontstage is composed of physical environment, service employees and the service delivery. If considering that e-commerce utilises a virtual environment, then this changes the service frontstage considerably. In the case of fashion retailers, this aspect overlooks the role of the sales person. Thus, this shows a potential limitation and opportunity for 3D virtual fitting rooms to improve.

The Value of the Salesperson in the Shopping Experience

A service oriented organisation requires by its nature personal interaction between salesperson and customer. The role of the salesperson is continually developing following the changes in the environment. The global marketing shift from Goods Dominant Logic (G-D) to Service Dominant (S-D) logic had fundamental implications for the role of the salesperson in the sales process and overall customer shopping experience. Adopting the S-D logic requires staff to develop additional skills that will elicit needs at both the values in exchange and value in use stage. This new sales process goes beyond selling goods and services to co-produce attributes of the customer usage process (Le Meunier-FitzHugh, Baumann, Palmer and Wilson, 2011).

Traditionally the sales process required the salespeople to persuade customers to buy the business goods and services (Sharma 2007). The more complex modern sales environment demands creating value by delivering integrated solutions (Brady, Davies and Gann, 2005), which means selling a combination of products and services adjusted to satisfy customers' particular needs (Davies, Brady and Hobday, 2007). The advent of relationship marketing and S-D logic requires sales staff to become more sensitive to the needs of their customers, adjust integrated solutions for specific customer groups. Under the new customer centric logic (S-D logic) the salesperson is responsible for aligning the internal and external resources to satisfy customer needs and build long-lasting relationships with the customer (Sheth and Sharma, 2008). Therefore, the salesperson has various roles, i.e., trusted partner that seeks to provide solutions, customer consultant and relationship manager (Sharma, 2007). The salesperson with his ability to co-create the customer shopping experience and at the same time communicate views of the product to underpin product/service innovations constitutes a strategic capability for the business (Le Meunier-FitzHugh et al., 2011). In fact, the importance of co-creation of value in services that utilise smart technologies has been emphasised repeatedly and should be addressed as an important research agenda in service design. The success of the future organisations will dependent on their ability to create new business models based on smart devices provision and shift from product-based to solution-based models (Wuenderlich, Heinonen, Ostrom, Patricio, Sousa, Voss and Lemmink, 2015).

The concept of value under the S-D logic is also context specific and relative to the other experiences, not only determined by the customer (Vargo and Lusch, 2004; Vargo and Lusch, 2008). Therefore, it is proposed that introducing the salesperson in the virtual fitting room would enhance that experience. However, there is limited or no research in this area. Thus, this study aims to address this gap and to explore the current and potential future applications of 3D fitting rooms by fashion brands.

Methodology

The study used the key words “3D fitting system”, “Virtual fitting room” “Virtual Dressing Room” and narrowed down the focus of analysis on several key conceptual papers i.e., Cordier, F., Seo, H. and Magnenat-Thalmann, N. (2003). Made to Measure Technologies for an Online Clothing Store. *Journal of IEEE Computer Graphics and Applications, 23*, (1),38-48. Pereira, F. Silva, C. and Aves, M. (2011). Virtual Fitting Room Augmented Reality Techniques for e-Commerce. *in Enterprise Information Systems* , *220*, 62-71. Zuo, P. and Zhao, Y. (2011). A design of 3D Modelling virtual fitting project for online shopping, Industrial Engineering and Engineering Management (IEEM), 1893-1897. The study also compared and contrasted five virtual fitting room websites, i.e., *Metail*, *Model my Outfit*, *3d-a-porter*, *SenseMi, triMirror* which are accessible in fashion retail market. For that, we have analysed the main design features from the websites’ services and their applications. We have looked at the main page and areas that describe the services provided by the 3D virtual fitting room tools. These were summarised in Table 1.

Findings and Discussion

A review of the literature has highlighted several important studies. Zuo and Zhao (2011) have designed a clear frame chart to explain step by step the process of how consumers can input their body measurements, choose the clothes they like and try them on. Cordier et al. (2003) have established a web application architecture based on existing models and 3D technology for online clothing store. In a more recent study Pereira et al., (2011) proposed a framework by applying a virtual fitting room for online retailing in three different contexts i.e., Augmented Reality (AR), Computer Vision and Image Processing (Pereira et al., 2011). They also put forward the application of virtual dressing room flowchart which uses “Upper Body Detector” and “Hand Detector” to display the new dress.

Zuo and Zhao’s (2011) model focuses on the detailed measurements in order to give consumers a more accurate selection of clothes size. In a similar line, Cordier et al., (2003) established an integrated web application architecture for online clothing store with includes clothing design, pattern derivation and 3D fitting service and attaches great importance to body measurement. Pereira et al., (2011), on the other hand, showed that the virtual fitting room can apply Augmented Reality (AR)techniques to online retailing; although this technique does not require the user to manually input their measurement, it uses a specialised digital cameras and Adobe Flash technologies, which might be difficult for middle aged people or people with low technical knowledge to use it. All three papers as well as more recent papers following the 6th International Conference on Electrical Engineering and Informatics (ICEEI) in 2017, focus on simplifying the user interface of the virtual fitting room for the user, but with no consideration for the humanising aspect of the virtual fitting room. Syazwan, Noraidah, Tengku (2018), following a systematic procedure of searching related literature on virtual fitting rooms, also confirmed the main issues to be the usability and profound emotional elements connected with the application. Syazwan et al. (2018) proposed a new virtual fitting room model based on the Unified Theory of Acceptance and the Use of Technology that aims to enhance usage intention through effectiveness, efficiency, satisfaction of usage and positive emotional arousal. However, the latter conceptual paper does not provide empirical evidence on how to achieve this. On the other hand, recent marketing literature examines the role of the virtual fitting room as a tool to increase online and offline exploratory behaviour, patronage and purchase intentions. Beck and Crie (2018) have found that the virtual fitting room specifically increases curiosity about the product, intention to patronise (online and offline) and intention to purchase (online and offline). The latter strengthens the importance of the virtual fitting room in the quality of customer experience and the quest for further research on the subject.

Whilst analysing virtual fitting room websites, we have encountered many similarities within the services provided by each website. All websites provided the service of 3D fitting room for both online and physical stores. Personalisation was an important design feature provided by these websites. For example, in the website *Metail*, customers can enter their measurements and edit skin colour and hair style and choose to virtually try on clothes from a variety of fashion brands. Similarly, the *Model my Outfit* virtual dressing room allows consumers to create a personal avatar and try on clothes from different fashion collections. In both cases, customers have to enter their measurements manually, while at the same time there is no point of contact with the brand or other customers to enhance the engagement with the medium or to reinforce confidence over the purchase process (see Table 1). This might be an issue that should be tackled in a long-term since consumer engagement should be a key concept for brands to succeed. Thus, by just having a

cutting edge technology as part of the service might not be enough for 3D virtual fitting room providers to survive competition and the market.

For example, in 2010 “Fits.me”, a robotics application virtual fitting room, was the first to partner with the UK luxury shirt retailer Hawes and Curtis to assist customers to virtually try on a mannequin before buying the product. Following the introduction of the virtual fitting room, Hawes and Curtis’ return rate dropped substantially from its already low rate of 4% to 2,99% (Baldwin, 2016). The virtual fitting room start-up “Fits.me” closed in 2018, three years after it was bought by the Ratuken Group (Fits.me, 2018). This shows that although there is a huge trend towards the use of 3D virtual fitting rooms in online retail, it might be difficult to scale and sustain this type of service in a long-term. Compared to the other websites mentioned in our analysis (*Metail*, *Model my Outfit*, *3d-a-porter*, *SenseMi* and *triMirror*), Fits.me has not included a variation of tools and it is possible that because of that the company had to shut down in 2018. Thus, possible reason for the closure of Fits.me could be the potential for innovation. If considering the other websites cited in our analysis (Table 1), none of the services mentioned the capacity to include the salesperson within the offered services. In fact, the tools mentioned by the websites in Table 1 are quite similar and it is difficult to distinguish their unique selling points, which may rely on technological advances such as algorithms or 3D body scanning. However, none of the websites analysed have specified developments on the services provided to the online and physical retail stores and brands. Therefore, there is still a huge potential for companies to invest on the development of services and touchpoints that utilise this technology with more proficiency. This could include new services and possibly new partnerships with brands and design consultants. Also, there could be a potential to develop tailored services according to different types of products and brands across the globe.

Table 1. A Comparison of Virtual Fitting Websites and Digital Services in the UK

Virtual fitting websites and digital services	**Design features**	**Reference**
Metail	3D virtual body representations that consumers can access online through mobile phones and websites. The service also provides data analytics for fashion retailers	https://metail.com/
Model my Outfit	3D virtual body representations that could be personalised according to different body shapes that consumers can select from a list	http://myvirtualmodel.com/
3D-a-porter	3D body scanning, magic mirrors and 3D virtual fitting services. Most services can be used from distance and online (consumers are not required to visit the physical store)	http://3d-a-porter.com/services/3d-virtual-fitting-room/
SenseMi	Online fitting room for websites, virtual dressing mirror, virtual makeover and smart table in stores. It uses augmented reality features, using camera and 3D projections	http://sensemi.com/
triMirror	In-store and online experiences for consumers through 3D virtual clothes and mobile solutions. This tool uses algorithms and 3D modelling to provide precision	https://www.trimirror.com/

Recommendations and future work

Although there are few studies examining the effects of salespersons to consumers (Rapp, Baker, Bachrach, Ogilvie and Skinner Beitelspacher, 2015), our work is the first to focus on the relevance of a digital salesperson in the virtual fitting room. A recent development by Amazon strengthens the argument for further research on the merits and challenges of having a salesperson in the fitting room. In 2017 Amazon launched Amazon's Echo Look camera (Alexa), a personal robot stylist that helps the customers choose clothes that best fit their body type and accentuate their best features. This study offers initial insights into the merits and challenges of the virtual fitting room and although the research design is appropriate for the nascent state of the virtual fitting room, future research should seek to refine the use of the salesperson in the virtual fitting room, once the latter has been more widely adopted in practice. The current status of many virtual fitting room websites, is largely dysfunctional with many customers lacking the technological skills hesitating to use them. Customers will either have to have a ruler at hand to take their measures, or know their figure and choose from basic but not specific mannequin types. The mechanical instead of emotional nature of the medium often results in lack of trust as customers need to input their measurements individually, and yet no technical support and no recommendations by anyone, the experience may result in loosing time without any gain. Despite all the challenges, such tools as the virtual fitting room are found to increase online intention to try, and even patronise behaviour and enhance purchase intentions (Beck and Crie, 2018). The additional feature of a salesperson in the virtual fitting room is believed to enhance the aesthetics of the online store, particularly for luxury brands. The present study answers to the quest of fashion brands on how to maintain uniqueness and convenience. Liu et al., (2013) study highlighted convenience as the key motivating factor influencing customers shopping desire. The virtual fitting room can be particularly convenient way of trying on clothes for customers who are not located close to the luxury stores and is not convenient to access them. The present study also compliments existing literature on how image interactivity can improve the online brand experience (Beuckels and Hudders, 2016) and transfer the traditional sensory experience into the online environment (Okonkwo, 2009). Li, Daugherty and Biocca (2001) found that interactivity features on websites enhance the value of the product and promote customer engagement. Altarteer, Charissis, Harrison and Chan, (2013) in their research on the interactive virtual reality shopping and the impact in luxury brands found that 3D models of luxury goods enrich the user experience and lead to higher levels of trust. Beuckels and Hudders (2016) recommend to online luxury retailers a more interactive approach through the use of 3 dimensional visualisation, increasing luxuriousness of the product indirectly, leading in higher levels of involvement and enjoyment for the customer. The presence of the salesperson in the virtual fitting room would promote engagement with the brand, strengthen customer's trust in the purchase process and reduce the returns because of bad fit. The customer-salesperson relationship is particularly valuable for fashion brands, as apparel brands are hugely popular, people tend to display strong feelings of attachment often translated to brand passion and managers are recently putting more effort to create and maintain emotional attachment to apparel brands (Das et al., 2019). Several service design recommendations on how to achieve this, include an avatar. The salesperson could be represented by an avatar that could give suggestions for the user. For example, the presence of an avatar in games can evoke positive attitudes towards a brand, particularly across cultures (Choi, Yoon and Taylor, 2015). This means that the presence of a 3D avatar in the 3D virtual fitting room would also need to be tailored according to the users' needs. It is also possible that this could change according to the perceptions towards the character considering gender, voice, behaviour and level of realism. If fact, the level of realism or human-likeness is another aspect to consider. For example, people who perceive human-like "robots" (or 3D images) as "humans" would have a positive attitude towards it, but then this attitude would reach a state in which the perception of human-likeness would decrease and people would feel "strange" about, evoking a sense of repulse towards it (Mori, MacDorman and Kageki, 2012). Another option could be adding the salesperson in form of recorded videos, which would have then a "real" person giving advices. This could be done by real personal stylists or even celebrities. Thus, future research in the area is needed in order to understand which technique is more efficient in order to improve service design of 3D virtual fitting rooms.

Another design recommendation is related to usefulness and familiarity with the 3D fitting room application. For example, consumers might not use the 3D fitting room if it is perceived as "difficult" to use. This aspect focuses the evaluation of this tool around usability issues. Considering this, it would be necessary to develop a set of usability guidelines for 3D fitting rooms. However, usability alone does not guarantee the success of the use of these digital tools. For example, consumers need to feel that these 3D projections are also projections of themselves. Thus, online fashion retailers could benefit from the collection of personal data including not

only body measurements but also personality aspects. Although this could evoke a high sense of ego involvement (Kang, 2014), it would also reflect issues around data privacy. Thus, an ethical and "transparent" 3D fitting room tool is also required. Another suggestion is the recording of personal preferences in order to provide a narrative experience. Websites tend to do this by using previous purchase data to give suggestions. In the case of 3D fitting room, this information could be recorded straightaway and linked to other personal data.

Other design suggestions could be the addition of 3D fitting rooms in Virtual Reality (VR) using headsets (see Figure 1). In the VR environment, consumers could experience the simulation of a "real" fitting room. The difference is that consumers could personalize the fitting room by adding their own features. For example, the fitting room could have a mirror and the decoration from the consumer's bedroom. A salesperson, in this case could be an avatar inside the VR room experience, giving suggestions of outfits, similar to a personal fashion expert. Consumers could also choose to have a salesperson or not talking to them. It could be possible that with future developments in the VR area, consumers could also share their VR room with family and friends.

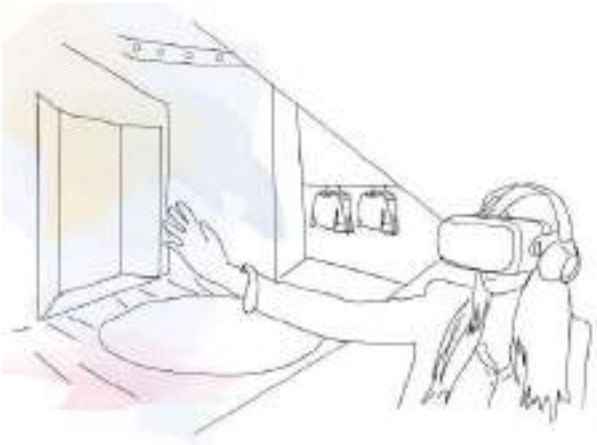

Figure 2 VR fitting room experience

Future work in this area could address the relationship between the 3D projections and the sense of ego-involvement, particularly through the engagement with the avatar. As mentioned before, a potential research could consider the application of the 3D fitting room in VR applications. This could evoke a sense of belonging and it could influence consumer's purchase intentions. The utilization of 3D virtual fitting rooms could also transform the in-store experience (physical). For example, studies could compare the differences between the real fitting room and the virtual one, highlighting its benefits for the overall consumer experience. It is possible that if the online fitting room becomes each time more immersive, then in-store fitting rooms would need to be transformed or perhaps adapted to include digital touchpoints. For instance, the mirror in the in-store physical fitting room in-store could be connected to the Internet and could give the consumer advices (see Figure 2). Similar systems have been suggested using Artificial Intelligence (AI). For example, consumers can get recommendations from a virtual agent through personalized algorithms (Fu, Liu, Jia, Ma, Meng and Huang, 2017). This opens possibilities for researchers and practitioners to "humanize" algorithms and make them similar to real-world salesperson. Smart mirrors could also enable consumers to call friends and family to ask for their opinion whilst choosing a specific outfit (using services like Skype or social media channels). This could also impact other niche businesses such as for outfits designed for a specific event, such as weddings. With the adoption of this type of technology, it might be possible that consumers could try wedding outfits without having to leave their homes and get them perfectly fitted for the special occasion.

Figure 2 Magic mirror

There are many opportunities to expand this research. For example, the websites and services analysed in our paper did not mention the role of the salesperson in 3D virtual fitting room and the possible connection with other people (e.g. family and friends, personal stylists and so on). This can be a key research agenda for future studies in the impact of virtual technologies in fashion online retailing and brand experience. Other opportunities could explore both technological and behavioural sides of the impact of 3D virtual fitting rooms. For example, designers could collaborate with developers and create prototypes of new 3D virtual fitting rooms that have different types of potential. At the same time, designers can also study the impact of such technologies on consumer behaviour, analysing their engagement and brand experience. Thus, this paper could be a starting point for research in this area. We also expect this paper would be of interest for service providers and designers, willing to explore the potential of 3D virtual fitting rooms, powered by the development of new technologies such as VR and AR.

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Research Perspectives IN THE ERA OF Transformations

Speeding-Up Innovation with Business Hackathons: Insights into Three Case Studies

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In recent years, the way organizations innovate and develop new solutions has changed considerably. Moving from 'behind the closed doors' style of innovating to open innovation where collaboration with outsiders is encouraged, organizations are in the pursuit of more effective ways to accelerate their innovation outcomes. As a result, organizations are establishing creative and entrepreneurial ecosystems, which not only empower employees but also involve many others to co-create new solutions. In this paper, we present a methodology for organizing hackathons, i.e. competition-based events where small teams work over a short period of time to ideate, design, prototype and test their ideas following a user-centric approach to solve a specific challenge. This paper also provides insights into two different hackathons organized in the United Kingdom, and Mexico, as well as a series of 5 hackathons organized in Argentina, Mexico, Switzerland, United Kingdom and in Senegal.

Keywords: Co-creation, Hackathon, Open Innovation, Design Thinking, Case Study

Introduction

Inventiveness, innovativeness and creativity run in our blood, but as we start growing up, influenced by our environment and the people that surround us, we change the way we see things and the way we think about them. But this happens to organizations as well. As they evolve from a startup to an established, large organization the challenges of maintaining the speed and frequency with which the organization innovates slow down and/or become less risky, less bold, less disruptive, and more easily replicable by the competition (Mootee, 2013 & Golob et al., 2015).

Not long ago, industrial leaders believed that the greatest opportunity to leave the competition behind was to invest heavily in internal R&D. The idea was to have vast R&D resources, leading talent and strong, top-level support carry out all innovation activities behind closed doors until new products - the seeds of the innovation process - were mature enough and ready to be launched to the market (Figure 1: Closed Innovation). It was believed that only those organizations would be able to keep up with the pace of change and innovation (Tucci, Afuah & Viscusi, 2018).

Fast forward 30 years or so, the situation in most industries is quite different. Organizations around the world have moved, or are moving, from inward-focused, 'closed' innovation to open innovation as proposed in Figure 1. Opening up the innovation processes and making its walls permeable, decisively encourages the use and exchange of external ideas, technologies, knowledge, talent, resources and more (Chesbrough, 2006). In

part, this can be achieved through the organization of co-creation events that are often referred to as hackathons, ideathons or innovation days. Once industry-specific coding sprints, they recently overtook the world of entrepreneurs, startups and, lately, large corporations (Cobham et al., 2017; Spaulding & Caimi, 2016; Di Fiore, 2013; Altringer, 2013). The word hackathon is composed of 2 parts: hack and marathon. The word hack refers to the creative problem-solving, designing, prototyping and tackling of the challenge, while the word marathon indicates the intensity of the event.

In a nutshell, a hackathon is an event with an element of competition, where participants work in teams over a set and short period of time to ideate, collaborate, design, rapidly prototype, test, iterate and pitch their solutions to a determined challenge. And since hackathons are time-limited events, they best fit the earliest stages of the lean innovation process, where the market is unknown or not yet well-defined, and many ideas are welcome to be tested using user-centric and Lean Startup concepts.

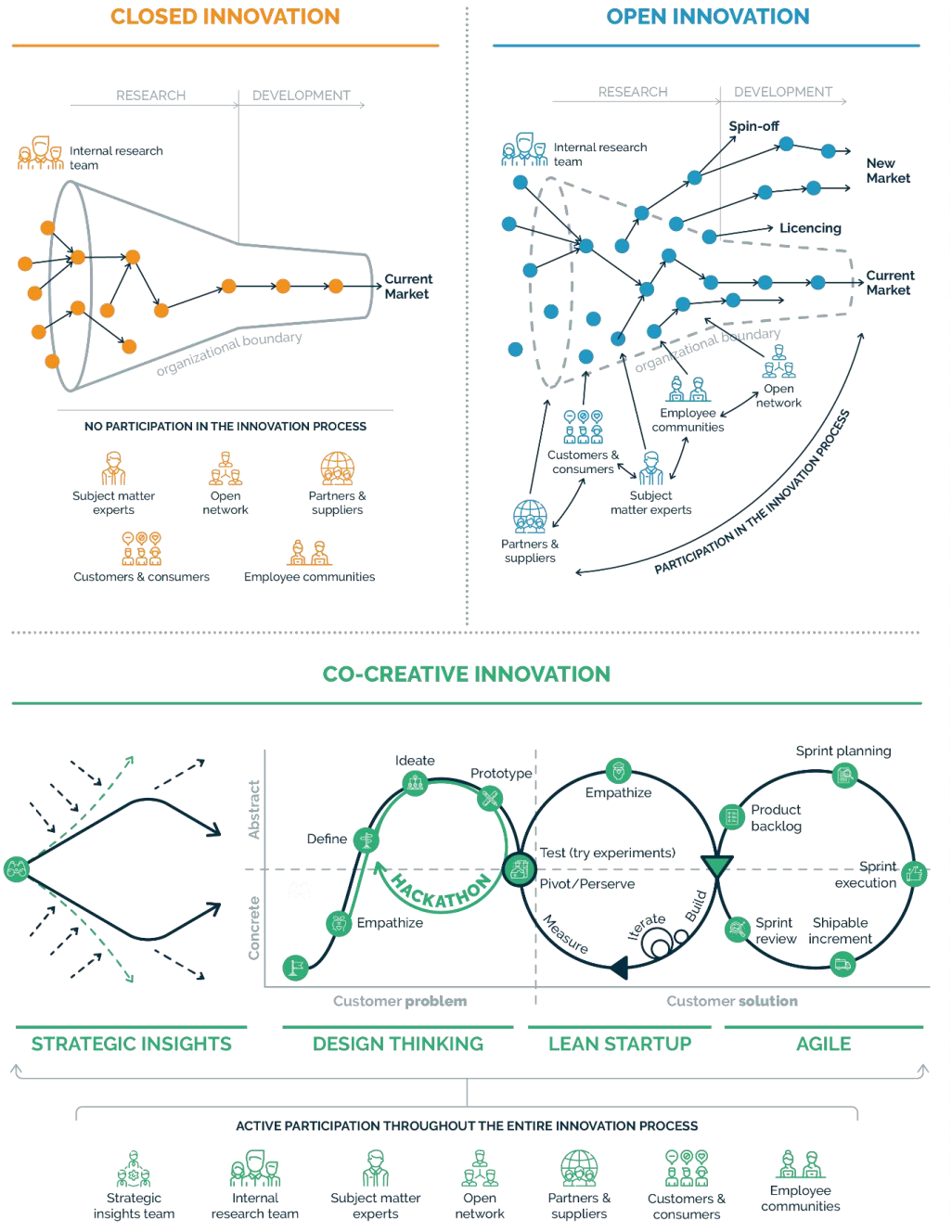

Figure 1: Comparing Closed Innovation, Open Innovation and Lean Innovation processes (adapted from Chesbrough, 2006; Optimus BT, 2010; and Gartner, 2016)

Chesbrough (2006) described open innovation as a concept where valuable ideas can come from both inside as well as outside the organization, and can, similarly, be pushed to the market from inside as well as outside the organization. Open innovation assigns the same priority or level of importance to external ideas and routes to the market as to internal ones. This hybrid concept provides an environment where innovative ideas and new products are underpinned solely by innate creativity and knowledge from within the four walls of the organization's R&D. This open environment actively seeks for collaborations reaching far outside the organization's R&D in order to co-create with partners, suppliers and even customers (Chao, 2012). However, making such a paradigmatic shift in the way organization operates its innovation ecosystem is not easy and requires unwavering leadership support and a structured approach.

LAA's Lean Innovation Model (Figure 2) relies on years of research, where different models from well-known authors and practitioners, as well as cases of successful lean innovation implementations in leading organizations, were studied and analysed (Flores, 2014). The resulting Lean Innovation Model consists of 12 enablers structured in 4 key building blocks and serves as a reference to support organizations in the creation of their lean innovation roadmaps (Flores et al., 2017).

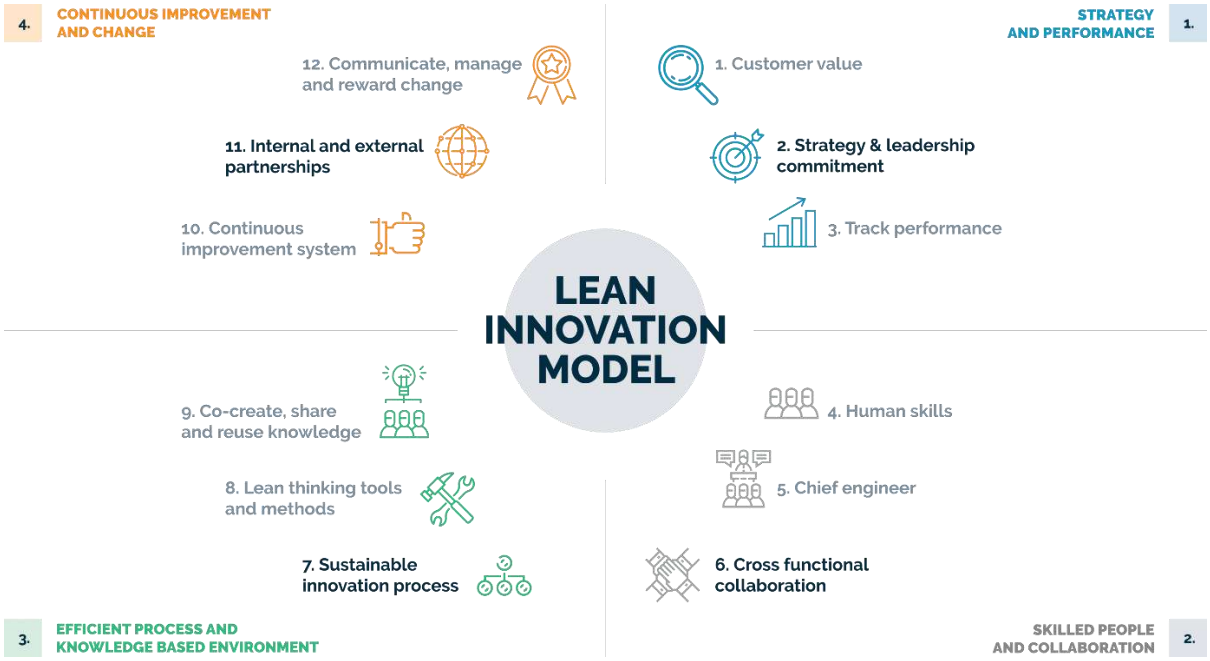

Figure 2: Lean Innovation Model with highlighted enablers for organizing hackathons (Flores, 2014)

The aim of the Lean Innovation Model is to provide a framework to help practitioners discover the various innovation practices, which could be methodologies, tools or techniques, such as open innovation, co-creation and others. In particular, the organization of co-creation events falls under the 4 enablers, as highlighted in Figure 2:

- **Strategy & leadership commitment:** For co-creation events to be successful, they require: 1) to be aligned with the organization's vision to determine strategic challenges for the event, 2) support from the leadership to communicate the seriousness of the intent to potential participants, and 3) to ensure the results have the potential to grow and become real projects.
- **Cross-functional collaboration:** Experts from the same domain can only come up with ideas situated around their area of expertise. Therefore, a wide diversity of participants is encouraged to ensure that out-of-the-box ideas emerge. It is key that employees interact with external participants during the co-creation events.
- **Sustainable innovation process:** To run a successful co-creation event, a simple, yet impactful innovation process is required. Commonly used methodologies for such events are Design Thinking, Lean Startup, Scrum, or a combination of these.
- **Internal and external partnerships:** Forming partnerships to organize co-creation events make a big difference in whether the event will be a success or just another mediocre workshop. Partners include

anyone from venue providers, support teams and photographers, to facilitators, subject matter experts, speakers and judges.

Hackathons leverage the creative and intellectual capacity of the crowd to generate a range of ideas that are crossing the organization's borders in order to not only accelerate innovation and refresh the portfolio of ideas, but to bring employees from different departments closer together (Flores et al., 2017; and Spaulding & Caimi, 2016).

Table 1: Innovation benefits resulting from organizing a hackathon (adapted from Flores et al., 2018)

#	BENEFITS	SUM	Uffreduzzi, 2017	Trainer et al., 2016	Li & Johnson, 2015	Briscoe & Mulligan, 2014	Altringer, 2013	Di Fiore, 2013	Spaulding & Caimi, 2016	CEMEX Hackathon	MeXXTI Hackathon	DT Olympics
BUILDING BLOCK 1: STRATEGY & PERFORMANCE												
1	**Accelerates innovation**	**8**										
2	Corporate brand promotion	2										
3	Earlier engagement with customers & potential users	5										
4	Alignment with leaders to identify the challenge	1										
5	Clearly defines the underlying problems	7										
6	Vision, organization's commitment and the hackathon challenge are co-developed by leaders	2										
7	Establishes criteria to assess the teams & ideas	4										
BUILDING BLOCK 2: SKILLED PEOPLE & COLLABORATION												
8	Talent engagement & recruitment	5										
9	Increases employee morale & relationship building	5										
10	Facilitated events using Design Thinking require minimum or none prior experience from participants	3										
BUILDING BLOCK 3: EFFICIENT PROCESS & KNOWLEDGE-BASED ENVIRONMENT												
11	**Provides a creative & stimulating environment**	**8**										
12	**Enables rapid development & the testing of ideas**	**9**										
13	Provides a time-intense innovation environment	4										
14	IP development	5										
15	Uses a simple, yet impactful innovation process	5										
16	Frontloads the innovation process	3										

17	Fuels the organization's innovation pipeline with already somewhat validated and prioritized ideas	2										
18	User-centric lean innovation tools and techniques	3										
BUILDING BLOCK 4: CONTINUOUS IMPROVEMENT AND CHANGE												
19	Intensive co-creation & radical collaboration	5										
20	Enables organizational change	6										

Table 1 compares the benefits of organizing a hackathon proposed by different authors, including those identified during the organization and execution of the three Hackathons, which were organized according to the four building blocks of the Lean Innovation Model and the proposed methodology shown in Figure 1.

From the analysis, it can be observed that literature generally agrees that hackathons help to accelerate innovation, provide a creative and more stimulating environment for employees and enable rapid development and testing of ideas. Interestingly only one publication besides our own findings highlights that hackathons help to fuel the organization's innovation pipeline with already somewhat validated and prioritized ideas. Similarly, only two other publications beyond our findings from the CEMEX Hackathon highlight hackathons as potential or partial means of frontloading the innovation process.

By integrating several practices identified with the Lean Innovation Model as a framework and using the findings from the literature as well as our experience in organizing hackathons (LAA, 2018), a step-by-step methodology for the preparation and execution of hackathons has been developed.

The paper is structured into four core sections, starting by the introduction (above) where literature and the need for business hackathons are explored, followed by the methodology for organizing business hackathons and the three case studies, before concluding the paper in findings and future work.

Methodology for organizing business hackathons

As described in the introduction of this paper, hackathons are co-creation events purposefully designed to utilize diverse mindsets, tackle complex challenges and create new business opportunities. However, to provide such an environment, any hackathon needs to be carefully planned, executed and wrapped up. From selecting the venue and the room layout (Rattner, 2017; Dam & Siang, 2018) to appointing the facilitator, determining the program (Amabile & Khaire, 2008) and selecting the awards (Bays et al., 2009), every detail influences the creativity and innovation potential of the participants.

A literature review highlighted some of the core areas of organizing co-creation events, covering mainly generic hackathons and not corporate ones (Cisco, 2015; Rissola et al., 2017; Tauberer, 2016; InfoSupport, 2017). Although most steps are transversal, the reasons, the planning and the alignment approach tend to differ. In addition, most of the literature still focuses on industry-specific events, largely on software development and digital technologies.

To ensure co-creation events deliver benefits for the host-organization as well as the participants attending, the LAA team defined a three-stage methodology that covers in detail: 1) the pre-hackathon planning, 2) the execution, and the 3) post-hackathon stage. The steps of the proposed methodology are shown in Figure 3.

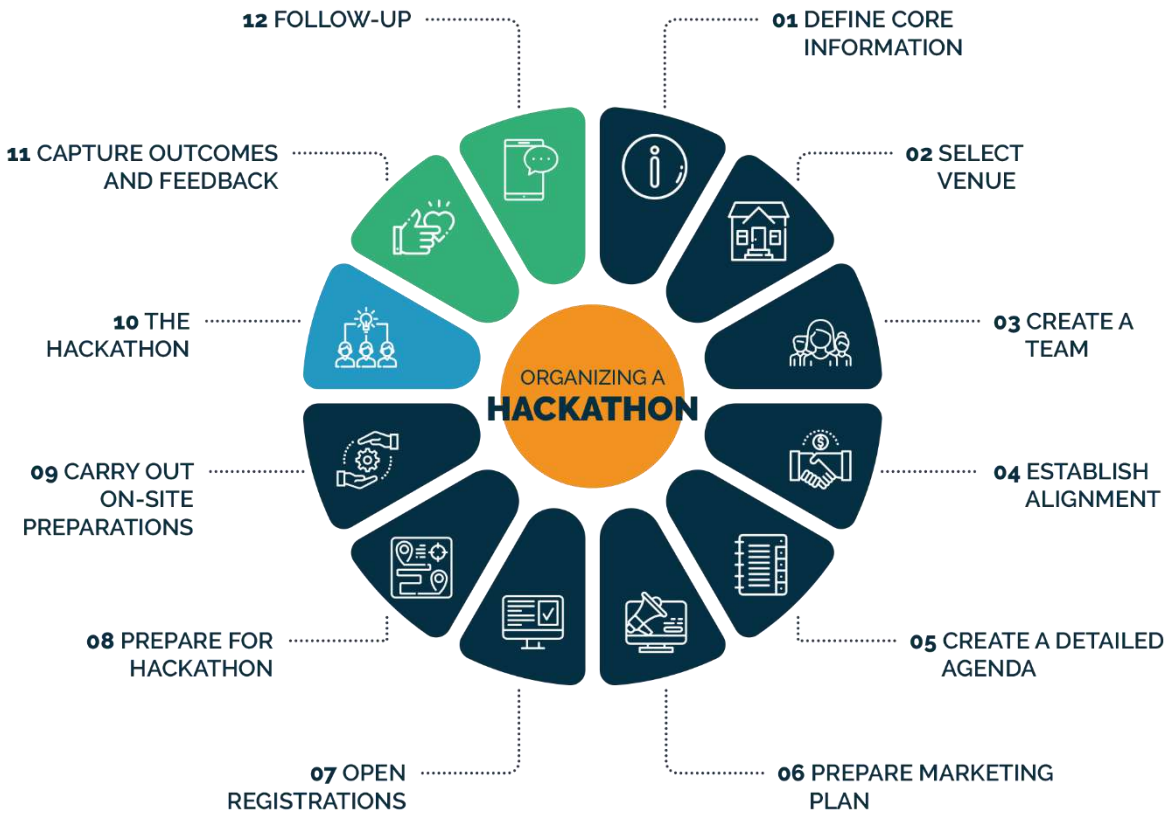

Figure 3: Methodology for organizing co-creation workshops in a corporate setting (Flores et al. 2018)

The methodology consists of three main stages: **pre-hackathon (preparation) stage**, the **hackathon (execution) stage** and **post-hackathon (reflection) stage**. In this paper, authors provide an in-depth overview of the preparation stage and use the case study section of this paper to outline the activities carried out during the execution stage. The reflection stage is also briefly described.

Pre-hackathon stage (planning)

The planning stage is the first and most critical stage when organizing a hackathon. It consists of 9 steps (as observed in Figure 3), starting from (1) defining the core information such as the aim and objectives, the expected outcomes, the theme or topic, the challenge, the date and duration, the target group (participants), the location and the budget. Having pinned these details down, a suitable (2) venue needs to be identified and a (3) team must be formed. As mentioned above, the venue needs to 'scream innovation and creativity' in order to maximize the diversity and originality of ideas and prototypes the participants will develop. Another important aspect of selecting a venue is the catering service; the continuous supply of food and drinks for such events is a must in order to keep the energy level high. However, the selection of the venue is only one part of the success, the other being the team that will help organize and execute the hackathon. While smaller hackathons need less time and people to organize, larger hackathons (100+ participants) require a dedicated, or "core" team (Cisco, 2015). Hackathons do require an extended team, including facilitators, subject matter experts, presenters and workshop leaders, judges and technical and support teams. Each individual plays a specific role before and, especially, during the event. For example, facilitators will be involved in planning the program in the pre-hackathon stage and will be leading teams of participants through the design and problem-solving process during the execution stage. Presenters and workshop leaders might also be involved in the planning stage but will play a crucial role in setting the scene and equipping participants with the needed knowledge at specific times during the hackathon. The core team will co-determine the evaluation criteria and protocol for the awards ceremony, identifying judges who, during the hackathon, will be carefully observing and evaluating how teams work and the ideas they develop. For more specific challenges, subject matter experts are needed in order to advise teams during the hackathon, help them with specific questions or dilemmas, and provide insights, knowledge and experiences, thus enabling teams to develop better prototypes

(InfoSupport, 2017). To ensure such a diverse group of people works together smoothly and delivers value, (4) team alignment must be achieved (including alignment with the sponsoring organization).

Hackathons also require a process to ensure the expected results are obtained in such a short time. Coding and software development hackathons typically consider the Scrum process to 'walk through' a design cycle. On the other hand, business and corporate hackathons usually follow a design thinking methodology to guide the teams through the day(s). Design thinking works extremely well in the business hackathon setting because it starts by deep-diving into the problem (challenge) through user interviews, observation and research. This provides strong foundations, rooted in real, human needs, to build ideas and prototypes on.

Design Thinking is a human-centred approach used to creatively and holistically solve complex problems in an iterative and collaborative manner (Brown, 2008). The design thinking process created by Stanford Design School (d.School, 2013) is structured into five-phases: Empathize, Define, Ideate, Prototype, and Test.

Using design thinking as the process to follow during the execution of hackathons, ultimately sets the back spine of the (5) co-creation program. While the program depends on the duration of the hackathon, the challenge, the expected outcomes, the facilitators, as well as the targeted audience, the core elements remain the same across the events. The typical structure of the hackathon program includes opening speeches and icebreakers, followed by the stages of the design processes (with lunch and coffee breaks, as well as occasional energizing activities), and concludes with the submission and presentation of prototypes to the judges and audience. The final act of the hackathon is the awards ceremony where winners are announced, and awards handed to the best team(s) or idea(s).

The following two steps of the hackathon organization methodology focus on (6) the promotion and marketing of the hackathon, and (7) handling the registrations. Whether the hackathon is being organized for an internal (in-company), external (open to the public) or mixed audience, getting the right participants will have an impact on the quality of the outcomes. Both activities need to be planned well ahead of the actual date of the event in order to ensure the news reach the largest audience possible and allow enough time to apply (InfoSupport, 2017). Both the promotion and registration processes are the first touchpoints the potential participants will have with the hackathon experience. While the promotion messages should be aligned with the challenge of the hackathon, the registration process should be set up in a user-friendly and simple way.

The last two steps of the pre-hackathon stage occur after registration is closed but before the hackathon day. During the final (8) preparation, the team will ensure that all presentations and speeches are ready, prototyping material is available, templates and visual guides are printed, the pre-work for participants is selected and distributed, the promotional material (such as T-Shirts, hats, mugs, pens, notepads, power banks, etc.) is ordered in the right quantities, and the venue and other suppliers (photographers, cameramen, doodlers and scribblers) have all the information needed. A day or two before the actual event, (9) on-site preparations are required. These include audio-visual checks, setting up the room layouts and workshop spaces, setting up the registration and welcome desk, printing the participants' badges, putting together welcome kits for participants, doing a trial run of presentations and speeches, and more.

The hackathon stage (execution)

After the official welcome and the initial presentation of the hackathon challenge, teams start working on the Empathize phase, were participants conduct preliminary research on the topic and engage with end-users and other stakeholders through interviews. Moving to the second phase, teams try to make sense of what they just learned through the interviews and research, by defining the problem they are going to address. While the hackathon provides the challenge, the underlying problem is identified through the analysis of data collected in the Empathize phase. With a clear problem statement, teams enter the third phase where they start brainstorming about potential ideas that could solve that problem and continue by ranking these ideas. The important notion at this stage is that ideation is not so much about the quality, but rather about the quantity of ideas. This is where teams should explore anything from conventional to entirely blue-sky options. What follows is a series of iterations, where teams start by developing a prototype for the selected idea, before testing it with the stakeholders. In a two-day hackathon, this is where day one typically ends. In the morning of the second day, teams undergo at least one more iteration, modifying their prototypes based on the feedback they received the previous day. With the updated prototype, teams will test it again with the end-users and apply final modifications before presenting it to the judges, as shown in Figure 4.

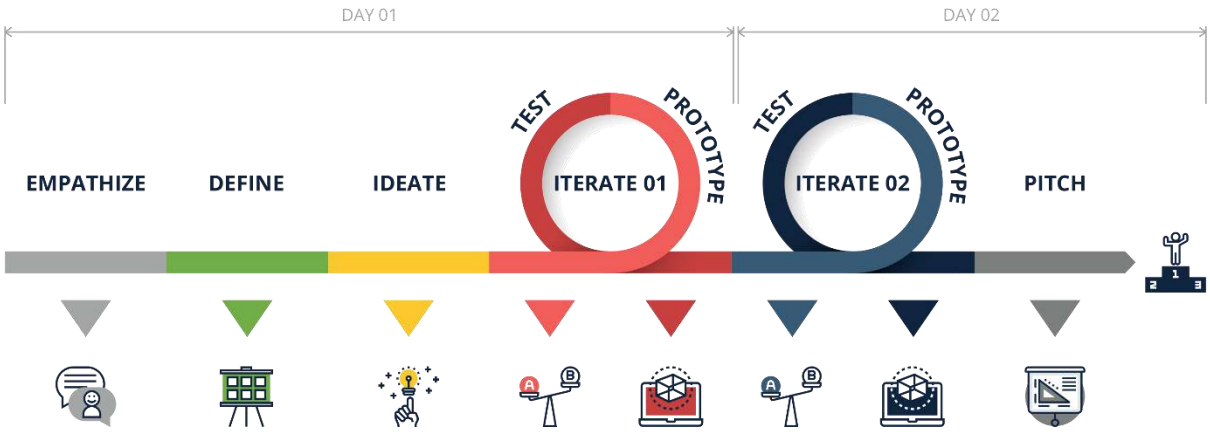

Figure 4: Design thinking processes proposed for a two-day hackathon event (Flores et al., 2018)

To support the execution of a business hackathon authors have developed new, or customized existing well-known tools and methods from design thinking. Some of the tools were redesigned to become templates that participating teams could use, others were used and moderated by hackathon facilitators. Table 2 highlights the tools used throughout the three hackathons, further classified according to the Design Thinking stage in which they were used.

Table 2: Tools and Methods applied by facilitators during the three hackathons

STAGE	#	TOOL / METHOD	The tool was () used in the:		
			CEMEX Hackathon	**MeXXTI Hackathon**	**DT Olympics**
Pre-hackathon	1	**Prework** *(familiarization with the hackathon topic - reading and video material is provided before the hackathon)*			
Empathize	2	**Challenge Specific Trends Analysis** *(organizers conducted research to collect, visualize and present trends & challenges relevant for the hackathon)*			
	3	**User interview** *(contextual interview to gain insight & understanding of users or customer pains, challenges, desires, etc.)*			
Define	4	**Personas** *(a fictional character that represents a customer segment and captures key findings from the empathize stage)*			
	5	**Empathy Map** *(capturing what persona sees, hears, says and think – this furthers the understanding of the persona & its challenges)*			
	6	**"How Might We?" Question** *(helps to define the problem that needs to be solved in a form of an actionable question)*			
Ideate	7	**Silent brainstorming** *(participants brainstorming individually for a short period of time before a group reflection – works best in 2 or 3 rounds)*			
	8	**Group brainstorming** *(participants share their ideas on post-it notes as soon as they write them, essentially enabling team members to build on ideas of instantaneously each other)*			
	9	**Crazy eight brainstorming** *(participants sketch 8 ideas in 8 minutes – guiding questions such as "how would Google solve that?" can be used)*			
	10	**Superpowers brainstorming** *(participants brainstorm ideas based on the assumption of having certain superpowers, e.g. Superman's flying ability)*			
	11	**Brainstorming reflection and voting** *(reflection is usually done after each round of brainstorming to ensure all team members are aware of all ideas before the doting system is used to vote for the best or craziest idea)*			

Prototype	12	**Paper prototyping** *(using paper, cardboard, scissors, glue, etc. to actually build a physical prototype of the solution or part of it)*
	13	**Wireframe and mock-up prototyping** *(using sketching and drawing techniques to rapidly develop and design user interfaces – typically for apps or websites)*
	14	**Roleplaying** *(like in a theatre, act-out the service or part of it to demonstrate how it works)*
	15	**Desktop walkthrough** *(using cut-out shapes or LEGO bricks to "play-out" a service or experience on the table-top)*
	16	**Blended prototypes** *(a combination of prototypes such as wireframes and roleplay to better convey the message/solution)*
Present	17	**Pitching** *(typically a pitch-deck coupled with the prototype demonstration and short (3-7min) presentation)*

While these 17 tools and methods were used during the three hackathons, facilitators are free to use any tool or method at their disposal to ensure their teams work most efficiently, have fun and produce the best possible result. Similarly, not all facilitators used all the tools mentioned in Table 2. Authors recognize that stronger consistency would help academic analysis, yet, in a hackathon, tools and methods are merely means to help teams work together better and navigate through the innovation process. Therefore, people come before teams and hence facilitators can deploy the tool, they see most fit for the given stage or challenge.

Post-hackathon stage (reflection)

Hackathons are high-energy events, which is the reason why post-hackathon work is often neglected. However, it is strongly recommended to also invest time in this last phase, where the organizing team arranges lessons learned sessions to analyse ideas, patterns and prototypes, and set in motion the wheels for establishing a project or projects based on the winning solutions. The organizing team also collects, structures and stores the outcomes of the event, prepares follow-up work and gets ready for post-hackathon promotion activities. It is important to highlight that leadership support is essential if the seeds of ideas from the hackathon are to sprout into full-grown projects.

Three hackathon case studies

Over the course of 2018, the Lean Analytics Association have organized and carried out 3 separate hackathon events, where one event, the so-called Design Thinking Olympics consisted of 5 individual hackathons. Therefore, this section provides insights into the experience of 7 hackathons for accelerating innovation and rapid generation of ideas.

Case study 01: CEMEX Mobilization Hackathon: Innovating at speed requires engaged employees

On February 9th and 10th 2018, the Lean Analytics Association organized and facilitated the first CEMEX Hackathon featuring over 130 people out of which 101 were participants: 67 CEMEX employees from 9 countries and 34 post-graduate students from 9 leading universities. This intense co-creation event was held in Cambridge, UK and welcomed anyone with a passion for innovation as well as design thinkers to collaboratively solve a challenge that aimed to increase employee engagement, motivation and mobilization, thus developing a new innovative culture in CEMEX.

Thirteen teams of 6 to 8 participants composed of CEMEX employees and students were formed and each team was assigned facilitators from the Lean Analytics Association or one of the 3 Universities (EPFL, Cambridge University and Cranfield University). In addition, one CEMEX employee per team was selected to document and store the generated insights, ideas, and knowledge.

Before the teams kicked-off with their work, hackathon organizers and sponsors delivered the opening presentations, formally opening the hackathon challenge, providing the background information about the

company and challenge itself, introducing the agenda for the two days, and providing a brief training on the design process for the hackathon.

Teams started the journey by doing contextual research and carrying out interviews with CEMEX employees. Using the insights from research and interviews, teams built the persona, a fictive representation of a real person that fits the profile of the segment of people that the challenge is affecting. Furthermore, they developed an empathy map for that persona in order to determine the underlying problem of the hackathon challenge. The idea of the problem statement is to pinpoint the challenge down to one problem based on the learnings and insights from the Empathize step (the first step of Design Thinking methodology; see Figure 4). There might be many problems that are resulting in the challenge, but for the two-day hackathon, teams had to focus on one. In the following step, teams used various brainstorming techniques as devised by facilitators, to come up with as many ideas as possible, before reviewing and ranking them. The idea that received the highest number of votes was prototyped in the fourth step. Teams used various prototyping techniques to manifest their ideas into demonstrators, mainly through the use of paper prototyping, storytelling, roleplaying, wireframing and mock-ups. During the prototyping step, teams had the opportunity to work with three artists from the Starfish Taylor to better visualize their ideas. At the end of the day, each team was given 2 minutes to demonstrate their prototypes to the judges and other teams, who provided their feedback through an interactive voting system. With that, the first day of the CEMEX Mobilization Hackathon came to pass.

The teams kicked off the morning of the second day with a discussion about the feedback received on the previous evening. Based on the new insights, they had to decide either to start modifying their existing concept or make a pivot and select a different idea from their ideation board (which they created during the third step of the Design Thinking Methodology; see Figure 4). All prototypes had to be completed by the end of lunchtime when teams were given time to prepare their final pitches and demonstrations. The hackathon closed after an international jury conveyed, unanimously selected the three winning teams, and announced the winners at the awards ceremony. The winning team received the award of 3,000 GBP and the opportunity to develop their solution further in CEMEX, while the second and third teams received 2,000 GBP and 1,000 GBP respectively.

Authors observed a great level of energy (see highlights from the even in Figure 5), motivation and determination from all participants, who also showed significant interest in the topics of innovation, co-creation and in creative problem-solving. They have collectively generated approximately 1300 high-level ideas, used over 10,000 post-it notes, created 24 prototypes in total, and delivered 13 pitches. In two days, participants collectively put over 1900 man-hours into dedicated problem solving and innovation, which is the equivalent of 1.1 years of one full-time employee. However, this number is presented only to demonstrate how much effort can be achieved in two, focused, days, as the diversity of ideas and vastness of experiences and skills cannot be compared (Flores et al., 2017; and Spaulding & Caimi, 2016).

Michel Andre, the UK Country President at CEMEX, one of the event's key stakeholders, sponsor and judge of the hackathon was well impressed with what was achieved in two days. He wrote, "*What a learning experience! Incredible engagement and passion demonstrated by all participants! Several great ideas being incorporated in our innovation model.*"

Figure 5: Highlights from the CEMEX Innovation Mobilization Hackathon (Cambridge, UK)

Case study 02: México Tierra de Innovadores: Mind the digital talent gap

As part of the first México Tierra de Innovadores (MeXXTI) conference held In Mexico City in September 2018, the Lean Analytics Association organized and facilitated a one-day Business Hackathon with 80 participants including innovation heads, managers and directors of some of the most innovative and successful Mexican companies and 20 junior high students varying from 12 to 16 years old from the Academia Aeroespacial México (Campus Tlaxcala).

One of the most recent trends in business nowadays is Digital Transformation. Many organizations are aware of it or have heard about it, yet, according to studies carried out by MIT Center for Digital Business and Capgemini Consulting, more than 3 out of 4 organizations considered in the study agree that missing digital talent and skills is one of the key obstacles towards their digital transformation (Spitzer et al., 2017). This indicates that there are many organizations trying to reduce the talent gap in their current workforce to enable their organization to be successful in their digital transformation journey and increase the competitive advantage. Therefore, the challenge of this hackathon was aimed at answering the following question: "**How might we help companies to bridge the digital challenge gap?**"

The MeXXTI Hackathon started by formulating 8 teams of 10, where each team had both students and professionals. The event was then opened with the presentation introducing the challenge, the hackathon process, the rules and the awards. While the agenda of the event followed the first four stages of the Design Thinking methodology, some changes had to be made due to a significantly shorter time as in the CEMEX Mobilization Hackathon. Therefore, the empathizing was done in two stages:

- Firstly, three companies, Airbus Defence & Space from Madrid (Spain), CEMEX from Monterrey (Mexico), and Axtel from San Pedro (Mexico), presented the need for the digital talent within their organizations and spoke about challenges they are facing in obtaining or educating it. During that stage, participants were encouraged to take notes and identify any pieces of information and insights that helped them understand the challenge from an industrial point of view.
- Secondly, participants within each team were then divided into pairs and tasked to interview each other, with the purpose of eliciting any additional needs, desires, pains, challenges or experiences related to their work and the hackathon challenge.

As in the CEMEX Mobilization Hackathon, teams then converted the generated insights into a persona, for which they also developed an empathy map. This map provides a condensed, visual overview of what persona is (1) Thinking and Feeling, (2) Seeing, (3) Saying and Doing, and (4) Hearing. Teams were now able to start defining various possible problem statements in the shape of "How might we?" questions. Table 3 displays some examples of the "How might we?" questions from one team's persona (in that case Martha, a Senior Portfolio Manager in the large international organization) in relation to the hackathon challenge:

Table 3: Examples of "How might we?" questions for the Mind the digital talent gap challenge

1.	How might we help Martha to be able to learn about the digital transformation at her own pace during her free time?
2.	How might we enable Martha to learn about digital technologies and how to apply them during lunchtime at work?
3.	How might we help Martha to recruit new people with the digital skills in her team while ensuring the work continues uninterruptedly?
4.	How might we support Martha on her path to convince the company's leadership to invest in internal training development for digital topics?
5.	**How might we help Martha to learn and keep up to date with the latest digital topics that will help her deliver new value to customer and business?**

While all five questions are relevant, by the end of the Define phase, each of the eight teams had to agree on one single question, which they were challenged to answer the same day during the following stages of design thinking. In the example above, the team selected question number 5 - highlighted in Table 1 - as their core problem statement.

Now participants began to brainstorm ideas that could answer the problem statement. Facilitators provided the teams with various brainstorming techniques, and most teams went through two brainstorming iterations. After carefully evaluating each idea, teams had to vote for one that had the biggest potential of answering the selected problem statement. In some cases, where this made sense, multiple ideas were merged into one in order to create one “superior” idea.

Having selected the idea, teams then began to develop prototypes. Most of the teams identified that some form of narrated storytelling in combination with the roleplay is the best way to convey their idea. To develop their prototypes, teams had only one and a half hour, plus an additional half an hour to prepare their demos and pitches. As the final act of the day, teams pitched their ideas to five international judges, who ranked them and their solution according to four evaluation criteria:

1. **Novelty:** How new/unique are the proposed ideas?
2. **Usefulness:** How actionable/feasible are the proposed ideas?
3. **Overall Creativity:** How creative was the team, the idea, the pitch, etc.?
4. **Pitch:** How exciting, clear and memorable was the pitch?

The judges had to select one team as the overall Hackathon Winner, as well as two winning teams for the categories of The Best Pitch and The Crazies Idea. These were announced at the awards ceremony which also marked the official closure of the México Tierra de Innovadores Conference. Figure 6 depicts some of the highlights and moments from the México Tierra de Innovadores hackathon.

Figure 6: Highlights from the México Tierra de Innovadores Hackathon in September 2018

Case study 03: Design Thinking Olympics: Mind the digital talent gap

Design Thinking Olympics is a series of international events in which teams of students from different Universities around the world work hands-on, compete, learn, innovate, prototype. The aim of the Design Thinking Olympics is to solve critical challenges for organizations and society by facilitating the discovery of innovative ideas in collaboration with students, academics, industry, governments and the wider society.

In 2018, the Lean Analytics Association organized 5 Design Thinking Olympics held at the following locations:

8. **Universidad Austral** – Buenos Aires, Argentina
9. **Cranfield University** – Cranfield, United Kingdom,
10. **EPFL** – Lausanne, Switzerland
11. **Tecnológico de Monterrey** – Monterrey, Mexico
12. **EDACY** – Dakar, Senegal

The main organizer in each location called these, Local Design Thinking Olympics. This is because the winning teams of each of the Local Design Thinking Olympics were invited to the second round in London, where the five local winning teams would pitch their solutions at the Lean Innovation Forum organized by the Lean Analytics Association, an international conference on lean thinking and innovation.

Similarly, to the México Tierra de Innovadores Hackathon, the challenge for the Design Thinking Olympics was "How to reduce the digital talent gap towards industry 4.0?" However, in the case of Design Thinking Olympics, this challenge was not to address the needs of the industry, but rather to address the needs of the students close to graduation, that in most cases still do not count with the digital talent required nowadays. Although there is awareness about this talent gap, concrete actions to reduce it are rarely taken. The aim of the Design Thinking Olympics is to solve this challenge in direct collaboration with the students and industrial partners who provide insights. Therefore, the high-level persona, (which participants further explored and enriched during their events) was loosely described as a student perusing a university degree, who is close to graduation and lacking digital skills or who will be searching for a job within 1 or 2 years.

Figure 7: Process of organizing Design Thinking Olympics

While the previous two hackathons were organized in accordance with the methodology described in Section 2 of this paper, the organization of Design Thinking Olympics required somewhat a different approach as shown in Figure 7. The first effort was to invite five universities and find industrial partners who would join the local event as subject matter experts and judges. In parallel, the details, event logistics, and the challenge had to be defined and agreed, and in March 2018 the first Local Design Thinking Olympics took place at the Universidad Austral in Buenos Aires, Argentina. Local events at the other four universities followed between April and June 2018. Each local event yielded one winning team which entered an international competition for a final prize of 2,000.00 GBP towards the idea incubation. However, to enter this competition, all teams had to undergo a second design iteration starting in July and ending in the second week of November 2018, in order to advance their prototype, and this time, test it with the real users. Throughout the second iteration, teams were given support by their local, university coaches, as well as by a global team of facilitators and mentors from the Lean Analytics Association. At the Lean Innovation Forum 2019 in London (UK), all five teams pitched (virtually or in person) their solution to a selected international jury, which used the same four evaluation criteria as in the México Tierra de Innovadores Hackathon. The competition was so close that the jury selected 2 winning teams: The team from Cranfield University (UK) and the team from Tecnológico de Monterrey (Mexico). Figure 8 shows the group photos taken during each of the local Design Thinking Olympics.

Figure 8: Design Thinking Olympics from the top down: Universidad Austral in Argentina, Cranfield University in the United Kingdom, École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland, Tecnológico de Monterrey in Mexico and EDACY in Senegal.

Case study comparison

Each hackathon was organized in accordance with the methodology described in Section 2 of this paper and followed the Design Thinking Methodology. However, each hackathon has been unique and the execution of the CEMEX Hackathon, México Tierra de Innovadores Hackathon, and the Design Thinking Olympics differed from each other and from location to location. Table 4 summarizes some of the key similarities and differences in the organization and execution of the three hackathons and uses the following key: (✓) fully agree/align to the attribute, (~) somewhat agree/align to the attribute, and ( ) does not agree/align to the attribute.

Table 4: Comparing the similarities and differences of the three hackathons

#	ATTRIBUTE	CEMEX Hackathon	MeXXTI Hackathon	Design Thinking Olympics
HACKATHON PROCESS				
1	Followed Design Thinking Methodology			
2	Participants engaged in Empathy Phase			
3	Participants engaged in the Define Phase			
4	Participants engaged in the Ideate Phase			
5	Participants engaged in the Prototype Phase			
6	Participants engaged in the Test Phase	–		
7	Participants had to pitch their ideas			
8	Participants completed at least two design iterations			
9	Participants used templates to help them navigate through the process			
ORGANIZATION PROCESS				
10	Hackathon had a sponsoring company			
11	Hackathon was open to a mixed audience			–
12	Hackathon had a clearly defined challenge			
13	Participant registrations were handled online			
14	Participants had to do some pre-work or pre-reading			
15	Subject Matter Experts were involved in the hackathon		–	
16	Hackathon facilitators and the core team established alignment before the event to follow a standard approach			
17	Formal structured interviews to end-users were carried out during the Empathize phase		–	
18	Awards were provided to the winning team(s)			
19	Hackathon duration	**2 days**	**1 day**	**1 day**
20	Intense promotion to invite students to attend			
21	The voting mechanism from all participants for the first prototype to provide feedback to all teams		–	–
OUTCOMES				
22	Total number of participants	**101**	**80**	**106** [1]

23	The approximate number of generated ideas *(including duplicated, conventional and unfeasible ideas)*	**1300** [2]	**200**	**460**
23	Total number of teams	**13**	**8**	**20** [4]
25	The average number of ideas per team	**100** [3]	**25**	**23**
26	Total number of prototypes	**26** [5]	**8**	**25** [6]
27	Total number of pitches	**13**	**8**	**25** [7]
28	Percentage of students among participants	**34%**	**25%**	**100%**
29	Number of final winners	**3**	**1**	**1**
30	Further work to continue developing and deploying the solution to innovate		**—**	
31	Coding was done by some teams during the event	**—**		**—**

Notes and comments on some of the statistic represented in Table 4:

(1) The total number of participants from 5 locations. Some locations had more participants than others.

(2 & 3) Participants were asked to brainstorm ideas for 6 individual areas, had more time for ideation and went through more brainstorming rounds than in other two hackathons, hence the number of ideas and number of ideas per team is significantly higher.

(4) The total number of teams from 5 locations. Some locations had more teams than others.

(5) Each of the 13 teams developed 2 prototypes (one during the first day and the second one during the second day – the second prototype might have been a modification of the first one or a completely new one).

(6) Each of the 20 teams developed one prototype, however, 5 winning teams were asked to improve their prototypes or develop new ones during the second iteration. The second prototype might be a modification of the first one or a completely new prototype. Hence the final number of prototypes sums to 25.

(7) Each of the 20 teams had 1 pitch, but on 15th November 2018, 5 winning teams will deliver an additional 5 pitches (one per team). Hence the final number of pitches is 25.

Conclusion, challenges and future work

Growing in their popularity amongst entrepreneurial individuals as well as larger organizations, hackathons provide a means to accelerate innovation. The regular organization of internal and mixed-audience hackathons is more than just a 24-hour or 48-hour workshop; it is a change initiative with a great ROI that reaches beyond R&D. Hackathons are a scouting-ground for new talent, a test-bed for 'crazy' ideas, a place for cross-functional and cross-cultural collaboration, a means for identifying and promoting intrapreneurs, and an opportunity to create new businesses and business opportunities.

In this paper, the authors describe the methodology for the organization of corporate hackathons, which provides a three-stage, step-by-step guide covering planning, execution and post-hackathon activities. It enables organizations to prepare an event that delivers value, it helps to change the innovation landscape and it empowers participants and employees to act on the resulting ideas. Furthermore, three case studies of different hackathon events are presented and compared in order to offer deeper and somewhat quantifiable insights into these co-creation events.

However, the organization and execution of the hackathons have different challenges. Furthermore, these latter vary in existence or magnitude, depending on the hackathon type, aim, objective, scale, location, or another variable. The key nine challenges and risks the Lean Analytics Association team faced during the organization and execution of the 3 hackathons are summarized in Table 5. The key used is the following: (□□) indicates in which hackathon the challenge or risk was strongly present; (□) indicates in which hackathon the challenge or risk was present; (□) indicates in which hackathon the challenge or risk was somewhat present). The order in which the challenges appear is random and does carry any significance.

Table 5: Nine challenges and risks when organizing and executing hackathons

#	CHALLENGE OR RISK	CEMEX Hackathon	MeXXTI Hackathon	Design Thinking Olympics
1	**Obtaining the right profile of participants** *Hackathons are attractive to many people, but not all hackathons are suitable for everyone. For example, coding hackathons would struggle to produce good results if the majority of contestants would not have enough or any coding skills.*			
2	**Achieving cross team alignment** *For hackathons to run smoothly, the entire team, including facilitators, presenters, organizers, photographer, venue, catering, workshop leaders, and anyone else involved in the event, must be aligned and aware of what is happening and what needs to happen next. It is also incredibly useful if people are aware of what to do in cases when things do not go as planned.*			
3	**Pick the right and experienced team to facilitate** *Each design thinking facilitator has a different skillset or a different toolkit to offer. Also, some might be more experienced in particular areas than others and it is the organizer's responsibilities to onboard the most suitable facilitators, capable of guiding the teams from the challenge to solution.*			
4	**Timekeeping** *Hackathons are high-energy, time-intense, creative events, where participants are immersed in the design challenge, trying to solve it. This often results in trying to stretch the allocated time to its maximum or even over, in order to gain additional time to perform their activities. Depending on the planning preparations and agenda, this can be allowed, or not in cases of the strict deadline.*			
5	**Attaining unwavering commitment and trust** *This is especially true when organizing a hackathon for a specific company. Hackathons are not a standard business practice yet and, therefore, require strong collaboration, continuous communication and transparency.*			
	Selecting the right challenge/theme *Hackathons typically focus on a specific theme with a specific challenge which the participants need to solve. However, not all challenges are suitable for hackathons, therefore selecting the right ones is of ultimate importance.*			
7	**Wording the hackathon challenge/theme** *Wording the challenge in the right way is critical to a successful organization of any hackathon. It is difficult to attract the right people or ensure the teams understand what they need to do, if the initial theme or challenge is unclear to begin with.*			
8	**Ensuring design thinking stages are clear to all** *The majority of participants are attending the hackathon for the first time; therefore, the agenda needs to be defined accordingly to ensure participants have enough time to get familiar with*			

	their teammates, the challenge and each step of the design process. Workshops parallel to the hackathon (e.g. how to prototype, how to pitch, etc.) might enrich the hackathon outcomes.			
9	**Post-hackathon activities and follow-up** *During the hackathon, a vast amount of new knowledge is generated, and (some) ideas and prototypes that emerge might carry real commercial value. The challenge is, how to document, structure and store the knowledge, and how to ensure the work done during the hackathon is utilized and applied in the organization to really innovate.*			

Relying mainly on regular and transparent communication and collaboration the abovementioned challenges and risks were mitigated or eliminated during the organization, execution and reflection stages. However, further tests and observations are required to derive more concrete conclusions on how to systematically and structurally address or prevent these challenges. It is a question of future research to investigate and further quantify the outcomes, experiences and results of organizing and executing the hackathons. Therefore, authors believe that the future work should look into individual areas of the hackathon organization methodology in depth to provide more specific and comprehensive advice while continuing to measure the benefits and challenges of organizing corporate hackathons.

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Track 4.c Introduction: Transformation IN and BY Design Thinking

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Scholars and practitioners are acknowledging the central role that design can play in innovation (Brown, 2009; Martin, 2009; Verganti, 2009 and 2017; Verganti and Dell'Era, 2014; Liedtka, 2013; Kolko, 2015; Kleinsmann, Valkenburg and Sluijs, 2017). Design is increasingly becoming a strategic source of competitive advantage, to the point that scholars investigate its managerial side and its impact in the creation of value (Capaldo, 2007; Dell'Era and Verganti, 2007 and 2010). Design Thinking, in particular, is making the headlines, with an extremely rapid diffusion in the practice and interest of organizations. Far from being connected with the "form" of products, Design Thinking is accepted as a formal method for creative problem solving, with the intent to foster innovation (Brown, 2009; Martin, 2009; Liedtka, 2015).

This rapid adoption of Design Thinking in practice however has not gone hand in hand with a robust development and diffusion of its theoretical underpinnings. On the practitioner side, Accenture, Deloitte, IBM, KPMG, McKinsey and PricewaterhouseCoopers rank among the most forceful players in acquiring design agencies in order to renew their offering and refresh their approach. Contemporary design thinking is booming in those industries where the digital transformation requires new competences and capabilities for developing delightful digital experiences (Calabretta and Kleinsmann, 2017). On the one hand Design Thinking describes significant transformations highlighting overlaps and synergies with emerging approaches such Design Sprint (Knapp et al., 2016), Agile (Bianchi et al., 2018) or Creative Confidence (Kelley and Kelley, 2010); on the other hand it is considered a fundamental paradigm to lead digital transformations. For this reason, the thematic track "Transformation IN and BY Design Thinking" investigates the evolution of this paradigm in relation to different theoretical lenses:

- Design Thinking and Innovation Theories
- Design Thinking and Creativity Theories
- Design Thinking and Leadership Theories
- Design Thinking and Organizational Theories

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Business Empathy: A Systems Thinking Perspective

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The strength of design is that it brings new perspectives - often referred to as 'out of the box' thinking. However, an attitudinal and methodological strength need not render the designer humble in systems-based business knowledge that improves the prospect of ideas being carried through to implementation. Systems thinking as a discipline offers designers a way to model and understand how a business works, from its processes and power structures to its people and underlying architecture. This paper proposes an incorporation of key system thinking tools including; Soft Systems Methodology, Business Architecture and Viable Systems Modelling into the design process to develop what we term business empathy. The paper contributes a system thinking perspective to an increasing body of literature regarding design innovation.

Keywords: Systems Thinking, Viable Business Model, Business Empathy, Holistic Thinking, Servitisation

Introduction

We begin with a scenario:

> *Company A* approaches a design firm with the challenge; assist our company to transform into a competitive force in an 'Industry 4.0' environment. The design firm sees immediate servitisation opportunities; both digital and physical adaptations to current product offerings. The design firm sets to work drafting and developing a series of changes. When the time comes to present these opportunities in a product-service blueprint; a glaring gap emerges. The people that work for the company have mixed views in determining the proposed value propositions and the best way to make the necessary changes. The company's business architecture simply won't support such a transformation, now or in the future. Further, it is difficult to visualise what incremental steps could be taken to optimise value during the business's evolution while mitigating risk associated with the cost of change. It becomes clear that the operational structures and systems within the organisation have not been factored within the design process to the detriment of both client and design firm.

Design (and design thinking) have provided a human-centric posture toward innovation enabling organisations to adapt to changing market conditions and absorb the shock of technological changes. However, the pace of change in Industry 4.0 requires greater attention to the necessary organisational structures to allow continued adoption. Industry 4.0 has been called the next industrial revolution, and is forecast to radically change the relationship between consumers and producers (Roblek, Meško & Krapež, 2016). This revolution will be driven

by physical objects with embedded software, driven by the internet of things (Almada-Lobo, 2015), creating a digitization of economies and society and a digital environment (Pozdnyakova, Golikov, Peters & Morozova, 2018). This mix provides business with the opportunity to gain continuous and real time feedback from operations (Roblek, Meško & Krapež, 2016) with the potential to customize and improve a value offering in a highly adaptive manner (Rymaszewska, Helo & Gunasekaran, 2017). Yet the development of Industry 4.0 also places new pressures on the internal infrastructure of an organisation - the business architecture - to afford self-awareness, self-predicting, self-reconfiguring and self-maintaining business systems (Lee, Kao & Yang, 2014).

Design is known to assist organisations to adapt to new value creation and capture mechanisms by testing deeply held assumptions (Liedtka, 2015). The popularity of design at this time is often constructed along the rhetorical narrative; *it is an age of uncertainty and therefore a prosperous time for design*. Yet gaps can emerge between a design proposal and the necessary business architecture changes to afford such transformation as we explored in our scenario. As we introduced in the scenario of *Company A*, not identifying how a business works can later impede the actionability of an idea or solution that emerges from the design process.

The following paper will look into systems thinking and identify particular tools which designers can incorporate into the design process during servitisation challenges in the context of Industry 4.0. The aim of the paper is to propose how these tools could be integrated into, and strengthen the design process of designers who operate within this context. We broaden the notion of empathising with users and stakeholders to deeply gather insights, to empathising with the logic underpinning existing structures and systems that allow an organisation to operate during explorative phases of the design process. The paper contributes systems thinking perspectives toward the design of product-service-systems in order to bridge the gap between disruption (innovation) and optimisation (implementation). Through this paper we seek not to lock design up in systematic tools, but rather expand the available means through which a designer operating in business can understand, create and implement change. We build toward implications for fourth order design that stem from greater attention to systems thinking, organisations and environments. The paper concludes with reflection upon design's increasing provenance with the business community.

Servitisation challenges of industry 4.0

Industry 4.0, as opposed to previous industrial revolutions, will see the absolute integration of instant communication into all production processes (Sukhodolov, 2018), fuelling the rise of servitisation. This has seen more organisations exploring advanced service offerings such as product service integrated solutions (PSS), with industry-based evidence suggesting it creates closer and more long term relationships with customers improving satisfaction and increasing sales (Hennik Research, 2017; ("Servitisation: The Changing Face of Manufacturing and Service", 2018)).

This shift from purely product-offerings requires organisations to think in terms of comprehensive systems with interdependent elements (Sukhodolov, 2018); and a change in the way they think about innovation. Whereas, 'pure product' was traditionally focused on technical expertise, service innovation requires human centred understanding as the products are not merely stand-alone solutions, but are used in the broader context of a users' life (Agarwal & Selen, 2015). This in turn changes the competitive landscape, where once businesses competed on technology, the new factor for success has become knowledge regarding experience; where the customer is the supplier, and the business the integrator (Burton-Jones, 2003).

While industry 4.0 is presenting these new opportunities for businesses, responding to these changes can be a challenge for businesses (Neely, 2014). Responding to the challenge of better understanding the relationship aspect with their customers organisations have been turning more towards design thinking with it being used as a strategic capability (Dell'Era; Verganti, 2010), as it is intrinsically based around human- centricity (Calabretta & Kleinsmann, 2017).

Design Thinking in the context of Servitisation

Design thinking is an approach for solving human- centred problems (Garrette, Phelps & Sibony, 2018) giving organisations a customer centric view, enabling them to deliver human-centred experiences, which fulfil emotional and functional needs which can be supported by business operations (Calabretta, Kleinsmann, 2017).

As a problem solving process with cognitive origins, design thinking can be seen as a form of abduction aimed at defining the 'What' and 'How' needed to identify a 'Result' (Dorst, 2011) which can be broadly defined in four phases including: the preparation phase, the incubation phase, the illumination phase and the verification phase (Tschimmel, 2012). The design thinking process has been represented in a number of ways including; the double diamond approach, the three I model, or the Hasso Planter Institute model (Stanford/Potsdam model) as represented in Figure 1. The notable aspect of these models is they all begin with a learning phase from defined users. The learning, or empathy stage with users is viewed as a foundation of design thinking (Garrette, Phelps & Sibony, 2018) which deepens understanding into the problem situation enabling the realisation of relevant solutions (McDonagh, 2010).

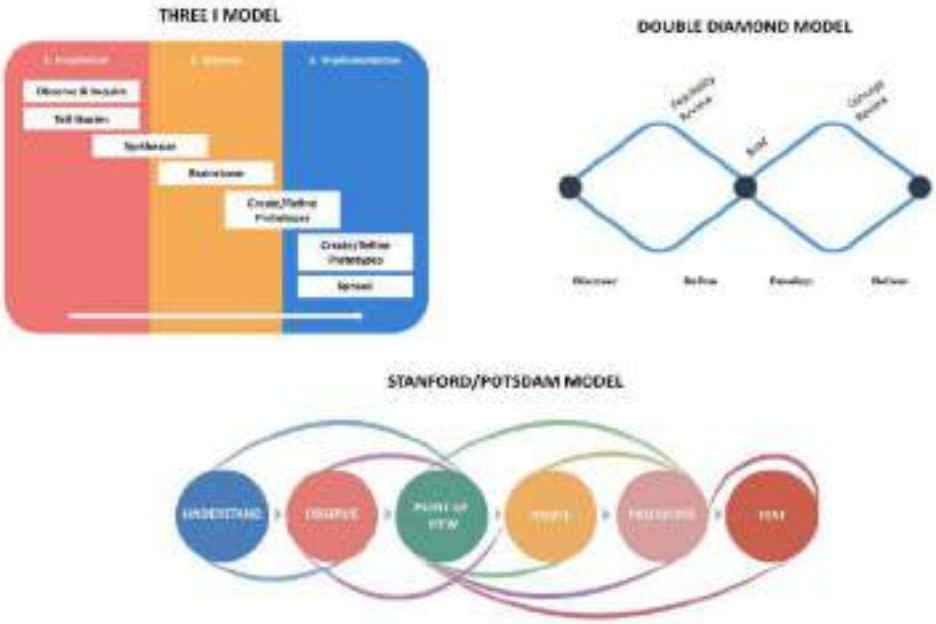

Figure 1: Design Thinking Process Models. Source: Tschimmel, 2012, redrawn

Empathy has been defined as 'perspective-taking' where one places themselves into someone else's position and adopting their perspective (Gasparini, 2015) and in the design process, focuses on key stakeholders namely the end user, within the context of the problem in order to understand their needs. In servitisation, this enables organisations to understand the customer perspective in turn creating a 'customer benefit package' (Goldstein, Johnston, Duffy & Rao, 2002). Through journey mapping and service safari's, designers can capture opportunities in existing processes (Howard, 2014) where improvements can be made to improve the user experience (Scherer, Kloeckner, Ribeiro, Pezzotta & Pirola, 2016). With this information designers can then describe a service in its constituent parts including: service product, process, place, physical evidence, people, productivity and quality, plus additional marketing elements (Goldstein, Johnston, Duffy & Rao, 2002). These are then organised into a process using a service blueprint, such as that shown in Figure 2. Through this designers can create a user centric business model, which visualises the different components and interrelations between stakeholders (Estañol et al., 2017).

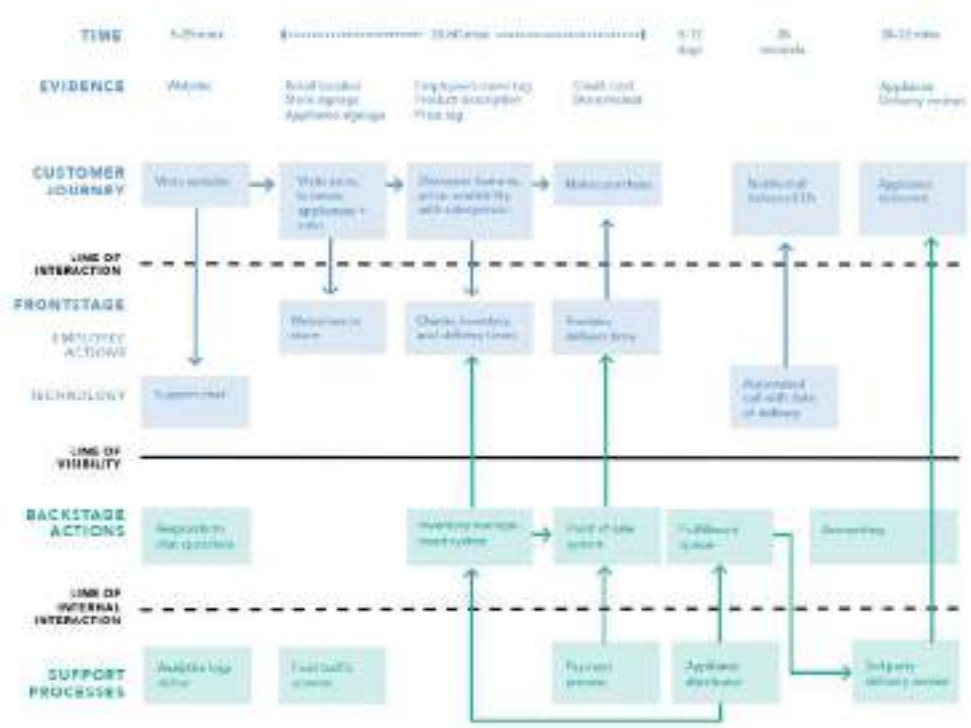

Figure 2: Example of Service Blueprint for online shopping. Source: Nielsen Norman Group, 2017

Limitations of Design Thinking

While design thinking gathers insights to propose business opportunities, these may sometimes be at odds with the current state of the organisation (Martin, 2009). In the context of servitisation, it is important that while designers should understand the user needs, they must also have an understanding of the system which the service will operate in (Calabretta, Kleinsmann, 2017). Without considering both views, the entire picture isn't complete (Kuehn, 2018), and value cannot be delivered until there is alignment between the invention and the business system (Auerswald and Branscomb, 2003). While service blueprinting outlines the requisite components an organisation needs to deliver a service, it lacks the rigorous analytical capabilities to be used to test a service within an organisation (Estañol et al., 2017). Activities up until this point can arguably be seen as product championing, which is demonstrating a problem solution fit and desirability in the market. While this is an important part of the new product development (NPD) process, failure to consider broader ramifications results in strategic neglect which is where focus has only been on desirability and viability, but not on achievability from a business perspective.

In order to avoid neglect, this requires reflecting the concept back into the business, framing it in how it contributes and impacts the business from not only market growth but on its people, processes and structures in what is known as organisational championing (Burgelman, 1983). Strategic neglect leads to what is also known as the 'valley of death' which is the result of short fallings in the organisational capabilities as well as institutional misalignment (Auerswald and Branscomb, 2003). Failure to bridge the valley can result in organisations missing the opportunity to realise value opportunities. The valley of death, as depicted in Figure 3, provides a broad view of the structures, processes, people and resources that are involved in commercially realising a solution. On the graph the y-axis indicates resource availability against the level of development on the x-axis.

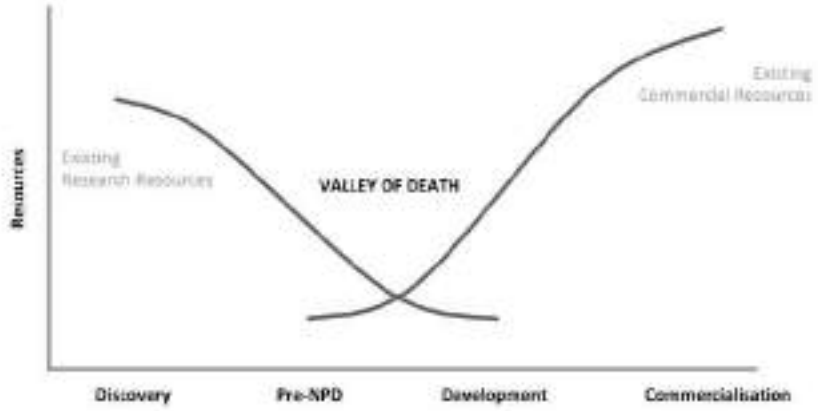

Figure 3: The Valley of Death. Source: Markham, 2002, redrawn

This gap is caused by misalignment attributed to the different perspectives which NPD professionals and organisations have (Markham, 2002). This can be seen where NPD is focused on innovation, which in its nature is disruptive; whereas a business is focused more on efficiency and stability.

Exploring Implementation Challenges in Design Practice

To better understand how this reflects in practice, exploratory interviews were conducted at a design agency currently operating in the space in assisting organisations realise the potential of industry 4.0. The agency does this by translating human insights and pairing it with technology to create new business opportunities in sectors including automotive, insurance and retail.

Interviews were conducted with 12 members of the team ranging from strategy, UX and UI design, project management and innovation consultants. Interviews, which lasted an hour and were semi-structured, asked individuals to reflect on the performance of previous projects with regards to how their work was adopted by clients; asking them to think about what was or wasn't successful. Quotes from these interviews were then coded and clustered in order to identify themes which related to why the products were or weren't adopted. It is worth noting, that the interviews only took on board the perspective of the agency, as such taking the NPD view of the valley of death. Further interviews would need to be conducted from the client side to gain an understanding from both sides of the challenge.

The projects which have been a success range from apps to physical products within a PSS and a key aspect to their success was the matching of the product to the broader context of the business. In two of these instances projects from the client were purely executional in terms of simply building the products. In these cases, the understanding as to how this would align with the organisation was already considered by the client, with pre-existing supporting business cases which gained broader organisational buy-in before development work had begun. Other successful projects had seen the agency take on a much proactive relationship with the client, where the agency had developed longer term innovation roadmaps with the client, and identified components within the business to support the agencies development work. Here the relationship with the client project sponsor in building project impetus within the business had been an important factor.

Speaking with individuals in the agency who had been involved in unsuccessful projects however, found that they viewed the client as a 'black box' and didn't fully understand the 'why' behind the projects. As such, the rationale behind projects reverted to 'common sense', from a viewpoint of what was desirable for the user, viable for the business, in terms of market fit, and what was feasible technologically. While feedback from the clients on the concepts was positive, in later feedback issues arose around business prioritisation, fit for the organisation or resource availability.

While these interviews only take into consideration the design agency perspective, the factors which affected the success or failure of these projects were related to understanding the broader context of the concept within the business. Where the broader implications of how the idea would fit into the business had been factored, either by the agency of client business, adoption and then implementation had been successful.

Those projects on the other hand, without this understanding were often lost at early stages of concept and first prototype, not making it to a pilot stage.

Disciplines for Understanding Business

As discussed by Whittington (2010), there are different approaches organisations can take with regard to process activities including either more deliberate or emergent decision making. Those which take a more emergent approach, can be seen more of as opportunistic where they look to the market to dictate decisions and their behaviour. These can be seen typically as more dynamic and responsive businesses, where taking a customer centric view is likely to be sufficient in decision making. On the other hand however, businesses with a deliberate approach which are more long term planners, look more for clear rational when making decisions. This approach considers legacy aspects within the organisation in order to inform decision making, therein making it more deliberate than opportunistic.

For organisations with a more deliberate approach, the broad range of challenges revealed in the literature review and exploratory interviews related to mindset, process and integration to the business requires a more holistic approach. A discipline such as system thinking enables designers to gain such an overview (Van Ackere, Larsen & Morecroft, 1993). It has been argued that more reductionist views such as business process engineering or service blueprints, compartmentalise processes which focuses on inventing a process from afresh (Romney, 1994). This in turn provides an artificial view of how a business works, where the subtleties between people and process are ignored (Stickland, 1996). As such, a more holistic view of an organisation through systems thinking is suited where not just the business components of a business are considered, but also the interdependencies between them are explored (Ackoff, 1999), as failure to do so typically leads to failure in the implementation stage (Cao, Clarke & Lehaney, 2000).

An Introduction to Systems Thinking

Systems thinking (we will use the acronym ST from herein) finds its roots in a number of different disciplines including philosophy, communication, control engineering and biology (Checkland, 1981). The aim of ST is to understand complex phenomena by reducing it into its elementary parts (Bertalanffy, 1950), and then looking at the interactions between these parts in order to generate a systems view (Ackoff, 1999). Unlike more reductionist methods of viewing a business (or parts of it in isolation), which aim to simplify a system; ST embraces complexity by breaking it into manageable separate elements in order to understand the interdependencies between its parts (Doleski, 2015)

When attempting to understand how a system operates, we turn to cybernetics which is the science of control within ST (Ríos, 2011). Cybernetics concerns itself with the relationships between; emergence and hierarchy, as well as communication and control within a system and how these all interrelate (Ashby, 1961; Checkland, 1991). An important cybernetics principle to consider when looking at organisations is the law of prerequisite variety or Ashby's law, which governs these two relationships. Ashby's law states:

> *For a system to be stable, the number of states that its control mechanism is capable of attaining (its variety) must be greater than or equal to the number of states in the system being controlled. (Naughton, 2017)*

This law is represented in Figure 4 and is true for any open system; whether it is biological or social (Ackoff, 1994).

When this is related to a business context for example 'a business as a system', it means that in order for a business to remain viable and deal to the variety of challenges, whether from the market or elsewhere, it must have a repertoire of responses which reflect the challenges it faces (Lockton, 2018). This variety can be seen as capabilities, information, individuals within the organisation who recognise the disruption.

Figure 5 shows how this variety is delaminated across a business system, between the external environment it operates in, the business operations and then the management of those operations. Between each of these the amount of variety differs, from the environment which has infinite variety, to the process which has less, and the management which has the least. The amount of variety is represented by the size of the 'V'. Between each of these elements exists a feedback loop which controls the communication between each element,

either amplifying or reducing the message (Beer, 1990). In reality, this can be seen by senior management creating initiatives, which are amplified through the business towards the market, and then customer feedback returning and being reduced through reporting back through the business to senior management. Between each of these entities the amount of variety which can be absorbed differs.

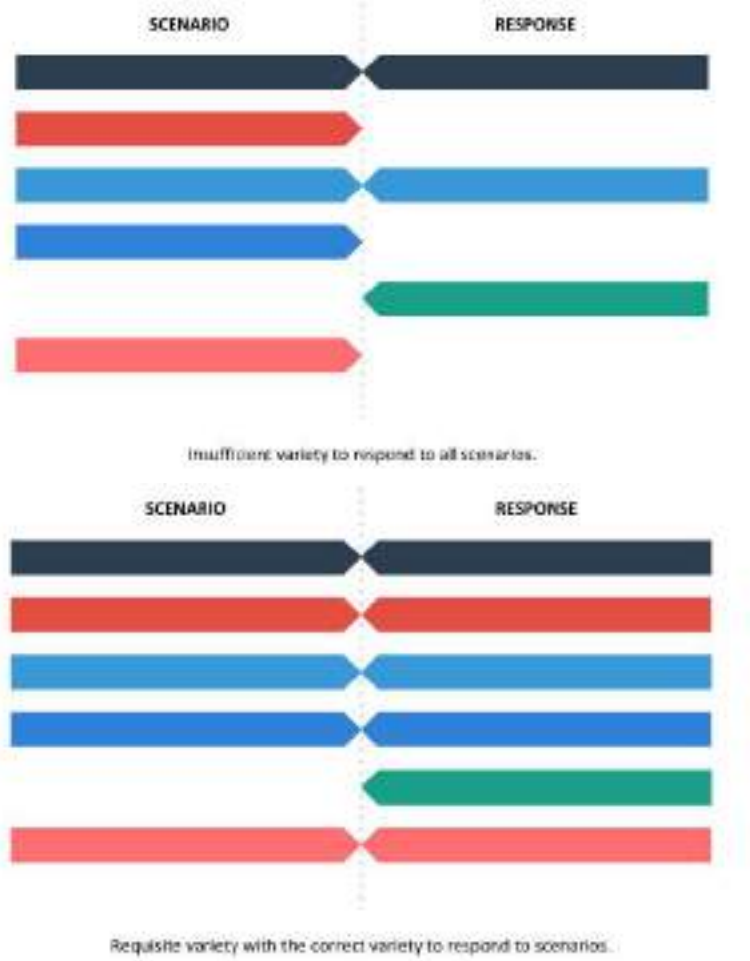

Figure 4. View of a System through Ashby's Law. Source: Lockton, 2018, redrawn

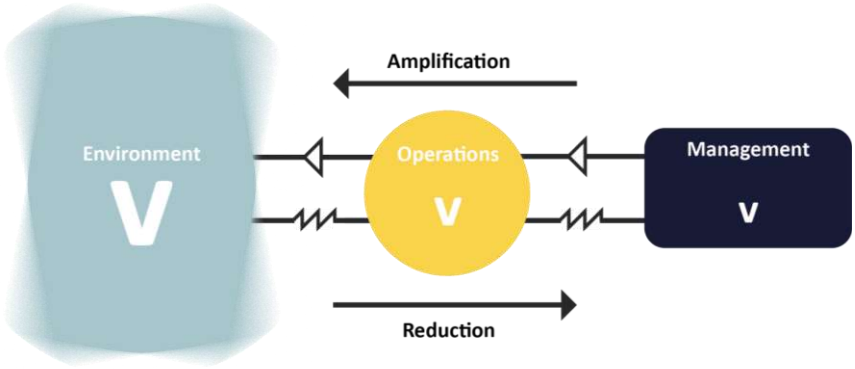

Figure 5. A View of Delamination of Variety across a Viable System. Source: Beer, 1990, redrawn

The purpose of reducing the variety is to ensure that management can focus on only what is necessary, rather than the large range of issues faced in the environment (Beer, 1990). Ashby's law states that how each part of

the system, between the environment and management is able to respond to the information in the feedback loop, determines the viability and survivability of the system. In reality the external environment is perpetually changing. Therefore, there is a constant requirement to continually monitor changes in the external environment as well as the efficacy in the management system to adapt to it.

While Ashby's law indicates how a system, such as an organisation, communicates; it doesn't provide an insight into the individuals within it, which is a critical consideration when understanding a social systems (Ackoff, 1994). As such in the discipline of system thinking a distinction in methods was created between people and processes resulting in soft and hard systems respectively. A hard system is considered something 'which has precise objectives which can be expressed in quantitative terms' (Kirk, 1995), which can be seen in disciplines such as operational research and systems engineering (Oliga, 1988). Soft system's on the other hand is related with human activities, aimed at understanding and reconciling multiple diverse and conflicting definitions of a situation; where there is no precise agreement on the objectives or outcomes (Oliga, 1988). A soft systems approach is concerned with how the system should behave, versus how it actually behaves (Kirk, 1995).

Consideration of both hard and soft perspectives in a business are important, as while a hard systems approach to a solution may appear rational to one individual, other stakeholders may have different views (Burge, 2015) which if ignored can lead to challenges.

Bringing Systems Thinking to Design Thinking

Based on this overview of aspects to consider within a business three themes have been identified which would assist a designer in understanding a business during the development of a new PSS: 1) A tool for understanding how people perceive the business; 2) A tool for understanding the capabilities which exist in an organisation; 3) A tool for understanding the interconnectivity of how a business works. These will come from hard and soft systems methodologies in addition to business architecture. The following portion of this paper will focus on a tool for each of these challenges and then how these can be incorporated into design. We will also draw on parts of the scenario in our introduction to connect to practice.

Understanding Worldviews – Soft Systems Methodology

> Scenario - 'The people that work for the company have mixed views in determining the proposed value propositions and the best way to make necessary changes'

Soft systems methodology (SSM), is a modelling approach which finds its roots in philosophy and social theory (Mingers, 2000), and is used to structure problem situations by providing a holistic view from multiple stakeholders (Checkland, 2000). It is argued by Checkland (2000) that every situation can be seen as a human situation as ultimately it is people who take action within a hard system, where all stakeholders within it have their own worldview or 'weltanschauung' which ultimately affects the performance of the hard system. This is particularly a challenge when individuals unconsciously adopt a particular perspective on a situation which may be completely opposite from another person but yet is still rational causing conflict (Mingers, 2000).

SSM aims to elicit, structure and model different individual understandings of a problem situation to create a structured debate about desirable outcomes, how to get there and the success and failure criteria. In practice SSM has been broadly used over the last 30 years within government and industry; notably within the supersonic aircraft project Concorde. In what was initially considered an Engineering challenge, with the question asked, 'how can British and French engineers logistically work together?', it was soon discovered that the challenge was not simply structural, but cultural and political. Using SSM compromises were able to be found enabling the better cohesion with the team and the eventual completion of the project (Checkland, 2000). There are four main activities within SSM which are illustrated in figure 6, and also described as follows:

1. Find the problem situation including cultural and political aspects;
2. Formulate relevant activity models
3. Debate the situation using the models and debate:
    a. Changes which could improve the situation both culturally and feasably,
    b. Accommodations between the situations.
4. Take action to bring around improvement to the situation.

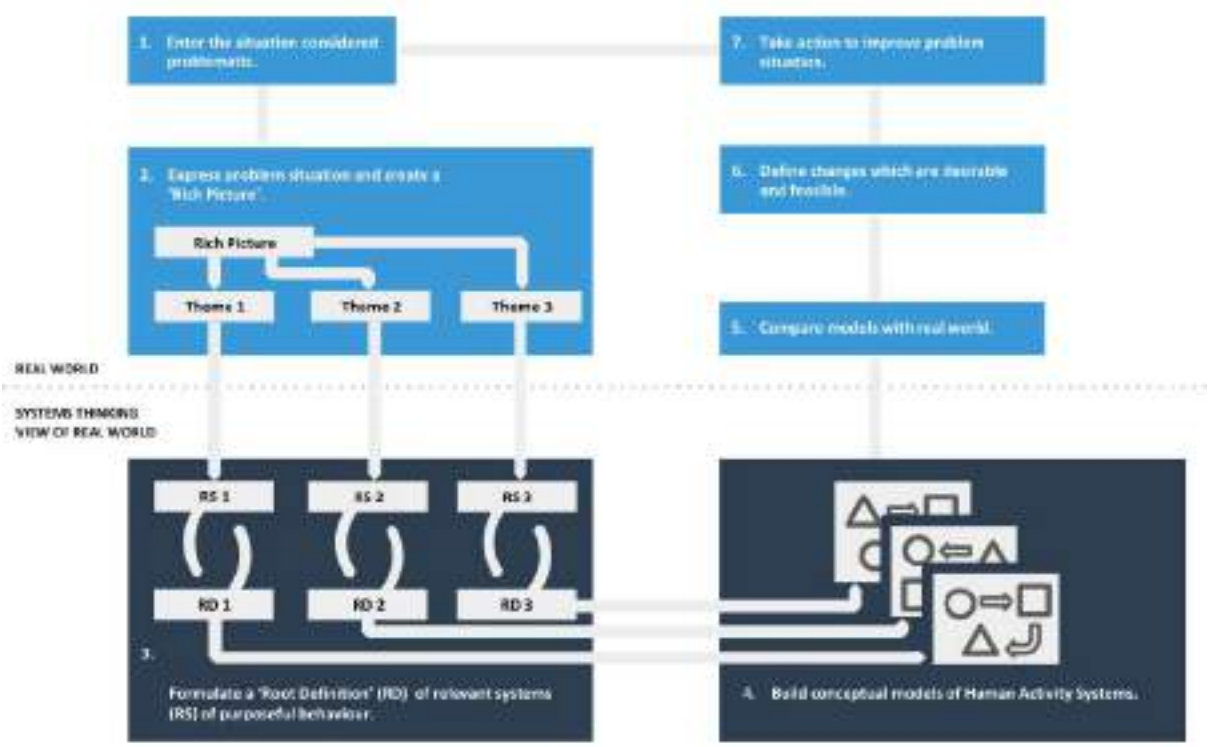

Figure 6. Soft Systems Methodology Framework. Source: Burge, 2015, redrawn

Within this process in stage 1, an understanding of the situation is created through what is known as a 'rich picture', whereby a situation is drawn by a stakeholder in the form of a flow chart from their perspective. Multiple of these are created from various stakeholders which are then compared to create 'root definitions', or points of emergence, of a problem situation (Burge, 2015).

When developing this rich picture, the shared root definition should include the following aspects, which Checkland created using the acronym CATWOE (Burge, 2015):

- Customer: The individual(s) who receive the output from the process (Pandey, 2011).
- Actors: The individuals who are involved in the execution of the process (Pandey, 2011).
- Transformation: The process of changing and input into an output (Pandey, 2011).
  eg. Operational Process
- Weltanschauung: the bigger picture and the reason for 'why' the transformation is taking place (Pandey, 2011).
- Owner: the decision maker who is concerned with the performance of the system (Burge, 2015).
- Environmental Constraints: the key external constraints that are significant to the system (Pandey, 2011).

The aim of the CATWOE analysis is to determine the; 'What to do', 'How to do it' and 'Why do it' (Checkland, 2000), which creates the rich picture of each individual allowing points of emergence and divergence to be highlighted. It is through modelling in SSM that these points of divergence can be highlighted, enabling structured debate in an effort to bring about the desired solution for all stakeholders

The benefit of such an approach to the design process is that it aims to identify the latent needs of stakeholders within a business, identifying diverse and conflicting views with an aim to find consensus. An approach such as SSM can be seen as an addition to a designers tool set, where they set out to identify the latent needs of users.

Understanding Capabilities – Business Architecture

> Scenario - 'The company's business architecture simply won't support such a transformation, now or in the future. Further, it is difficult to visualise what incremental steps could be taken to avoid the risks of inaction.'

In order for a designer to create solutions which align with the business they must understand and gain a cross sectional view of the business from its capabilities to internal value streams (Gharajedaghi, 2011; Kuehn, 2018). This can be achieved through business architecture which aims to create a multidimensional blueprint of a business from its structures to its capabilities. The aim of this is to create an objective view of the business to assist in realising strategy (Winter & Fischer, 2006), which is used as a communication tool between stakeholders to turn value propositions into actionable initiatives (Kuehn, 2018). Through this, internal capabilities can be matched to emerging market opportunities (Gharajedaghi, 2011), as illustrated in figure 7.

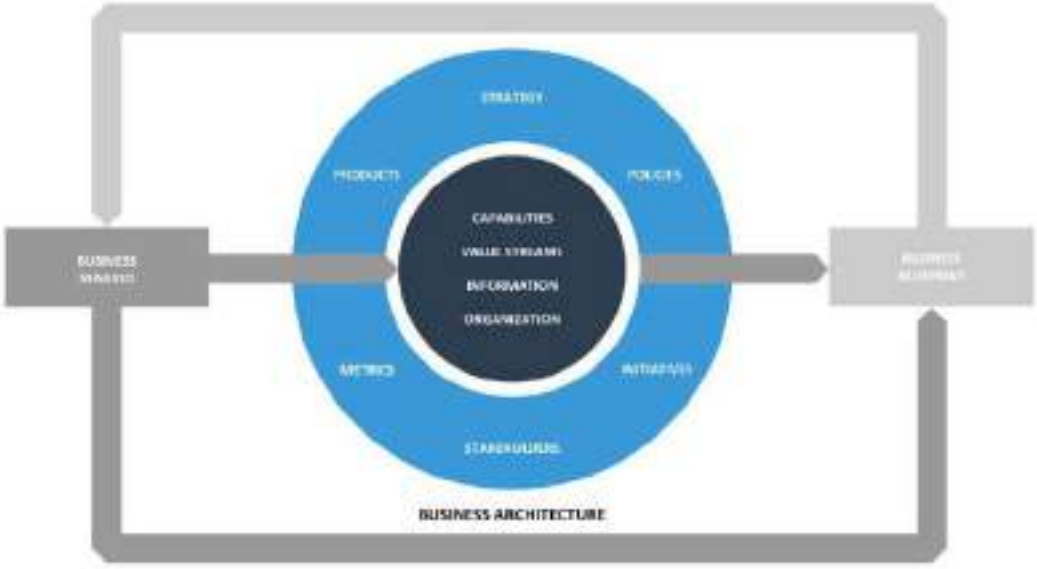

Figure 7. Business architecture flow chart. Source: Kuehn, 2018, redrawn

When the capabilities of a business are connected together through a particular value stream it is possible to understand how stakeholder value (whether internal or customer) can be delivered (Kuehn, 2018). Business architecture takes this view of a business, rather than structure as shown in Figure 8, which does not show internal relationships within the business. Instead business architecture divides these capabilities into four functions of a business including input, output, market access and control capabilities, as shown in Figure 9.

Figure 8. Structural Business Model. Source: Gharajedaghi, 2011, redrawn

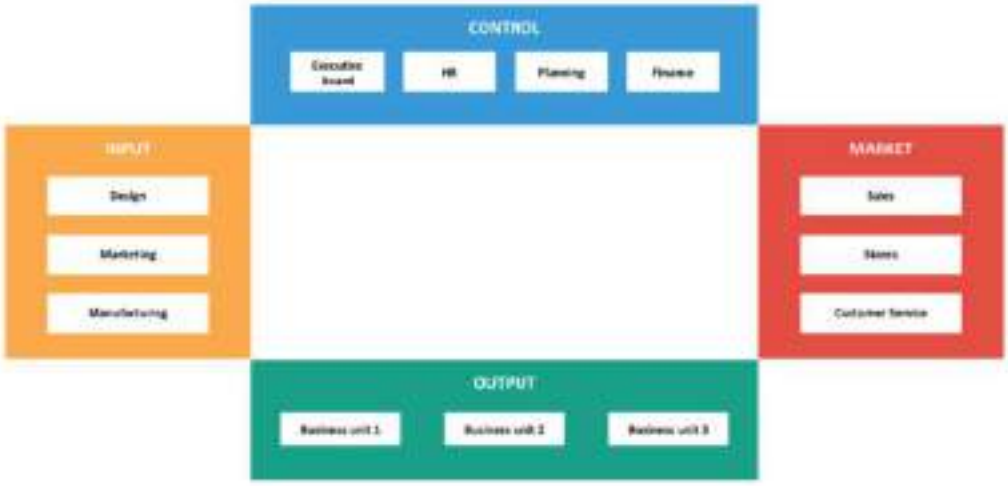

Figure 9. View of Business through capabilities. Source: Gharajedaghi, 2011, redrawn

Through identifying the various capabilities across the different spectrums, they can begin to be connected to create value streams which show the business capabilities required to deliver value as shown in figure 10. Through mapping the business this way, it allows the relationships between peer to peer groups to be seen, from input, to output to market access, allowing the necessary interfaces between capabilities to be highlighted (Gharajedaghi, 2011; Kuehn, 2018).

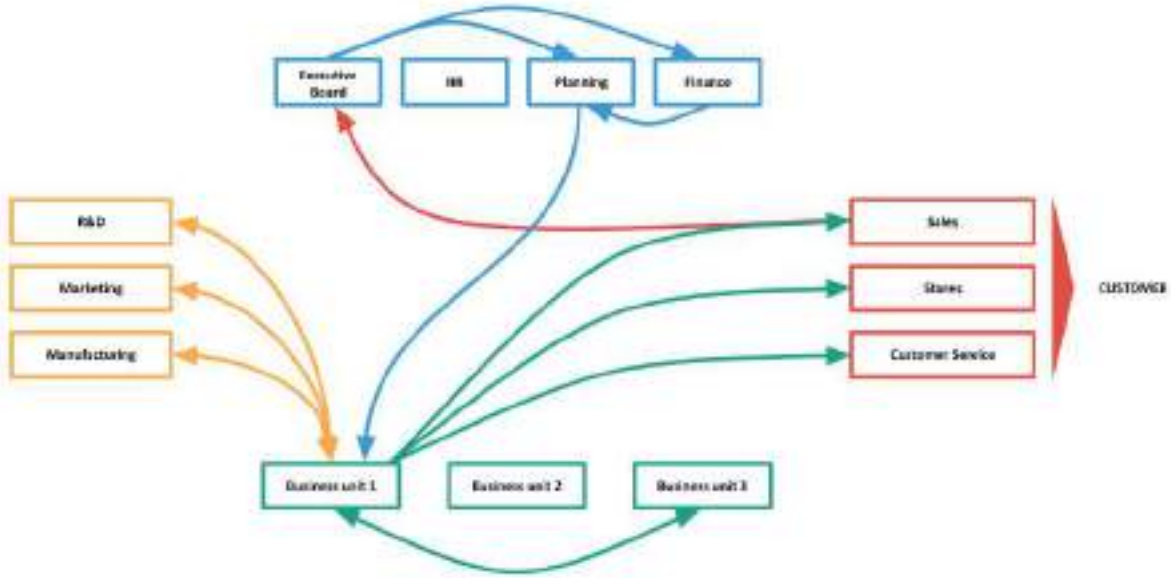

Figure 10. Example of value streams within a business. Source: Gharajedaghi, 2011, redrawn

The aim when identifying capabilities is to remain objective when defining them, as they constitute the basic DNA of a business. By remaining objective, and not tying a capability to a particular outcome, it enables designers and the organisation to reconfigure itself for any given context (Kuehn, 2018).

The benefit for designers, when developing a service blueprint for an organisation, is it allows for an objective view of the business and enables a new service proposition to be compared to existing business capabilities within the organisation. As such for a new service, a designer can propose not only a customer centric business model, but explain this within the current limitations of the organisation and also propose which capabilities will require investment, thus strengthening a service proposal.

Understanding the Workings – Viable Systems Modelling

> Scenario - 'It becomes clear that the existing operational structures and systems within the organisation and how these interdepend and interact with each other have not been factored within the design process'

Once a designer has developed a business model through business architecture, they can use viable systems modelling (VSM) which is an integrated business modeling tool (Wehinger and Herrmann, 2012) to identify deficiencies in existing business system and highlight changes which may need to be made (Hildbrand & Bodhanya, 2015). Unlike more common business models tools, which reduce complexity, an integrated model such as VSM provides a comprehensive framework that breaks down the dynamic aspect of complexity into manageable separate elements (Doleski, 2015).

This integrated business model approach breaks this down by describing all management activities through three lenses that include; Normative, Strategic and Operational management functions. These can be described as follows: Normative is described as the management of general business activities, expectations, values which steers the behaviour of the organisation; Strategic, which is based on normative aspects but steers the focus of the organisation and finally; Operational which focuses on the execution of the day to day tasks. These should all be considered concurrently rather than in isolation, in terms of how they relate to each other (Doleski, 2015).

Based on this aspect, VSM models how each of these functions behave across an organisation through five subsystems which come together to create a viable business which are noted in table 1. The definitions of these systems are identified through qualitative interviews with key stakeholders within the organisation (Hildbrand & Bodhanya, 2015). These all interact as shown in figure 11, which shows the interrelated aspects of VSM, which is essence is an extrapolation of figure 5.

Insufficient performance, missing components or issues in feedback loops between any of these aspects ultimately endangers the viability of the organisation (Hildbrand & Bodhanya, 2015). As such VSM may be applied within the context of analysis, used to run and test scenarios (such as the introduction of a new service) through a system to identify issues in a how an organisation responds. Once these issues have been identified, it enables designers to appreciate potential incompatibilities either within the design of the service or the ability of the organisation to address the requirements for the service to function.

Table 1: Systems required in a Viable Systems Model

Name	*Function*	*What is asks of the Business*
System 1 (Including S1.O (Operation) & S1.M (Management))	Operational unit activities with their direct Management, which are essential duties of an organisation. eg Sales, Logistics, Procurement etc (Hildbrand & Bodhanya, 2015).	What is happening here and now?' (Wehinger and Herrmann, 2012)
System 2 (S2)	Co-ordination of System 1 activities, limiting the principle freedom, to manage each output.	Are optimal standards being exploited for the overall system to work without constraining innovation in system 1 activities and outputs? (Lamb, 2017)
System 3 (S3)	Operational Management, Monitoring and Auditing - Ensures output from all system 1's are coordinated to deliver on broader mission of the organisation. Is responsible for optimizing resource allocation. (Wehinger and Herrmann, 2012)	'What is happening on the short term basis in operative business framework?' (Wehinger and Herrmann, 2012)
System 4 (S4)	Strategic Managment - Makes organisation aware of the current and future environment both in	'What could happen next in the environment or internally in the

	and out the organisation (Wehinger and Herrmann, 2012).	system?' (Wehinger and Herrmann, 2012)
System 5 (S5)	Normative Management - Makes decisions on policy, standards and organisational focus (Wehinger and Herrmann, 2012). Defines the mission and goals and manages the conflict of resource allocation between Systems 3 and 4.	'What should happen in the future based on all the knowledge present in the system?' (Wehinger and Herrmann, 2012)

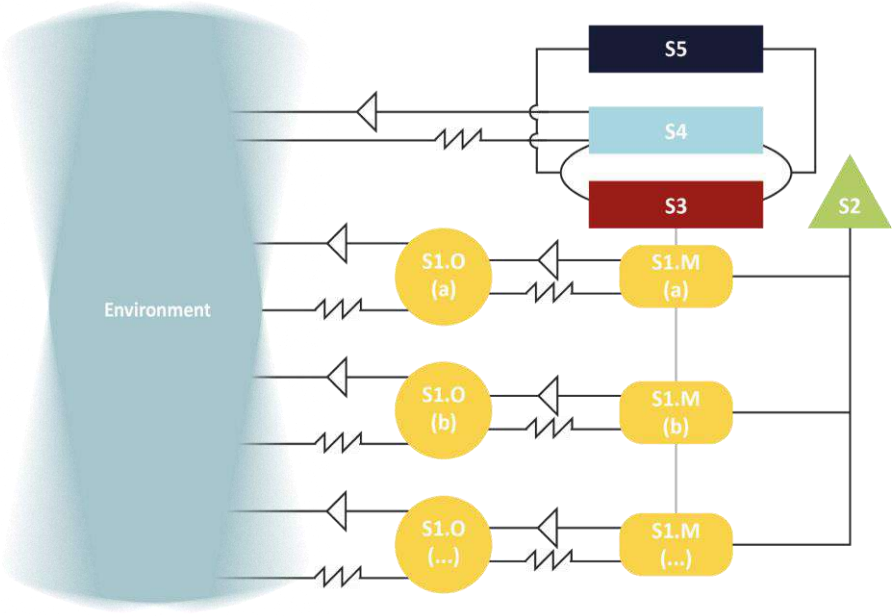

Figure 11: Viable Systems Model. Source: Beer, 1990, redrawn

VSM enables designers to gain a view of the structural recursion of command and control actions within an organisation (Espejo, 2003). Such a view enables designers to model and observe the behaviour of how an organisation reacts the environment it operates in. With such a model it enables designers to identify bottlenecks within the organisation which could limit the implementation of a new PSS solution, enabling discussion about proposed enabling solutions.

Developing Business Empathy

Through this paper we have discussed the importance of acknowledging the various complexities within a business which should be considered when developing and introduction a new PSS. While design thinking provides an insight for businesses into customer behaviour which can be translated into new value propositions, the tools which designers have to understand and articulate these overly simplify the view of a business causing challenges in adoption and subsequent adoption. In order to understand this aspect we propose designers develop what we describe as business empathy. Based on the exploration above this means taking the perspective of the business in terms of the people, processes and structures within a firm which are relevant for the implementation of a new value proposition.

The purpose of business empathy is to allow designers' to pair the knowledge of the current state of the business to a customer centric value proposition. With this information a designer can propose a minimal achievable product, from a business perspective and propose a broader program of projects which move from pure business centricity to more customer centric, or from incremental to more radical design solutions.

The ST tools outlined in table 2, aim to complement the existing tools in the designers toolbox by enabling them to populate service blueprints or business model canvases in a more considered way which reflects the current state of the business. The use of SSM, BA and VSM would enable designers to understand from the businesses perspective; the situation from the internal stakeholders perspective, the existing resources at the disposal of the business, and how the business is managed and is able to respond to new solutions/situations.

Considering how this would be used in practice, we envisage business empathy as opening the black box of how a business works, to aide designers in developing solutions which acknowledge dependencies surrounding implementation. In the case of the design agency interviewed, for projects which require organisational championing; designers would start by using SSM to gain an understanding of the expectations stakeholders had behind the project. Here designers would understand the 'why' and understand the underlying values motivating the project. This would then aide in the shaping of the idea as well as how designers would eventually articulate the value within the business.

When considering how a service would be constructed, designers would consider both the customer and business perspectives. Starting with a service blueprint approach designers would assert the core logic behind the delivery of value to the user. Using BA, designers would then reflect on the actual resources available within the firm to support the delivery of value. With this the designer would compare the customer centric service blueprint and the business centric blueprint. Comparing the two perspectives, the designer would then shape a number of options which scale between complete customer or business centricity. In doing so they create a number of options from a minimal achievable product to a completely customer centred solution. The application of VSM enables designers to take a deeper look at the organisation in terms of the monitoring or communication in order to reflect how the introduction of the new value proposition would impact the organisations processes. Again here designers are able to propose either changes to the business, or incremental solutions which will allow the business to adopt the minimal achievable proposal and adjust according.
Through the application of these tools, business empathy enables designers to discuss value propositions beyond what is simply desirable for the customer in the product championing phase, but discuss their ideas at a higher level within the business through organisational championing.

Table 2. Tools for Business Empathy

Tool	*What it does*	*When to use it*
Soft Systems Methodology	Provides a method of analysis to interpret multiple stakeholders views of situation, such that they can be objectively compared and discussed with said stakeholders.	In order to understand the expectations of a new project from multiple stakeholders (the people within the business), and identify either points of emergence of divergence. The aim here being to create a shared vision.
Business Architecture	Provides an objective view of an organisation's capabilities and value streams.	In order to gain a view of a business's capabilities to shape what supporting activities are required from the business for the value proposition.
Viable Systems Modelling	Reveals interactions and linkages of managerial regulations across an organisation as a whole.	In order to gain an understanding of the communication channels and monitoring activities within a business which the new value proposition will exist in or need to shape proposals how a system can be redesigned to absorb such new proposals.

Conclusion

As design's provenance within management continues to grow, many organisations' are looking become more customer centric. Spurned on at the eve of Industry 4.0 and the potential which IOT brings, companies are finding their old ways of working are being challenged as feedback loops between customer and business move into real-time. These challenges raise questions as to the limitations of the design process, where tools are aimed at customer experience and unpacking technological possibility, ignoring the current state of the organisation. In order to overcome this we propose business empathy as a means of understanding what happens in a business with regards to people, processes, power dynamics and capabilities. By incorporating the established tools discussed in this paper with existing design tools such as the service blueprint or the business model canvas, designers would be able to propose holistic solutions.

The addition of these tools to a designer's tool set builds on the notion that design thinking is user centric and aims to understand the customer, but now frames business as a network of stakeholders including the customer. With designers having the skill set to gain insight on user behaviour at a time when industry 4.0 brings businesses closer to their customers, the organisations who approach this also need to be understood as they will become the user of operating models proposed by designers. By using tools to empathise with businesses, it transforms the role of designers and enables them to develop a mature value proposal aiding them in bridging the valley of death. The use of these tools leads designers to a holistic view of all stakeholders engaged in the product lifecycle and service solutions, replacing prescriptive customer centric business models with a more considered joint business and stakeholder/customer centric solutions.

In order to remain sustainable, organisations' must repeatedly interpret their own operational boundaries, products and services, the environment they choose to work in and how they work within it. As Industry 4.0 has no boundaries, It will be up to organisation's to interpret what value they choose to create around this industrial evolution. Design thinking enables organisations to exploit human centric opportunities, and working with designers who have a holistic approach, will ensure the creation of solutions which reflect the specific and unique challenges of that organisation even during a volatile transition to Industry 4.0.

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Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

The Organizational Impacts of Design Thinking used as a Toolbox for Managers or as a Theory of Design

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The adoption of Management Innovation in organizations is difficult to investigate. Controversies exist on the nature of Design thinking (DT), which can be used as a toolbox for managers, or as a theory of design practice. Based on a multi-case study, this article investigates the impacts brought by DT in organizations, in terms of new practices and roles played by designers. Referring to various definitions of DT and its relation to Design, this article proposes a framework articulating the objectives of DT as Management Innovation and its adoption. The results show two intertwined factors: the fit between the cultural, technical and political dimensions of the organization, and the profile of the change agent, designer or not.

Keywords: Design Thinking, Management Innovation, Organizational Culture, Change Agent

Introduction

Management innovation introduces new management practices and processes that are significantly different from the existing norms operating in an organization. If the variety of these innovations and their multiple contributions to the companies' performance has been examined in-depth (Damanpour and Aravind, 2012), their adoption and impacts on the functioning of organizations have been poorly analyzed (Volberda and al., 2014). The management innovations are most of the time put under pressure when introduced in companies (Birkinshaw and al., 2008), and go hand in hand with change management (Damanpour and Aravind, 2012). Outlining the contours of a management innovation and assessing its actual degree of novelty are both complex (Adam-Ledunois and Damart, 2017; Mignon and al., 2017; Volberda and Van den Boch, 2013). Depending on the context in which management innovation is implemented, its new principles and practices are more or less aligned with the initial key features of organizations (Ansari and al., 2010). The degree of rupture brought by a management innovation is therefore analyzed based on its diffusion and adaptation trajectory.

Design Thinking (DT) is a representative case of management innovation whose outlines (Rauth and al., 2014) and degree of novelty in organizations (Carlgren and al., 2016a) are complex to assess. While it is often described as a set of practices for acquiring new innovation capacities (Schmiedgen and al., 2015), the concept of DT remains unclear and may refer to a cognitive style, a theory of design activity or a resource for organizations (Kimbell, 2011) depending on the situation. This debate on its definition and its relationship to the professional practices of designers creates a tension in the assessment of DT as a management innovation. Some consider it to be profoundly transformative for the organization (Brown, 2009), while others approach it as a complementary managerial tool (Verganti, 2009; Mahmoud-Jouini and al., 2016). In one case, the designer's skills are essential to apply and disseminate DT (Walter and Baxter, 2008), while in the other case his practices

are regarded as easily appropriable by managers (Verganti, 2017). Our research question is therefore: what are the organizational impacts of Design Thinking used as a management innovation in companies?

Conceptual frame

The outlines of Design Thinking as Management Innovation

DT results from a formalization of the designers' mode of reasoning (Archer, 1979). It takes its inspiration from their thinking patterns and practices to formulate and solve unstructured problems (Brown, 2009; Johansson-Sköldberg and al., 2013; Kimbell, 2011). Carlgren and al. (2016a, 2016b) and Walter and Baxter (2008) have identified the key practices:

- Multidisciplinarity, i.e. the integration of numerous fields of knowledge, including imagination. DT lies on abductive reasoning: it is about questioning a variety of concepts and their connection with others in terms of a concrete reality that is meant to be transformed (Cross, 2011).
- An exploration approach focused on people's experience (Brown, 2009). Users are at the heart of problem framing and solving, with the help of field observation and/or co-creation.
- The materialization of ideas, reflected in the use of visualization, experimentation and prototyping very early in the exploration process, not limited to technical performance and functionality (Kimbell, 2011).

In view of these practices, DT would constitute a mixed management innovation as presented by Le Roy and al. (2013). On the one hand because it renews the way companies explore, and thus produce knowledge (Mahmoud-Jouini and al. 2016). On the other hand because it impacts the processes, roles and relationships of the different kinds of expertise. It thus tends to bring together specialties and functions of the organization that were previously separated (Brown, 2009; Jahnke, 2013).

This identification of DT as a mixed management innovation depends strongly on how the links between DT and Design are regarded. Thus, Kimbell (2011) highlights two types of relationships: while DT is seen by some as the basis of a general theory on Design, others regard it only as a simplified approach to designers' practices and ways of thinking. Our hypothesis is that this tension between DT as a reflexive foundation for Design discipline or as a managerial practice has strong implications on the measure of the impacts brought by DT in organizations.

The nature of the impacts associated with DT

Depending on the relationship between Design Thinking and Design

Some authors consider DT as a toolbox for managers (Boland and Collopy, 2004), relatively detached from the cognitive capacities and know-how of designers (Deserti and Rizzo, 2014; Verganti, 2017). It is therefore not very transformative, especially regarding the relationships between stakeholders, often applied only in exploration phases. It can be utilized as a method that can be used in a flexible way in order to solve new problems (Krupp and al., 2017) and help to overcome a lack of agility, creativity and ability to explore (Deserti and Rizzo, 2014; Verganti, 2017; Krupp and al., 2017). In this perspective, DT would represent a management innovation with a local impact: integrating into existing and well-defined innovation processes, contributing to their improvement. Although the way knowledge is produced is evolving, the relationships between the stakeholders and organizational functions would not be fundamentally transformed (Verganti, 2009). In this context, the key practices associated with DT would be applied in a flexible or even loose manner (Verganti, 2017).

When DT prefigures a general theory of Design, it represents on the contrary a key step in the transformation of the corporate culture, to put Design and user-centred innovation at the heart of its activity (Walter and Baxter, 2008; Liedtka and al., 2013). As a vector of organizational transformation, DT then aims to fundamentally change the whole process from exploration to exploitation of ideas (Rauth, 2014; Walter and Baxter, 2008; Carlgren and al., 2016a). From this perspective, the potential impacts of DT could be global. It thus features all the characteristics of a mixed management innovation, changing not only the modes of knowledge production, but also the relationships within the company. Many authors point out that adopting DT by systematizing its key practices would lead to major changes: reduction of organizational silos and

adoption of decision-making methods based on a mix between rationality and intuition, at all levels of the company (Brown, 2009; Carlgren and al., 2016b).

This is why we are putting forward the following proposals:

Proposal 1: When DT is considered as a managerial tool detached from Design, it introduces a low degree of novelty, limited to a local scale of the organization.

Proposal 2: When DT is considered as the basis of a general theory of Design, it is disruptive for the organization as a whole, both in its way of generating knowledge and in its relationships.

Depending on the organizational context

The greater the degree of disruption potentially brought about by a management innovation, the greater the problems of organizational alignment increase. Consequently, its content is adapted or altered (Volberda and al., 2013, 2014). Ansari and al. (2010) propose to consider technology, culture and power relations as the key components of organizational contexts. A poor alignment of management innovation with these three dimensions would imply a strong potential breakthrough and difficult adoption. The authors conclude that the adoption trajectories of a management innovation vary according to its adequacy to the context. A technical gap would require a moderate adaptation of innovative practices. If the gap is cultural, innovative practices would be tailored but more broadly adapted within the organization. Finally, a political gap would create an ambivalent movement to strengthen innovative practices and compromise their widespread adoption within the company (Ansari and al., 2010). From this perspective, the local or global adoption of management innovation and its degree of disruption depend on the ability to manage "gaps" with the organizational context (Volberda and al., 2014).

The issues of alignment with the organizational context are presented in the academic literature in different ways depending on the definition of DT. When the latter is seen as a toolbox detached from the Design, the problems appear to be weak, because the practices and methods would be sufficiently flexible and therefore adjustable to adapt to the managers' working methods. Deserti and Rizzo (2014) conclude that the adoption of DT as a managerial tool does not really alter the way large companies operate on a technical, cultural or political level. For example, the materialization of ideas during DT workshops can be based on the use of techniques that are not very different from the practices and thought patterns usually used by managers (brainstorming, mind mapping, use scenarios). Verganti (2017) points out that, in companies with a technology-push approach, DT would help to consider users' experience earlier in the exploration process, without transforming the engineers' way of thinking and problem solving. DT would also be consistent with an organizational culture based on market-pull, as it makes it possible to start from customers' needs. In the statistical approach to marketing, DT would bring a focus on the experiential.

However, while the adoption of DT as a toolbox does not fundamentally change the company's culture it may still have unexpected impacts on internal power relationships. Thus, some authors tend to show a negative impact on the internal legitimacy of the Design department, when there is one (Rauth and al., 2014). The adoption of DT would thus devalue the expertise of designers by giving the impression that their added value compared to the tools and methods of DT is low. For Verganti (2009), it would tend to limit designers' role to aesthetics. In the same perspective, Norman (2010) argues for the abandonment of the concept of DT, considered harmful to the recognition of professional designers in companies. That is why we make the following proposals:

Proposal 3: When DT is seen as a toolbox detached from the Design, practices are developed in a flexible way to align with the technical, cultural and political dimensions of the organization.

Proposal 4: When DT is perceived as a toolbox detached from Design, it can have an undesirable effect on the position of the company's professional designers, by downgrading their expertise.

Conversely, when DT prefigures a general theory of Design, it implies a systematic adoption of key practices (Walter and Baxter, 2008) that may contradict the traditional functioning of established companies. First of all, from a technical point of view, DT brings tools that are new for managers in order to materialize ideas (such as drawing, video or other forms of rapid, physical and virtual prototyping). From a cultural point of view, DT, which reflects the practices of designers, carries reasoning schemes that are not very compatible with those of managers of large companies. Decisions on exploration projects are usually concentrated within the chain of command, and based on rational criteria. On the contrary, DT is based on employees' autonomy and includes intuition in the decision-making process (Carlgren and al., 2006b). Some authors such as Beverland (2005) and

Rylander (2009) go further by pointing out that, in companies where innovation processes are structured by a market-pull and/or techno-push approach, the adoption of DT is likely to be interpreted as a challenge to reasoning patterns and the dominant roles of marketing and/or engineering. With its ability to manage multidisciplinary teams and adopt abductive thinking, Design would then gradually take on a central role in the innovation process, to the detriment of other functions. It thus acts as a "glue" orchestrating all practices in the organization (Walter and Baxter, 2008). Since the cognitive skills and abilities needed to mobilize and operationalize DT at this scale are difficult to acquire (Carlgren and al. 2016b), designers would naturally become key in the innovation process (Walter and Baxter, 2008; Brown, 2009). DT as a transitional phase towards a Design centred corporate culture would thus represent a technical, cultural and political break with the models of established companies. That is why we make the following proposals:

Proposal 5: When DT is considered as the foundation of a general theory of Design, it implies a strict application of its key practices, which are at odds with the technical, cultural and political dimensions of established companies.

Proposal 6: When DT is considered as the foundation of a theory of Design, its adoption reinforces the role of designers and the Design function in the company's innovation processes.

Table 1: Synthesis of proposals from the literature

DT as	*Type of Management Innovation*	*Adoption of key practices*	*Degree of rupture to the context (technical, cultural, political)*	*Impact on the Design function*
Toolbox for managers (Verganti, 2017, 2009; Deserti and Rizzo, 2014)	Local and non-mixed (limited to the production of knowledge)	In a flexible and loose way	Little rupture	Work of specialist or even devaluation of Design expertise
Theory of Design (Brown, 2009 ; Walter and Baxter, 2008 ; Carlgren and al., 2016a and b)	Global and mixed (evolution in the production ok knowledge and relationships)	In a complete and correlated approach to the designers' mode of reasoning	Potentially in strong rupture	Highlighting of designers' meta-competence and at the heart of innovation

Methodology

We used a qualitative method based on a multi-case study (Yin, 2009), allowing to study complex phenomena whose explanation is intrinsically linked to the interaction between a variety of dimensions, actions and relationships (Langley and Royer, 2006). The selected approach is based on abduction, an iterative process of enriching the theory based on data collected on the field (Thomas, 2010). The abductive method can lead to the reformulation of certain proposals resulting from theoretical concepts as well as the emergence of new ones (Gehman and al., 2017). The research protocol followed the precepts of grounded theory (Strauss and Corbin, 1990).

24 semi-structured interviews were conducted with 22 employees from four companies, lasting between 45 and 120 minutes each. We interviewed managers who are non-designers (14) and designers (8). They were three types of profiles: (top) manager in charge of introducing DT in the organization, project manager using DT, and designer (when this is a different person). Data was collected in two phases. A first series of 12 interviews was carried out between 2015 and 2016 in the context of research projects aiming to study the innovation practices and organizational transformation. However, the researchers were not involved in an action research approach to deploy DT initiatives in the companies studied. The interviews allowed identifying the innovation practices and cultures as well as the use of DT and the implementation of Engineering, Marketing and Design functions in change management. 12 new interviewed were specifically conducted in 2017, in order to complement initial data on the links between DT and Design, as part of their adoption by companies.

The interviews were recorded and transcribed by each researcher separately. The analysis process was shared. The coding process was shared, based on the concepts provided in the literature review supra. Iterations generated preliminary results that allowed identifying the level of adoption of DT according to the

organizational context. The coding singled out the practices and objectives associated with DT, as well as the degree and nature of the ruptures brought in the organization, regarding new practices and the design function. The second round of interviews aimed at “theoretical saturation” and generated more “groundness”. Theoretical saturation was not completed until reaching a convergence in coding superior to 90%.

Case study analysis

Presentation of the companies and their Design Thinking initiatives

Companies were selected based on the characteristics that underpin their organizational culture, and the diversity of DT's initiatives over the past five years or more. They all have in common a strong hierarchy, as well as a verticalization of functions and a relatively large silo structure. On the other hand, other criteria differ according to the companies: the place of techno-push and market-pull approaches, which are reflected in the predominance of R&D engineering and/or marketing in the innovation process, as well as the existence of a Design function prior to or concomitant with DT initiatives. These points are summarized in Table 2.

In two cases, Air Liquide and SEB Group, DT represents a creative method used by managers in new user-centred innovation laboratories. As for EDF and Carrefour, on the other hand, DT is at the heart of a company transformation project aimed at integrating design practices more broadly. In the case of Carrefour, the concept of Design Management is even preferred to that of DT, to highlight the strategic value of Design that must permeate all the company's activities.

Table 2: Presentation of companies studied

Company	*Initial culture before the use of DT*	*Design Function*	*Initiatives and objectives associated with DT*
Air Liquide Gas production and associated services	Techno-push (90% engineer)	Non-existent Initially recruiting of a Designer at the I-Lab (2015)	DT as a toolkit for user-centered innovation. Used to enhance creativity in the I-Lab, Innovation laboratory created in 2013 (18 people). Goal: develop radical innovation
Carrefour Mass market	Market-pull Limited scope for innovation	Design Center created in 2009 (30 people, led by a Designer) strategic for innovation	DT as a mode of reasoning associated with professional Design skills. Advocacy led by the Design Centre since 2008. Goal: build up a corporate culture and strategic vision focused on users’ experience
EDF Electricity production and supply	Techno-push	Innovation Hub created in 2000, integrating 12 designers (since 2012) + 3 Innovation Catalysts: DT experts in the group	DT as transversal skills for all innovation activities. Used in intrapreneurial projects, fablab (I2R) and contests in the Innovation Hub since 2012. Goal: cultural transformation to better take into account societal issues
SEB Conception and production of small household appliance	Double approach: techno-push and market-pull	Institutionalized function (44 designers) but limited to product design	DT as a toolkit for interdisciplinary work. Used to enhance creativity in the SEBLab, an innovation laboratory created in 2013 (3 people). Goal: support the group’s business units with rapid prototyping and innovation acceleration

New practices associated with Design Thinking according to the assigned objectives

In all cases, DT-based initiatives involve approaches that focus on users’ experience, multidisciplinarity, and the rapid implementation of ideas (including prototyping). For SEB and Air Liquide, DT is a creative toolkit for developing exploratory projects in the SEBLab and I-Lab innovation laboratories.

When we asked the business units what they needed, [...] people told us about thinking of use, desirability... They also talked about the need to work in co-construction with the other functions of the company. All of them put a name to the methods they wanted to develop inside the SEBLab [...] and most often it was Design Thinking. [SEBLab Manager]

Therefore the goal is to bring new practices, easily usable by managers to complement the existing exploration modalities. Thus, creativity sessions mobilize new materialization tools for the employees: rapid prototyping, drawing (Air Liquide and SEB) or usage scenarios (Air Liquide).

We have no other place [than the SEBLab] to materialize ideas through rapid prototyping or to dare to use drawing as a key element in working together. When SEBLab facilitators lead a creative session with Design Thinking, these dimensions are essential [...] and it profoundly changes our habits and the way we approach projects. [SEB BU Marketer]

For EDF and Carrefour, DT contributes more broadly to a global policy of corporate transformation, with the ambition of impacting all business lines and functions. In this context, convincing people of the interest of DT entails concrete practice rather than methodological training.

The engineer doesn't forget the user or customer, but by professional deformation, he tends to consider this is not his problem. To change you have to educate. This involves changing exploration methods, and also depends on the expectations of engineers... When they consider that they are missing something, then it is easy to get them to change. [EDF R&D Engineer]

Design Thinking was first and foremost an attitude, which was formalized to be understandable by managers. [The objective to achieve is] to recognize it as a bundle of skills fused into all trades. [EDF Collective Innovation Catalyst]

Carrefour uses DT not only to design innovative products (such as a shopping cart imagined after an observation of the uses and unspoken desires of its customers), but also to rethink core activities such as the construction of internal brands' identity. In this perspective of global acculturation to Design, Carrefour even participates in the creation of a joint research laboratory in 2017 dedicated to the value of Design for organizations, alongside other academic and industrial actors.

Changes linked to the adoption of Design Thinking as Management Innovation

On the practices within the organization

Whatever the objective assigned to DT, its associated principles and practices overturn the technical, cultural and political dimensions of each company. Its adoption as a management innovation thus transforms the modes of knowledge production and relationships, but on various scales. The rupture is first of all of a technical nature, through the integration of tools from Social and Human Sciences or imagination.

For example, we invited novelists [...]. It's essential but complicated [...] because in this case, we bring something that really didn't exist before in the company and yet that is essential to innovate [...]. We don't use Design Thinking to present ideas on Power Point, otherwise it's useless! [Air Liquide I-Lab Manager]

The practice of multidisciplinarity also has an impact on the relationships between functions, on a local scale when DT is used in new innovation laboratories (Air Liquide and SEB). Thus, the composition of exploration teams changes from the traditional pair of strategic marketing and R&D engineering, interacting with other functions at specific phases of the innovation process. Within the SEBLab, 5 to 6 representatives of different functions (strategic and operational marketers, R&D and production engineers, designers, and even external users) are involved in all phases of the project over very short periods of time. At Air Liquide's I-Lab, the changes are reflected in the degree of autonomy of project leaders, who do upstream work with marketing, engineering and production functions as well as start-ups, for example to test prototypes with users. They behave like intrapreneurs, enjoying a freedom of organization that allows them to propose new ways of working and relationships in the activities for which they are responsible.

While the most visible changes are local, the adoption of DT can also have impacts on the rest of the organization, reflecting a broader cultural transformation:

I have observed that the practices developed in the I-Lab are gradually spreading beyond [...]. I see more and more employees who use DT at least partially to carry out their project on a daily basis [...] For example, they are looking to change the composition of the teams, including more systematically employees from other functions to find a solution. [Air Liquide I-Lab Manager]

In the cases where DT is considered as a step towards Design, this cultural impact is sought on a global scale. Nevertheless, the transformation has not been completed within EDF. While DT's methods for project management are systematized in the Innovation Hub laboratories, the approaches are not clearly claimed and the associated mindset struggled to be spread. Three cross-functional experts called "Innovation Catalysts" work as facilitators to bridge the gap between the traditional functioning of the organisation and promote DT, which has so far been seen in a rather negative way.

Organizations underestimate the ability of Design Thinking to formalize collaborative processes and organizational forms. Yet it is the discipline best suited to managing complexity. I use it to set dynamics in motion, with a maieutic objective. [Collective Innovation Catalyst EDF]

The obstacles to the adoption of new practices are mainly cultural. DT clashes with the dominant evaluation criteria in an engineering-focused company.

How to enhance other types of innovation in this company where patents remain the standard? This is an on-going discussion... [EDF Project Manager Designer]

If DT represents for EDF a step towards the integration of Design, it is therefore incrementally, without breaking or questioning the preponderance of engineering in the innovation processes.

For Carrefour, on the other hand, the cultural transformation has been faster and more marked since the creation of a Design Centre to meet the strategic ambition of developing innovation centred on uses (Marketing being initially not very legitimate on these subjects). The arrival of a tutelary figure, former head of Design Decathlon, as Design Director has facilitated the process of disseminating DT practices and tools to all branches of the company. Today, the impact of projects carried out according to these Design approaches can be measured by "increased sales or press coverage". This tangible evidence ensures an interest in DT methods on a global scale, although some "silos and power struggles" [Brand Designer Carrefour] remain.

On the Design function

In each case, the adoption of DT also impacts designers and the institutionalization of their role in the organization. For SEB, the designers can be involved from the early stages of exploration projects within the SEBLab, unlike their daily work, where they are limited to product design on prototypes validated by engineers. For them, DT is a rather familiar approach, even if they are *"not used to [mobilizing it] in their daily work"* [Designer SEB]. On the other hand, they were able to bring their technical skills into the SEBLab:

They are the ones who most easily use drawings and graphic representations to reason and share some thoughts.... They are often more active in rapid prototyping or use scenario building. [SEB marketer who participated in a project within the SEBLab]

The experience of designers within the SEBLab has gradually convinced SEB's Design Director that their role could evolve in the innovation processes, gradually including other forms of contribution in the company.

At Air Liquide, where no Design function existed, DT is not associated with any specific business. However, the need to rely on professional skills quickly became apparent, and the I-Lab recruited a designer. This one has a double skill: as a product designer, he masters the methods and tools of field observation and solution Design; as a "design maker", he masters the methods and tools of prototyping. He is a professional who allows *"to move from a traditional logic to a really professional logic"* [I-Lab Manager]. This designer is thus mobilized in all phases of the I-Lab projects. Upstream, he takes part in the study of consumer behaviour, explorations and helps to propose approaches to shift points of view. Downstream, he intervenes in the phases of prototyping and integration of user feedback, up to solution Design.

Within EDF Group, the adoption of DT has made little contribution to the institutionalization of the Design function. The reclassification of the "Transversal Design Manager" function to "Collective Innovation Catalyst" illustrates the low prevalence of the profession. Similarly, no career paths are planned for in-house designers. Today, only one project manager comes from a Design background. Nevertheless, the skills associated with her

original expertise as a designer seem to contribute usefully to managing innovation projects involving DT. *"The ability to materialize, to give shape"* helps her to include and articulate the visions of different stakeholders: *"I seek to give others what I have sometimes lacked [when I was involved in projects]: i.e. meaning"* [EDF Project Manager Designer].

> *Like a cat which kicks his paws and sees how it reacts, you have to develop the ability to judge quickly and accurately, to listen, to detect, to assume responsibility for listening to an intuition. These are not qualities specific to designers, but unlike other professional cultures, they have not at least learned to repress them. [Collective Innovation Catalyst EDF]*

At Carrefour, the Design function has been considerably strengthened over the past ten years. Thirty designers gathered in the Design Centre play an educational role in the group's departments. This can be done through the organisation of training courses, conferences or multi-trade workshops, the production of brochures or videos, as well as the organisation of exhibitions. Many consider themselves as *"Design Ambassadors"* even if their recognition as actors of innovation at the company level is not systematic. While the services are largely convinced of the value of the methods and tools advocated by designers, they use them on an ad hoc basis, sometimes using external competition to reduce lead times. The Design function today aims for a broader political recognition: *"We need [...] to obtain a critical mass of designers in the company [...] and to organize internal governance to avoid bypassing."* [Carrefour Design Director]

Although DT is linked to a global strategic approach for Carrefour, led by the Design function, the political impact remains limited as long as the Design Centre is not fully recognised as a pilot.

Profile and role of the change agent

In the cases studied, two types of profiles carry DT's initiatives: engineers and designers. Their internal legitimacy depends on the organizational context. In the three companies where the culture is mainly based on engineering, engineers with seniority promote DT. For Air Liquide and SEB, the fact that the use of DT is limited to a clearly identified physical location, and that the pilots are familiar with the organization, facilitated the adoption of practices that are at odds with organizational culture. Open and curious, these engineers have initiated themselves into DT by collaborating on projects with start-ups or experienced consultants.

> *It is all the more credible to talk to them about an approach [Design Thinking] that is very different from theirs because we are one of them [...]. It is also reassuring […]. If we have succeeded, then they too can do it. [SEBLab Manager]*

> *It is easier to convince employees to adopt 360° practices in their daily lives when you are at home, when you have managed to do it yourself and when you communicate with the right words to reassure. [Manager I-Lab]*

This internal legitimacy of the change agent has smoothed the political stakes associated with the adoption of DT is key in order to avoid considering the adoption of this management innovation as a questioning of the power held by certain key functions of the organization in the innovation process. For example, as an experienced R&D engineer in the company, the SEBLab manager was able to convince the engineers and marketers responsible for innovation projects to change the way they involve designers, without this being perceived as an infringement of their prerogatives.

Similarly, the main pilot for the adoption of DT within EDF is an engineer. Nevertheless, he defines himself as a *"frustrated designer, pushed towards technology"* [Collective Innovation Catalyst EDF], who discovered DT during his studies at the University of Technology of Compiègne. Convinced of the relevance of dual profiles in a culture of change, he now uses his engineering background as well as his knowledge of Design to formulate approaches and assign the most appropriate designers on a case-by-case basis.

Carrefour is the only case where a designer occupies a hierarchical position that allows him to be an advocate of DT, because his function is sufficiently institutionalized to ensure legitimacy in the company. He acts as a mentor for designers, defending them so that they can do their job as well as possible. *"He tries to open the hierarchical door for us to act."* [Carrefour Brand Designer]

Table 3 synthesizes the results of the compared study.

Table 3 – Synthesis of the results

Company	*Relationship DT / Design in the initiative phase*	*DT change agent*	*Application of DT key practices*	*Trajectory of adoption of key DT practices and degree of novelty*	*Impact on the designers and the Design function*
Air Liquide	DT as management tool	Engineer with seniority	Strictly within the I-Lab, more flexibly beyond	Local disruption in a new Lab, with progressive diffusion of the user-centred approach in other entities of the group	Emergence of the Design function: recruitment of a specialist designer
Carrefour	DT as theoretical basis of Design	Designer at high hierarchical level	Flexibly, considered legitimate on a global scale	Global disruption at the technical and cultural level but partial at the political level (orchestration by the poorly acknowledged Design function)	Design became legitimate to represent the Innovation function because there was a gap to fill
EDF	DT as theoretical basis of Design	Engineer with a strong design culture	Flexibly, considered legitimate on a global scale	Progressive and punctual adoption on which entities of the company: no technical / cultural / political breakthrough	Designers' role still limited, spread in the Innovation Lab laboratories
SEB	DT as management tool	Engineer with seniority	Strictly within the SEBLab	Local disruption in the newly created Lab	Progressive evolution of the role of designers at group level

Discussion

This research allows better qualifying DT as a management innovation impacting organizations on two aspects: the practices associated with exploration projects management, and the role of designers in their implementation.

The way in which DT is used, as a toolbox for managers or as a theoretical basis for Design, is a key element of the theoretical controversy over its degree of novelty. The case study shows that this conceptual debate is not neutral within companies: it strongly influences the strategic objectives assigned to DT, much more than it reveals concrete differences in practice between these two approaches.

Considered as a managerial tool, it is locally deployed in order to acquire new and complementary innovation capacities. When DT is regarded as the theoretical basis of Design, it is promoted as a means of transforming the company's culture and practices in all fields. It is then associated with a mixed management innovation as defined by Le Roy and al (2013), intended to change the production of knowledge and the relationships between actors.

The case study tends to show that these two different visions of DT are linked to different profiles of change agents: DT as a managerial tool is carried by non-designer managers, while DT as a theory of Design is carried by professional designers (Carrefour) or managers who have developed a global knowledge of Design in their career (EDF). These change agents contribute to building meaning around DT. This perspective allows us to rephrase initial proposals 1 and 2, and to propose a new outcome from the field analysis:

Proposal 1 reformulated: When DT is considered as a managerial tool detached from Design, it is based on a strategic objective of acquiring new practices to manage innovative projects. Its application is local.

Proposal 2 reformulated: When DT is considered as the basis of a general design theory, it is based on a strategic objective of global transformation of the organization, both in the way it produces knowledge and in the relationships between actors.

New Proposal: The change agents who use DT as a managerial tool are non designer managers, while DT as a basis for Design is carried by professional designers or managers accustomed to Design and influenced by its practices.

Indeed, the conceptual approaches of DT are linked to different visions of the degree of disruption that management innovation should bring to the organization. But they do not prefigure the actual level of disruption brought by its adoption. In all the cases studied, the practices attached to DT contradict the technical, cultural and political dimensions of large established companies. The strict or flexible application of new practices depends on the need to negotiate their content in regards to the company's cultural and political challenges. In line with Ansari and al (2010), the study showed that these two dimensions determine in which ways the management innovation is adapted. The local adoption of DT as a managerial tool in newly created innovation laboratories makes it possible to strictly apply practices, thus creating a break with existing practices. Using DT contributes to the gap with the rest of the organization by promoting multidisciplinary teams, a user-centered approach and new techniques to materialize ideas. As soon as practices diffuse beyond these laboratories (Air Liquide), they are adapted to fit the cultural and political context of the company. Their application is consequently more flexible, and the degree of rupture less important.

The case study shows that the introduction of DT as a managerial tool does not necessarily devalue professional designers, unlike the results of Rauth and al. (2014) or Carlgren and al. (2016b). Rather, it leads to the enhancement (SEB) or emergence (Air Liquide) of a Product Design function. Moreover, the contribution of designers to the innovation process can extend beyond aesthetics and solution Design (SEB). This positive impact on the Design profession is partly explained by the change agent who plays a key role as mediator, legitimizing the use of DT and reducing potential political tensions. These results lead us to invalidate the relevance of proposals 3 and 4, and to propose the following formulations:

Proposal 3 modified: When DT is understood as a managerial tool, key practices can be strictly applied and therefore a source of disruption as soon as they are adopted in a defined environment that functions differently from the rest of the company.

Proposal 4 modified: DT as a managerial tool introduces a new sensitivity to Design professions, if the change agent contributes to enhancing them through his or her legitimacy, in a way that is consistent with the company's political context.

When DT is considered as the theoretical basis of Design, the gap between the management innovation and the organization can lead to a strong adaptation of DT key practices. Thus, in the case of EDF, despite ambitious strategic objectives associated with DT, the new practices are applied in a flexible way, sometimes on an ad hoc basis, because the engineer's culture remains predominant. In this sense, even if designers' profiles are recognized as relevant in exploration projects, the profession remains poorly represented and valued in the company. The Design function has therefore not been strengthened by the adoption of DT, although change agents play the role of facilitators. This is due to a fragmented hierarchical positioning that does not allow them to act as a lever for global impact.

DT linked to a theory of Design may create a break in practices provided that internal power relations evolve. For instance at Carrefour, the Design Centre promotes DT methods and tools. The function is gradually being strengthened, until being recognized as key in innovation processes – even if not yet unanimously acknowledged. Only then will Design skills appear as a meta-competence at the service of innovation in the entire organization. In this perspective, our results lead us to reformulate proposals 5 and 6:

Proposal 5 reformulated: When DT is seen as a general theory of Design, it is at odds with the technical, cultural and political dimensions of the company, and can only be adopted globally when the political context of the company is favorable to designers.

Proposal 6 reformulated: When DT is seen as the theoretical basis of Design, it strengthens the Design function in the company's innovation processes provided that policy alignment has been achieved.

Table 4 summarizes the results obtained and the new framework for analyzing the impact of DT on organizations.

Table 4 – Analysis of the impacts brought about by DT as management innovation

DT as	*Type of Management Innovation*	*Strategic objectives associated with DT*	*Change agent*	*Degree of rupture depending on the context (technical, cultural, political)*	*Impact on the Design function*
Toolbox for managers	Local and mixed	Bring additional capacity for innovation	Manager non designer	DT practices adopted in a comprehensive and strict manner. They bring rupture in a dedicated space (break with the organization). Beyond the Labs, DT practices are deployed in a flexible way.	Enhancement of the designer as a specialist profession
Theory of Design	Global but little mixed	Support the organizational transformation towards a Design-centered approach	Designer	Tendency to adopt DT's key practices in a flexible way. The technical and cultural ruptures depend on the capacity to change the relationships of power in the organization.	Enhancement of designers' meta-competence. Institutionalization of the Design function, innovation pilot

Finally, an unexpected contribution of this research is to highlight the figure of the change agent to explain adoption trajectories, as suggested by Volberda and al (2014). Therefore, the fact that this manager is a designer or not influences the strategic objectives assigned to DT. In addition, the change agent's internal legitimacy (partly linked to the function embodied) is key in the diffusion of management innovation. Distinguishing between DT as a toolbox for managers and a theory of Design also highlights different skills and contributions of designers in the adoption of DT practices. While using DT does not always require a professional designer as a sponsor, including a variety of expertise and forms of idea materialization remains attached to professional Design skills. In line with Carlgren and al (2016b), these results suggest that the more the company seeks a significant break, the more specific skills are involved in the implementation of DT. Acquiring these skills takes time and can slow down the adoption of DT in organizations.

Conclusion

Until now, research on the degree of disruption associated with DT has mainly focused on its generic principles rather than on its adaptation while diffusing in organizations. This research proposed to consider DT as management innovation in two different ways: as a toolbox for managers or as a theory of Design. This allowed distinguishing between its generic principles and actual adoption trajectories depending on organizational contexts. The results contribute to informing the debate on the impact of DT in companies.

This research presents several perspectives for future work, and limitations. First of all, it does not analyze all the potential impacts of DT on the organization and is limited to impacts on practices and on the Design function. Further work on the decision-making process in innovative projects could thus be useful to complement our approach. Secondly, the generalization of the proposals made in this article is not possible at this stage. The abductive method made it possible to produce relevant hypotheses and a clearer analytical framework to define and evaluate the impact of DT as management innovation, based on the initial objectives attached to it and its adoption trajectory. However, these hypotheses must be tested on more numerous and varied cases. Finally, this study opens up new research perspectives on the role of designers and non-designer managers as change agents.

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A Model of Positive Strategic Sensemaking for Meaningfulness

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This article proposes a design perspective on strategizing by presenting a Model of Positive Strategic Sensemaking for Meaningfulness. Theory elaboration is used drawing from three related disciplinary fields; strategizing, sensemaking and design. It is proposed that positive and human-centred design facilitation enhances strategizing as an ongoing embodied and material activity where meaning changes in strategy and vision may emerge. By viewing strategizing as a socially constructed evolving phenomenon the model adopts sensemaking and critical theory perspectives where the consequences of decisions for human beings and environment guide further activities. Designers as co-strategist may support or challenge an existing strategic direction resulting in incremental or more radical meaning changes among those affected by, and affecting, the emergence of strategies.

Keywords: Sensemaking, meaningfulness, HCD, strategizing, design research

Introduction

This article proposes a new design perspective on strategizing by presenting a model of Positive Strategic Sensemaking linked with broader considerations for strategy and changes of meanings that are facilitated by design professionals. It is proposed that positive strategic sensemaking that is facilitated by design contributes, firstly, to how new, even radical meanings, may emerge (Verganti, 2008; Verganti & Shani, 2016, pp. 104-105) and business opportunities can be explored. Secondly, the article creates links between design that is action oriented, strategy as practice and open strategy discussions. Thirdly, the article contributes to both sensemaking and strategizing as material and embodied phenomena. These three aspects will have an impact on the evolving role and requirements for future design professionals and their education. There is a paradigm shift in which designers gain increasing importance in addressing strategic questions (Åman, Andersson, & Hobday, 2017; Brown, 2009; de Mozota, 2017; Liedtka, 2015; Muratovski, 2015).

Dealing with uncertainty and discovering opportunities in multiple alternative futures are the domains where designers mostly feel at home. The aim of this article is to pay attention to the impact design professionals have in strategic sensemaking, which means exploring vision and interpreting its potential in organizations. This leads to new meaning discoveries for organizations and actors. The model presented in this article draws from design streams in human-centered design (HCD), (van der Bijl-Brouwer & Dorst, 2017), and positive design (Desmet & Pohlmeyer, 2013), and links them with streams of research that address sensemaking and strategy. Johansson and Woodilla (2017) encourage design researchers to expand from the prevailing functionalist view to other paradigms (pp. 461-465). It is in this vein that the article reflects upon what a change towards human-centered design-driven strategic processes may entail. Attention may shift towards the responsibility of broader consequences (Alvesson & Willmott, 2012, p. 30) of the decisions in organizations

concerning their meaning for users, employees, citizens and the environment. This article can be linked with Critical Theory (Burrell & Morgan, 1980, pp. 298-299).

Earlier research has pointed to creative actions that facilitate organizational learning (Beckman & Barry, 2007; Cousins, 2018; Ford & Ogilvie, 1996, p. 4), which in turn aims at, for example, enhanced adaptability (Argyris, 1999, p. 1) needed in uncertain conditions. Learning is believed to increase flexibility and enhance organizational knowledge creation (Nonaka, Toyama, & Konno, 2000, p. 6-7). This article proposes that new meanings for products and concepts emerge from learning through a broadening frame (Dorst, 2015; Paton & Dorst, 2011) through sensemaking that can be facilitated by design professionals.

Following the threads of strategy as practice (SAP), (Jarzabkowski, Spee, & Mets, 2013, pp. 41-44), and open strategy (Whittington, Cailluet, & Yakis-Douglas, 2011, p. 532), the paper yields insights in design professionals working in strategic sensemaking contexts. The framework presents a way of understanding how the impact of design may enable more inclusive and embodied strategic involvement in design-driven organizations. As a result, the design function itself may reach a higher impact at strategic-level decisions. Consequently, the values and practices of designers may transform the way organizations and people in organizations understand and modify their own core meanings and values that drive organizational life. The term strategizing refers generally to activities that lead to the creation of organizational vision and strategies (cf. Vaara & Whittington, 2012) including devising and thinking of strategic issues.

Meanings may change gradually, yet a radical rewiring of core values is not excluded. A parallel can be found from innovation management perspectives: Verganti (2008) has pointed to incremental and radical innovations in contexts in which playing with new materials and technologies is conducive (pp. 444 & 450). Designers are not the only meaning-makers; rather, this article depicts the designer as a co-strategist and facilitator embedded in social situations enabling and triggering meaning exploration. However, human beings who are ultimately the losers or winners of decisions taken within and amongst organizations lie close to the hearts of designers. Radical meaning change, or a change in vision, can have its origins in unknown circles (Verganti & Shani, 2016, p. 104-105). When the conventional management view on the rational consumer who seeks economic advantage is replaced by a broader view of the plural contexts of humans, the consequences of production (Alvesson & Willmott, 2012, p. 30) for the natural environment in which people live gains importance. People seek meaningfulness and seek to emphasize the positive. Vuori, San and Kira (2012) link sensemaking with the need to understand. For meaning-making to occur, the authors explain that people at work seek to create positive order. Thus, this article adopts the presupposition that meaningfulness is the driver of human action.

The article contributes to research discussions on 1) meaning and meaningfulness through design 2) positive design and human-centred design in strategizing and 3) strategizing as a material and embodied design supported activity. These lead to a) a reconsideration of the strategic role of a designer; b) design impact on more inclusive strategizing; and, c) design facilitation contributing to new meanings for products, services and society.

The article uses theory elaboration (Lee, Mitchell, & Sablynski, 1999) and aims at making sense of what is occuring, and what might occur in the future, when a design professional is embedded in organizational strategizing. It draws from the design expert´s perspective and combines it with theoretical insights towards a new cross-disciplinary theoretical model suggesting meaning changes that are influenced by design´s enactment in strategic sensemaking. The model suggests that the search for new meanings within company-level and profit-based views may not be the only factor producing positive meaning changes. Challenging current strategies may open up radical changes towards meaningfulness in all stakeholders. However, theory elaboration typically does not present hypotheses (Lee et al., 1999, p. 164).

Next, methodological considerations are presented, followed by the theoretical framework leading to the model of Positive Strategic Sensemaking (Figure 1).

Methodological considerations

This article utilizes pre-existing conceptual ideas derived from the fields of sensemaking, strategizing and design. It reviews some of this literature with the aim of theory elaboration. As Lee et al. (1999) explain theory elaboration occurs when pre-existing conceptual ideas or producing a preliminary model is the driving factor of the research. Fisher and Aguinis (2017) refer to horizontal theory borrowing as a form of theory elaboration (p. 455), in which an existing theory can be adapted in new contexts crossing disciplinary fields. The

elaboration of theory in this research results from a combination of a cross-disciplinary literature review and overarching themes forthcoming from a longitudinal research on the evolving role of the design profession in organizational settings. These aspects form the core of the proposed model of Positive Strategic Sensemaking.

This article takes largely a sensemaking perspective, yet with a critical perspective by being concerned with consequences (Alvesson & Willmott, 2012) of strategic decisions. Reflexivity is part of qualitative research (Lee et al., 1999, p. 163). The article makes a first elaboration on a theoretical model narrowing the gap concerning the partly overlapping fields of strategizing, sensemaking and designing. Hypotheses and theory testing, however, as Lee et al. (1999) confirm, are not the aim of theory elaboration. Typical for design research, however, is the exploration of what might be. This article has extended this prospective sensemaking aspect into its research approach.

The longitudinal research focuses on experienced professional designers in middle or senior management positions in companies ranging from large technology driven international manufacturers to some specialized renowned design consultancies. The participants represent a range of design disciplines closely linked to service design, such as interaction, industrial, graphic, HCI, UX and experience design. Initially, thematic analysis (Braun & Clarke, 2006) was utilized. It became evident that the overarching themes identified during the analysis required to continue research by employing theoretical elaboration, thus forming the following step across disciplinary borders as part of the ongoing longitudinal research. The research concentrates on exploring how the designers make sense of their professional approach and its contribution to the organizations they work for. The ongoing research considers interdisciplinary interactions as part of the context in which designers work.

Theoretical framework

This article proposes a Model of Positive Strategic Sensemaking. The focus of design is shifting from implementation of existing strategies towards increasingly exploring possibilities of new and fundamentally different meanings and opportunities. Designers are hence becoming co-strategists. In this approach, sensemaking and strategizing are intertwined, becoming one ongoing activity. The model forms the theoretical understanding of meaning change through positive and human-centred strategic sensemaking (Figure 1).

The proposed model draws from and combines three theoretical streams: strategizing, sensemaking and positive HCD. By viewing this triad as one core the model suggests a process in which design embedded in an organization co-acts in continuous sensemaking which is strategic and positive. Aiming at positive change and following the ethos of designers, it considers reflection on the consequences (Alvesson & Willmott, 2012) of future alternatives as a key element in developing and facilitating alternative views in co-creation with participants. Ultimately, any technology, product or system is translated into experiences that either have positive or negative consequences for humans and the environment we all share. The discussion on consequences should thus not be separated from any discussion on profits and innovations. Finally, meaning changes, incremental or radical, and steps towards meaningfulness may remodify the core of the organization towards a better future.

First, sensemaking, strategizing and positive design will be discussed, after which the proposed model will be introduced (Figure 1).

Sensemaking

Sensemaking is an interplay between action and interpretation (Weick, Sutcliff, & Obstfeld, 2005, p. 409). Designers are involved in positive sensemaking embedded in social and discursive, but also material and embodied contexts which can support strategic sensemaking. Designers guided by their ethos may challenge existing organizational values and suggest new meanings. For example, service designers´ specific values are holism, empathy, and co-creation (Fayard, Stigliani, & Bechky, 2017, p. 282). Consequences for humans and environment as guiding principles of design may yield surprising new meanings for participants and users.

Weick (2001/2011) proposes that people act in ways that create value and give meaning to their action, groups act their values to their identities and organizations to their mission (pp. 3-4). Sensemaking unfolds retrospectively during an actual event while uncertainty prevails. In retrospect, events seem to make sense for participants. Weick suggests that micro behavioral commitments can have macro consequences with a social basis (pp. 14-15). The language of goals implies collective justification (p.7). When designers participate in

strategic sensemaking, different perspectives are voiced and visualized. Designers mediate between the values of users, management, stakeholders and other participants. Environmental values and individual meaningfulness can be part of design facilitation. Normal rational routines are broken and allow more space for human sensemaking, beyond profits as the starting point.

Ravasi and Stigliani (2012) examined designers supporting conversational practices by exchanging, combining, and constructing interpretations collectively (p. 1232), and in prospective sensemaking in future oriented group processes (Gioia, Thomas, Clark, & Chittipeddi, 1994), such as strategy making or new product development. Change can be understood as a change in the strategic position or in the cognitive perspective (Mintzberg, 1981, p. 319-324). The participants made sense of their situation for themselves and others, while simultaneously acting both as influenced and influencing actors in uncertainty and ambiguity (Gioia et al., 1994, p. 376). Prospective sensemaking occurs when participants make attempts to see future consequences of their actions as a way of understanding their present situation (p. 378). Key symbols and metaphors were central to the construction of meaning. Symbols formed the means for participants to express their preferences and served as an impetus for influence and action.

Designers´ positive sensemaking utilizes material symbols supporting cognitive interactions (cf. Weick & Roberts, 1993) and knowing in practice (Orlikowski, 2002). Participants are engaged in sensemaking by joint action such as by prototyping items that are not judged on their aesthetic features. Rather, collective understandings and meaning-making are facilitated (D´ellera & Verganti, 2010, p. 125; Krippendorff, 1993a, p. 21; Krippendorff, 1993b, p. 35; Norman & Verganti, 2013, p. 89). Gioia and Chittipeddi (1991) in their study of a strategic change refer to sensemaking and sensegiving (p. 442). Sensemaking is connected with "meaning construction and reconstruction by the involved parties as they attempt to develop a meaningful framework for understanding the nature of the intended strategic change´´ (p. 444). Sensegiving occurs in attempts to influence the sensemaking and meaning construction of others toward a preferred organizational reality. These findings resemble design processes as they, following Gioia and Chittipeddi (1991), took place in an iterative, sequential, and reciprocal fashion. Meaning is socially constructed, while the creation of things is also about interpretation and meaning making. Meaning is always co-created (Ind & Coates, 2013, p. 87).

The current research supports the view that sensemaking processes are anchored in and engage with material settings (Bakke & Bean, 2006, p. 1). These authors transcend the cognitive, intersubjective or communicative approaches and propose materiality as the basis of sensemaking suggesting that both sensemaking and design have an influence on future actions through material elements. Sensemaking studies may hence gain insights from design studies. There is an emergent perspective of organizations as social, discursive, and material systems. Individual identities are formed as cognitive, emotive, and corporeal entities where organizations shape, and are shaped by, individuals, other organizations or societies. In the context of designers´ positive strategic sensemaking, materiality presents itself in specific design units and creative spaces or labs as is evident in the current research. Materiality of thoughts, however, is not limited to the spaces devoted to creative activities. For designers, the material and the cognitive are interlaced and form a design space, both physically and mentally. The material and the embodied are embedded in the social and the cognitive and vice versa.

Strategizing

Strategy as practice (Jarzablowski et al., 2013) uses the verb strategizing to place emphasis on the strategic practices by practitioners (p. 41). Designers often are involved in strategizing, although this is not always explicit. Strategy as practice extends beyond rational strategy analysis, but involves the social and the material (Vaara & Whittington, 2012). Spee and Jarzablowski (2011) reconceptualized strategic planning as a communication process (p. 1219). Referring to Ricoeur´s recontextualization (Thompson, 1981), they show the cyclical and evolving nature of strategic planning where the plan itself is the result of the process of reinterpretations. The relationship between text and talk forms the basis of their analysis. In the current paper, design influences such strategizing by more versatile elements than only text and talk (p. 1238). Additionally, the SAP approach (Jarzablowski et al., 2013) resonates well with the conception of socially constructed meaning in strategizing and the call for research on materials (pp. 41-43).

Strategy can be viewed as situated, socially accomplished activity through the actions and interactions of actors (Vaara & Whittington, 2012). Design experts act as co-strategists by embedding design knowledge into organizational and inter-organizational contexts. Designers are co-strategists who facilitate learning and learn themselves during the process, while helping others to simultaneously experience and learn (Orlikowski, 2002) from the experiences that designers facilitate. Collective positive sensemaking enabled by designers in

strategy-making involves the framing and re-framing of divergent views. Drawing from the present research, it is suggested that design experts facilitate sensemaking in strategic context by hands-on collaboration with multiple stakeholders and by altering between thoughts and material prototypes or other artifacts. Iterative cycles of positive sensemaking allow design experts to support and concretize collective future-oriented sensemaking as a mode of strategic way-finding (cf. Jacobs & Wintrob, 2016, p. 45). Strategic renewal can be viewed as continuous innovation (Ravasi & Lojacono, 2005, p. 54).

Strategizing as a verb and continuous activity enables learning by empowering organizational members to experiment and reinterpret unfolding events. However, the learning school of strategy underlines that strategies balance between deliberate planning and emergent more spontaneous forms of becoming. The emphasis between the two fluctuates over time, yet emergent strategies are connected with more flexibility and better suited to coping with complexity in environments. Important for organizations is the ability to learn and become self-aware of the effects of actions (Mintzberg & Waters, 1985; Mintzberg, 1987) when predictability of future events is difficult (p. 69). Sensemaking, like strategizing, can be viewed as an ongoing activity where strategies unfold. The two form a unity. Not the planning, but rather the joint action and reflection describes strategizing. Both Weick and Mintzberg are thus intrigued by the connection of action and thought in organizations (cf. Argyris, 1999, p. 9) and suggest that action itself *is* to make sense. This implies an ongoing flow of iterative interpretations amongst participating actors who learn from each event. Mintzberg (1987) implies that intentional strategies may remain unrealized (p. 68), and advises organizations to avoid rigidity by fostering a more creative approach.

By viewing sensemaking and strategizing as an ongoing unfolding activity aiming at a positive goal, the current research proposes that design may have an important role in extracting cues and facilitating the emergence of new positively charged meanings, leading even to organizational transformation. Design activities are fragmented, yet often embedded in events, creating opportunities for collective understandings and meaning-making (D´ellera & Verganti, 2010, p. 125; Krippendorff, 1993a, p. 21; Krippendorff, 1993b, p. 35; Norman & Verganti, 2013, p. 89). Mintzberg (1987) speaks of crafting a strategy by comparing a company strategy to the strategy of a pottery maker (p. 66-68). Crafting might better capture how strategies come to being. The potter as a craftsperson "must also resolve one of the great challenges the corporate strategist faces: knowing the organization's capabilities well enough to think deeply enough about its strategic direction" (Mintzberg, 1987, pp.66-68). What matters is learning continuously by experimenting. Elsbach and Stigliani (2018) suggest that experimental design thinking tools (cf. Liedtka, 2015; Tripp, 2016) and organizational cultures are tightly linked. They suggest design thinking tools support the development of the values, norms and assumptions that form an organizational culture. For example, organizations using design thinking tools were more open to experimentation and collaboration and had a culture that valued human-centeredness and collaboration.

The present article suggests that design professionals act as co-strategists in organizational contexts. Especially making as meaning negotiation (Groth, 2017, p.82) can be linked with strategic sensemaking. Design methods (cf. Fayard et al. 2017, pp.292-296) share some similar ideas by placing stakeholders into a situation where making and thinking merge. Experimentation guides further action, learning takes place in cycles. An obsession with control and planning may lead to risk aversion. In such a case, reluctancy emerges towards creative ideas or quantum changes. Both of them are unpredictable and beyond control. (Mintzberg, 1993, p. 33.) Balogun and Johnson (2005) suggest that strategy development should be seen as an emergent process instead of as a top-down model (p. 1573). Mintzberg proposes that organizations utilize more visionary approaches and learning through experimentation (Mintzberg, 1993, pp. 37-38). This line of thought brings design approaches close to the ideas of strategizing.

Open strategy trends have become of interest in strategy research (Whittington et al., 2011, p. 532). Openness is not only connected to innovations and external actors but is also a trend concerning the degree of participation by internal actors (p. 535). Large corporations face new pressures for both greater inclusion and transparency. Strategizing becomes less exclusive and elitist. From a sensemaking point of view, participants with less formal power are nevertheless able to construct meaning resonating with others. This meaning may turn out to be the one enacting an environment (Maitlis & Sonenshein, 2010, p. 572). However, even holding formal power does not automatically lead to a dominant position in constructing meaning as people interpret the given meanings individually. Action follows from collective justification (Weick, 2001/2011).

Many design-driven organizations utilize participatory approaches and co-creation (Degnegaard, 2014; Frow, Nenonen, Payne, & Storbacka, 2015) while designers shift from designing form and function towards participation in strategies concerning services and systems development in, for example, digitalizing

environments. The designer or design team is mostly embedded either in an organization, or guiding an organization from outside in a facilitating role, as a strategic design thinking unit, or as a consultant. However, the designer context, as earlier notions confirm (Verganti, 2008, p. 444), extends beyond the organizational borders.

Positive and human-centred design

The focus on human happiness is central to the world of design. Positive design aims at engagement in meaningful activities; some designers, for example, believe to be able to design happiness (Desmet & Pohlmeyer, 2013, p. 6). Supporting the emergence of new meanings, and meaningfulness is an asset that designers can utilize in their activities. Maitlis and Sonenshein (2010) point to optimistic sensemaking effects on organizations and their members where positive statements emphasize possibilities for actors to enact their futures in post-crisis change situations (pp. 555-556). Meaning is not given; rather, it is co-constructed among participants (cf.Mattelmäki, Brandt, & Vaajakallio,2011). Desmet and Pohlmeyer (2013) use "positive design" as ´´an umbrella term for all forms of design, design research and design intention in which explicit attention is paid to the effects of design on the subjective well-being of individuals and communities´´ (p.6). It is additionally concerned with the side-effects of consumption. Van der Bijl-Brouwer and Dorst (2017) explain how HCD can support exploring deeper insights of the human needs and assign this ability to design expertise built over long term practice. Verganti (2008) suggests that radical changes in meanings imply radical change in sociocultural regimes and can be understood by taking a broader view on long term phenomena (p. 442).

Positive strategic sensemaking has its foundation in the positive attitude often found amongst designers. (Michlewski, 2008, p. 386-387; Brown, 2009, pp. 76 & 242). Michlewski´s (2008) views support the idea that designers are well suited to strategizing; they focus on future and see reality as pliable. Assertion instead of evidence guides their work. Designers may combine the rational, emotional and aesthetic, prefer novel ideas and may stimulate change due to their generally positive attitude towards change (p. 386-387). Especially service design with participatory approaches and empathy (Fulton Suri, 2003) connects with “the human turn” in business and service development. This broadens the scope of service design well beyond services as its only application field and points towards strategic opportunities. Positive design aims at engagement in meaningful activities. The willingness and even enthusiasm to accept constrains is the very foundation of design thinking (Brown, 2009, p. 18). Finding a balance between organizational constrains such as feasibility, viability and desirability contributes to strategic sensemaking (p. 18-21).

Designers´ ethos may well guide an organization towards a future where climate change or other social challenges need broader understanding. With a firm belief in making positive change with good consequences for human lives and nature, designers suggest new strategic meanings and facilitate other people´s voice being heard. Sometimes they may be channeled through designers´ ethos. This research has some links with Sonenshein and Dholakia´s (2012) three meaning-making dimensions explaining employee engagement with strategic change (p. 16). These dimensions (strategy worldview, benefits finding and positive affective meaning) may resonate with positive design facilitation, thus supporting strategic change. Employees’ interpretations of strategic change play an essential role in determining how they ultimately implement such change (p.16). Yet, the model did not discuss radical bottom-up initiated meaning change. Importantly, the content of meaning-making proved essential in understanding employees’ responses to change. The research involved social psychological viewpoints in strategic change implementation.

A Model of Positive Strategic Sensemaking leading to meaning change

The model of Positive Strategic Sensemaking thus draws from the three theoretical streams presented, and combines them: strategizing, sensemaking and positive human-centered design. The intertwined ongoing interplay between the three elements yields a different perspective on strategizing and the role of designers supporting or initiating these activities. Instead of describing a strictly controlled managerial process, the model stresses joint action for meaning construction. The model suggests an ongoing activity with diverse participants and perspectives joined for finding a meaningful focus. This perspective stresses the core of the vision and meaning of organizational life rather than implementation of a distant strategic goal that is given top-down by an organization. Positive Strategic Sensemaking implies an ongoing search for cues that are meaningful enough for actors to change course and, at times, challenge an existing strategy or clarify its content. The strategy is in a constant state of becoming and evolving in an iterative fashion.

Figure 1: A model of Positive Strategic Sensemaking leading to meaning change and meaningfulness. Source: Pääkkönen & Sarantou, 2019.

Allowing even critical views on strategy to surface and be articulated and elaborated on, may yield insights and energize substantial change. This paper proposes that positive strategic sensemaking through the design perspective opens up opportunities for meaning change and increased meaningfulness for participating actors. Incremental meaning changes as Verganti (2008) suggests, follow the existing strategic route and modify it to some extent, yet maintaining the course of the existing strategic direction. In the case of radical meaning change, the direction and basic values of the organization are rewired towards genuinely striving to increase well-being of individuals and communities. It also positively challenges organizational actors to reconsider consequences of consumption and environmental effects on the long term. Ultimately, the support rendered by positive design may transform the organization into a radically new positive direction. Consequently, meanings cannot and should not be forced. Even when proposed, ultimately, the interpretation cannot be managed. What can be beneficial, is ongoing reflection following each move. Paradoxically, challenging the current strategy may thus not be directed to criticizing management, or is not a matter of power play; rather, it can be viewed as a joint positive force in a world that, according to many design perspectives, does require change towards meaningfulness.

The professional designers mentioned some examples of meaning changes. A manufacturing company changed the core of their strategy from a supplier of technology towards understanding their role in enhancing health and well-being at home. New visions around sharing economy have emerged, challenging the traditional conceptions of ownership. Early phase probing, earlier than any prototypes or testing, is an example of continuous extracting of cues that further builds design knowledge available for use in specific situations. Becoming a service company entails support for the crucial role of the employees who provide the promised service experience. A software company focuses on users who generally dislike the software they need to use. Many of these examples changed the strategic understanding of the organization where the designers worked. However, more research is needed to find out if radical changes extend to the less evident aspects such as genuine environmental protection, choice of materials that are sustainable and ethically sound production site conditions. Meaningfulness gains importance on the long run and has value for human beings who form the core of organizations. While these changes cannot be managed, their emergence, perhaps, can be cultivated.

Discussion and Limitations

As to radical innovations (Verganti, 2008; Norman & Verganti, 2014, p. 88-89; Verganti & Shani, 2016), the radical new meaning may become the core of the strategy and transformation inspired by design ethos and support. Designers work in multidisciplinary interactions. Strategizing is not only open to more participants,

but allows insights other than those given or chosen exclusively by conventional management. Radical new meanings need not take quantitative data as the first or only criteria. Other cues and opportunities may guide action such as health, well-being or equality concerns. Reducing cognitive load is a challenge that is not yet solved. One might ask if robots are needed in elderly care and if so, whether children in a few years will be taken to robotic daycare. Regarding the increase of Artificial Intelligence (AI) in service industries, the replacement of mechanical and analytical tasks is estimated to take place rapidly. Instead, intuitive and empathetic skills and creative thinking will offer sustainable and lasting advantages to human service employees. Ultimately, the AI revolution in the service economy is a realistic threat to all employment in the sector. (Huang & Rust, 2018.)

Strategizing is continuous sensemaking. With designers' values and ethos, there is scope for meaning changes with a broader impact. While design managers gain power, the research encourages them to give voice to those who will be impacted by their designs. Designers are both capable of supporting and challenging existing strategies. The latter can take place with designers supporting and triggering change by focusing on consequences for society and people. Material, embodied interactions by design facilitation support learning and create involvement. By finding meaningfulness strategizing makes sense.

Limitations

This preliminary theory elaboration is a first attempt to link sensemaking, strategizing and the positive enabling aspects of design into a theoretical model supporting meaning change. It is meant to serve as inspiration and insight for further exploration and elaboration both among designers and design, strategy and sensemaking scholars. However, Maitlis and Sonenshein (2010) found warning examples of too much optimism where routine actions cause blindness preceding crisis situations (pp. 555-556). Strong positive statements made the event look ordinary and participants neglect the signs of danger. Design-driven organizations and their sensemaking processes on individual and collective levels require further clarification.

One possible purpose of qualitative research is radical change. Following the Critical Theory path, the current paper makes a first elaboration on a theoretical model through which actors in organizations, through sensemaking and responsible reflection, may radically change the meanings of their actions. Such new meanings might guide organizational strategies towards change that benefits the environment and people. However, this research is limited to theory elaboration, instead of testing a hypothesis. Theory elaboration may lead to overly complex theories. Interdisciplinary theory elaboration risks being limited by the depth of scholarship in the field from which one borrows. The aim of theorizing in this article has been both to borrow yet also to contribute to the other fields of sensemaking and strategizing and bring design closer to these disciplines. As to the design field, the model is a step towards better capturing features of the design profession in the context of strategizing, in which the management perspective has been dominant. This research has limitations as to the interpretations made and it cannot exclude the assumptions held by the researchers with backgrounds in business and design fields. Perhaps the model proposed appears to be too optimistic in some cases. Further, the research takes the perspective of design experts' views; a design knowledge perspective that has not gained much attention. In addition, cultural differences have an effect on the intensity of design use. Organizational learning may not always be a beneficent phenomenon and even its desirability as axiomatic can be questioned (Argyris, 1999, pp. 9-14). Neither have Open Strategy developments, so far, led to transfer of decision rights (cf. Hautz, Seidl, & Whittington, 2017; Mantere & Vaara, 2008; Whittington et al., 2011), while the evolving role design experts play in organizational strategizing, requires further research.

Design as a discipline contains multiple streams. Many other design streams could have been included in the theoretical model supporting strategic impact on organizational questions of sensemaking. The model does not claim that designers are the only actors involved in positive change. Yet, reconsidering strategic direction is necessary in times of limited planetary resources and both design and other disciplines need to face this situation as a shared responsibility. Designers are there to support this change.

Conclusions

A Model of Positive Strategic Sensemaking was presented. It utilized the theoretical insights from sensemaking, strategizing and positive and human-centered design. Positive Strategic Sensemaking can be understood as an ongoing evolving sensemaking activity embedded in social and discursive, but also material

and embodied strategic contexts. Positive Strategic Sensemaking implies an ongoing search for cues that are meaningful enough for justification and joint action towards meaningfulness supported by design.

The article proposes that designers support positive strategic sensemaking as facilitators or co-strategists. Sometimes designers, interacting with others, support an existing strategy. At other times, they might challenge the strategy. In both cases meaning changes are made possible and new opportunities may be found. In the first case, meaning changes follow largely an existing strategy with minor changes in products and systems. In the latter case, radical meaning changes might emerge as a result of opening strategy to multiple interpretations among participants. Meaningfulness is a strong trigger for changes that may not be derived from managerial rationalism but from a sense of deeper meaning for human beings. Such genuine meaning changes reside in individuals and societies, waiting for a suitable moment to become active and visible. Radical meaning change, even a new vision leading to transformation, may emerge where designers' ethos guides action.

The research opens new avenues for design to be closely aligned to and associated with strategizing. The current research suggests that positive support by inclusiveness and empathy allows diverse interpretations to be articulated and a broader understanding of issues influencing a future event be constructed. Communication is supported by materials and embodied activities encouraging different perspectives to be heard. The research is of importance to designers showing their strategic importance as facilitators and supporters of meaning change. This has implications for education of designers and managers alike, stressing the search for meaningful consequences as a positive force supported by design facilitation. Future research could, for example, look deeper into meaningfulness by considering the many perspectives involved as well as the enabling and hindering factors behind such attempts on individual, collective or organizational levels.

Social and material embodied design involvement offers space for further research. Research could look deeper into the ethos of designers interacting with other organizational actors enacting their organizational values towards meaningful futures. The research may interest those involved in SAP or open strategy research from design impact point of view. It contributes to the emerging sensemaking literature as material and embodied in addition to cognitive and discursive interpretations. In addition, there seems to be scope for research on strategy emergence, the role of materiality, and critical interpretations of strategy as Vaara and Whittington (2012) point out. This article has provided new insights regarding the role of design experts and their approaches in this context by combining positive design streams with strategizing and sensemaking as an ongoing phenomenon.

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Envisioning a design approach towards increasing well-being at work

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Organizational attention to increasing employee well-being (EWB) is a relatively recent phenomenon, which can be linked to the penetration of information technology, its connection to organizational performance, and millennials facing a lack of optimism about the future. Recent research in the field of management has indicated that design principles like human centeredness and holistic thinking should be applied to create better employee experiences. However, how the positive impact of design on EWB can be achieved, is underspecified in literature. In this conceptual paper, we explore complementarities and potential synergies of design principles and practices with the conditions for EWB, leading to a principle-practice-ingredient (PPI) portfolio. This portfolio can help designers of employee experiences succeed in increasing EWB through the process they apply. For instance when applying envisioning and inspiring activities that address virtue and personal significance to develop workplace tools (such as an app for teamwork around a specific task).

Keywords: Employee well-being, positive and strategic design

Introduction and background

Employee well-being (EWB) can be defined as the overall quality of an employee's experience and functioning at work (Warr, 1987). It has become a major topic of research across several scientific disciplines in recent years (Bartels, 2015). The concept has also been receiving growing attention in business (Heath, 2017). This growing attention is supported by changes in the nature and context of work due to the rise of information technology (Guest, 2017), by its connection to organizational performance (Christian, Garza & Slaughter, 2011), and by millennials facing a lack of optimism about the future (Elliott, 2016). As an example of this growing attention, Facebook surveys its workforce twice a year, asking what their employees value most (Goler, Gale, Harrington & Grant, 2018).

> *Firms spend money on happiness coaches, team-building exercises, gameplays, funsultants, and Chief Happiness Officers (yes, you'll find one of those at Google). (Spicer & Cederström, 2015).*

Yet, many workplace well-being programs seem to have limited effect, as reflected in the low engagement scores measuring the effects of these programs (Morgan, 2017). The limited effects are mainly linked to organizations that apply short-term fixes instead of redesigning the employee experience. The employee experience was defined by Morgan (2017) as a holistic concept; a combination of organizational culture, the technological, and physical environment. These short-term fixes, or static reactions in need for control, seem

to be a recent phenomenon in a world that has become more 'fluid'. This 'fluidity' in terms of more open, complex, dynamic, networked problems will only increase because we live in a nexus between technological revolutions, and momentous social and cultural changes. (Dorst, 2015). Dorst explained that it is crucial to understand the underlying structures of the specific situation.

As part of the initial stage of a PhD project, a preliminary study was conducted by the authors at an international airline company to better understand the reasons for the limited effect of well-being programs. The airline company operates in a highly competitive, regulated and complex business. The preliminary study included in-depth interviews, observations during training- and management sessions, a survey shared with participants in a masterclass (n = 65), and an analysis of recent engagement studies done by Ipsos (Employee Monitor 2013, 2014, 2015, 2017; n = 10564). One of the main conclusions from this study is that HR managers do not know how to actually increase EWB (what to do and where to start with and "how to get the most value for bucks"). Employees experienced substantial benefits from being involved in design processes, such as more freedom to think and act, and a better understanding of the impact of their work related to the company's purpose. The assumed positive impact of design on EWB is further explored in this paper.

Dorst (2015) explained that leading innovators have increasingly been turning to design for help. According to Liedtka (2018), design helps innovators to get around human biases or attachments to specific behavior norms that block innovation. She argues that employee engagement is both a condition for, as well as an outcome of successful innovation, as organizations are built upon people's perspectives and emotions and the experiences of the innovators are shaped by design. A design process or a design outcome can support pursuing well-being (Desmet & Pohlmeyer, 2013). Pohlmeyer (2017) explained that design for well-being can play a pivotal role in facilitating activities and enabling experiences. For instance, Parker (2014), explained that the design of the employee's work experience can be a powerful vehicle to positively impact EWB. Recent research has indicated that design principles like human centeredness and holistic thinking should be applied to employee experiences (Gruber, De Leon, George & Thompson, 2015). However, how the positive impact of design on EWB can exactly be achieved, seems to be underspecified in the literature. The question arises which design principles and practices should be used to increase EWB? The following research question is addressed with a conceptual approach:

> *RQ1: What are the potential design principles, strategic design practices and positive design ingredients that increase EWB?*

The main purpose of this paper is to advance the current understanding of how design can be integrated and leveraged for improving employee experiences. Or, as identified in management literature (i.e., Knight, Patterson & Dawson, 2017), to create an employee experience in which employees can thrive. In this paper, we draw from the literature covering management, psychology and design perspectives on well-being at work, design principles, practices, and positive design ingredients in order to explore solution directions for increasing EWB. We advance an argument that applying a design approach helps to succeed in increasing EWB. We first synthesize conditions for increasing EWB, as part of the first phase of the PhD-project in order to define an initial set of propositions. In this paper we subsequently link these conditions to design practices (i.e. empathizing, connecting, leveraging sensorial aspects, prototyping, inspiring, and applying a 'gestalt' view), underlying design principles (i.e. human and meaning centered, design co-creative and inclusive) and positive design ingredients (i.e. design for personal significance, design for human flourishing). Through this conceptual approach, we organize design principles, design practices and positive design ingredients for increasing EWB into a principle-practice-ingredient portfolio (PPI). This PPI portfolio shows how design practices can be applied to the field of EWB to keep supporting contemporary (employee) innovation activities in a designerly way. Moreover, these design practices can be used as guidelines in combination with experience goals based upon positive design ingredients. Through these guidelines, this paper contributes to the design literature by extending the field of application of strategic design, and by providing initial insights into how the positive design approach can be applied within organizations, for the purpose of increasing EWB. In the following sections the literature review and PPI portfolio are discussed, followed by elaborating on the applications of these guidelines in the final section.

Increasing well-being at work

EWB was described in the introduction of this paper as the overall quality of an employees' experience and functioning at work. This holistic definition is an integrated perspective of the literature domains of healthcare,

sociology, psychology and philosophy (Warr, 1987). The definition moves beyond well-being as a primary affective state (the hedonic view, also known as subjective well-being [SWB]), towards a multi-dimensional phenomenon (the eudemonic view) (Taris & Schaufeli, 2015). The concept has been defined and operationalized heterogeneously in academic literature (Bartels, 2015; Taris & Schaufeli, 2015), varying from affective judgment to a broader phenomenon involving other, non-affective, aspects as well. The broad, holistic perspective, allowing for contextualization (Warr, 1987), is used in this study to define EWB. This definition includes the dimensions affective well-being (organizational commitment), aspiration (personal growth), autonomy and competence (mastery), and integrated functioning as a secondary dimension. Personality factors seem to determine well-being to some degree (Hallberg, Johansson & Schaufeli, 2007; Taris, Van Beek & Schaufeli, 2014). For example, individuals who pursue goals to fulfill intrinsic values (goal self-concordance) experience higher levels of EWB (Bakker & Demerouti, 2008). Since personality factors are generally considered to be difficult to influence, they are left out.

EWB interventions

Improving EWB is seen as a complex task according to management literature. Drawing conclusions about the kind of Human Resources (HR) practices that affect EWB has been difficult (Grant, Christianson & Price, 2007; Guest, 2017). Focusing on EWB brings multiple challenges, as there may be trade-offs between different types of well-being. Synergistically increasing multiple dimensions of EWB instead of creating conflicting outcomes is one of these challenges (Legge 1995; Ramsay, Scholarios & Harley, 2000). For instance, high levels of job challenge and opportunities for growth may coincide with high levels of stress (Cohen & Colligan, 1997).

Few studies on well-being interventions have been conducted (Lyubomirsky, Sheldon & Schkade, 2005). These studies describe only a few examples of synergistically increasing multiple dimensions of EWB, such as involving employees in the design of safety practices, leading to an increase in social, physical, and psychological well-being (Grant, Christianson & Price, 2007). Most of these studies focus on positive psychology approaches (Bolier et al., 2013; Wright & Cropanzo, 2004). Positive psychology was defined as 'a scientific understanding and effective interventions to build thriving in individuals, families, and communities' (Seligman & Csikszentmihalyi, 2000, p.13). The positive psychology approach often takes a one-size fits all approach, even though personalization based on people's need could work better (Bolier et al., 2013). Experiencing positive emotions (Fredrickson & Joiner, 2002), and task significance and variety are positive influencers of EWB (Hackman & Oldham, 1976). Multiple positive interventions at once may be more effective than engaging in only one activity (Sin & Lyubomirsky, 2009). Yet, much well-being-related research focuses on studying the effectiveness of single interventions at a time.

Three main short-comings in literature were identified:

- Well-being can be understood and measured in many different ways and relates to a wide range of concepts. It should not be limited to affect (SWB) only;
- Synergistically increasing multiple dimensions of EWB is a challenge, with only limited evidence of approaches that have succeeded in this;
- Very few EWB intervention studies have been conducted, mostly in the field of positive psychology, using a one-size fits all approach, only studying a single intervention at a time.

Towards a principle-practice-ingredient portfolio

We identified seven conditions for increasing well-being at work. These conditions were derived based on an in-depth literature review that included human resource management, psychology and organization research streams. The conditions for increasing EWB at work are codified in Table 1. In this table, illustrative references are included, highlighting the cross-disciplinary agreement over time. These conditions can be summarized as ensuring interventions are tailored to individual needs (Condition No. 1), address a sense of mastery and competence (Condition No. 2), address a sense of self-determination (Condition No. 3), address organizational commitment and support (Condition No. 4), address the job's meaningfulness (Condition No. 5), address the need to explore and assert (Condition No. 6), and include the broader context of EWB (Condition No. 7). The conditions for increasing EWB as shown in Table 1 are illustrative rather than exhaustive and will be further explained in the next sections.

Table 1 Conditions to increase EWB and illustrative references

No	*Conditions to increase EWB*	*Illustrative references*
1	Importance of tailoring interventions to individual needs	"In addition to demonstrating that happiness-boosting interventions can work for at least some people, this […] provides further support for our proposition that the fit of the activity to the person makes a difference" (*Lyubomirsky, Sheldon & Schkade, 2005, p. 124)*
		"It goes without saying that a user-centred approach is pivotal to positive design, because the user will be the only expert truly able to assess her own subjective well-being" (*Desmet & Pohlmeyer, 2013, p. 14)*
2	Importance of having a sense of mastery and competence	"How happy workers feel; how motivated they are by an intrinsic interest in the work; how positively they view […] their work, and themselves—all these combine either to push them to higher levels of achievement or to drag them down" (*Amabile & Kramer, 2011)*
		"First of all, […] healthier people possess a stable sense of identity – they have a good sense of who they are" (*Kets de Vries, 2001, p. 104*)
		"Furthermore, organizational leadership has to create the conditions to foster a sense of competence, signifying that organizational participants have a feeling of personal growth and development" (*Kets de Vries, 2001, p. 108*)
		"[…] think of in terms of five main components of mental health in Western societies. Those may be labelled as […] competence […]" (*Warr, 1994, p. 84)*
		"[…] we have identified the needs for competence […] – that appear to be essential for facilitating […] personal well-being" (*Ryan & Deci, 2000, p. 68*)
3	Importance of having a sense of self-determination	"The combination of employing and expressing a person's preferred self yields behaviors that bring alive the relation of self to role" (*Kahn, 1990, p. 700*)
		"Closely tied to this need for exploration is self-assertion, the ability to choose what one likes to do" (*Kets de Vries, 2001, p. 106*).
		"[…] think of in terms of five main components of mental health in Western societies. Those may be labelled as […] autonomy […]" (*Warr, 1994, p. 84)*
		"[…] we have identified the needs for autonomy […] – that appear to be essential for facilitating […] personal well-being" (*Ryan & Deci, 2000, p. 68*)
		"Happiness mostly results from an individual's ability to make choices" (*Gavin & Mason, 2004, p. 388)*
4	Importance of organizational commitment and support	"By supporting people and their daily progress in meaningful work, managers improve not only the inner work lives of their employees but also the organization's long-term performance, which enhances inner work life even more" *(Amabile & Kramer, 2011)*
		"[…] positive relations and working climate*returns once again to the perception of well-being as a positive quality of interpersonal relationships, regardless of the rules and position held" (*Biggio & Cortese, 2013, p. 9, 10)*.
		"People vary their personal engagements according to […] the guarantees, or the safety, they perceive in situations" (*Kahn, 1990, p. 703*)
		"Clearly, work characteristics influence psychological work adjustment factors that ultimately affect employee health and well-being" (*Wilson, DeJoy, Vandenberg, Richardson & McGrath, 2004, p. 582)*
		"A healthy organization is one characterized by intentional, systematic, and collaborative efforts to maximize employee well-being and productivity by

		providing […] a supportive social–organizational environment […]" (*Wilson, DeJoy, Vandenberg, Richardson & McGrath, 2004, p. 567)* "The results of this study support Laschinger's research that workplace climates and engagement were positively associated, suggesting that organizational leaders, managers, and practitioners by improving workplace climate in their respective organizations could increase employee engagement and increase the likelihood of positive individual-level affective outcomes […]" (*Shuck & Reio, 2014, p. 54)*
5	Importance of meaningfulness of one's job	"Whether the goals are lofty or modest, as long as they are meaningful to the worker and it is clear how his or her efforts contribute to them, progress toward them can galvanize inner work life" (*Amabile & Kramer, 2011)* "[…] work engagement is more strongly related to job characteristics that are associated with the perception of meaningfulness of the work itself […]" (*Christian, et al., 2011, p. 122)* "[…] an individual experiences positive affect to the extent that […] he cares about (experienced meaningfulness)" *(Hackman & Oldham, 1976, p. 255, 256)* "[…] people were personally engaging in situations characterized by more psychological meaningfulness than those in which they were disengaging (*Kahn, 1990, p. 704)"* "When a workplace is designed and managed to create meaning for its workers they tend to be more healthy and happy" (*Gavin & Mason, 2004, p. 381*)
6	Need for exploration and assertion	"[…] everyday progress—even a small win—can make all the difference in how they feel and perform" (*Amabile & Kramer, 2011*) "Playful exploration and manipulation of the environment in response to exploratory-assertive motivation produces a sense of autonomy, initiative, and industry" (Kets de Vries, 2011, p. 106) "[…] think of in terms of five main components of mental health in Western societies. Those may be labelled as […] aspiration […]" (*Warr, 1994, p. 84)* "[… those record the degree to which a person seeks out challenging goals in his or her job, a process which can be viewed as a central aspect of job-related aspiration*"* (*Warr, 1994, p. 86))* "Optimal psychological functioning requires not only that one achieve the prior characteristics, but also that one continue to develop one's potential, to grow and expand as a person" *(Ryff, 1989, p. 1071)*
7	Importance of a broader (multi-dimensional) perspective of EWB context	"[…] the individual and situational perspectives on the relation between individual well-being and performance are interconnected" (*Taris & Schaufeli, 2005, p. 24*) "The final aspect of mental health, integrated functioning, concerns the person as a whole and the relationships between other components" (*Warr, 1994, p. 86*) "Happiness is a holistic ideal" (*Gavin & Mason, 2004, p. 388*)

Building on the understanding of conditions for employee engagement, the following sections introduce an illustrative PPI portfolio for establishing well-being at work by addressing the research question:

RQ1: What are the potential design principles, strategic design practices and positive design ingredients that increase EWB?

We follow a similar approach to Karpen, Gemser and Calabretta (2017) by synthesizing the conditions for well-being at work and subsequently linking them to design principles (Beverland, Wilner & Micheli, 2015; Buchanan, 1992; Karpen, Gemser & Calabretta, 2017; Luchs, 2015; Swan & Luchs, 2011), strategic design practices (Argyris & Schön, 1974; Calabretta, Gemser & Karpen, 2016) and positive design ingredients (Desmet & Pohlmeyer, 2013). The illustrative PPI portfolio in Table 2 lists those practices and ingredients relevant for increasing EWB. The portfolio consists of seven illustrative constellations of conditions for increasing EWB, design practices, combined with the tools and methods of positive design. Each constellation builds on foundational conditions for increasing EWB that are well established in the literature (e.g. *Christian, et al., 2011; Lyubomirsky, Sheldon & Schkade, 2005; Ryff, 1989*), as shown in Table 1. The examples are used to outline a preliminary employee experience view of design practices and to lay the foundation for an evolving research stream in strategic design. In the following sections, design principles, strategic design practices and positive design ingredients will be subsequently discussed, in relation to the seven constellations.

Design principles

Businesses increasingly use design as a way to innovate in today's digital environment (Calabretta & Kleinsmann, 2017). As Kolko (2015) states, "There is a shift underway in large organizations, one that puts design much closer to the center of the universe". This study adopts the definition of design from Buchanan (2001, p.9): "the human power of conceiving, planning, and making products that serve human beings in the accomplishments of their individual and collective purposes".

Improving EWB can be considered a strategic challenge, as redesigning the employee experience involves several stakeholders, implies a long-term approach and a certain degree of risk, and requires a variety of resources (Gruber et al., 2015). As a result, strategic design was used as a starting point for reviewing design literature, since this is the research domain where this kind of challenge is dealt with (Calabretta, Gemser & Karpen, 2016). Strategic design connects design principles to practices that can be applied for strategic purposes and can be defined as "[…] the use of design principles and practices to guide strategy development and implementation toward innovative outcomes that benefit people and organizations alike" (Calabretta, Gemser & Karpen, 2016). The design principles as coded by Karpen, Gemser and Calabretta (2017), served as the starting part for this review. The principles that were considered relevant in the context of this study and could be directly linked to the conditions for increasing EWB can be found in Table 2.

Table 2. The principle-practice-ingredient portfolio for increasing well-being at work

Constellation	*Design principles*	*Guidelines in the form of strategic design practices*	*Positive design ingredients*
First constellation: individual needs	Design is human- and meaning-centered in nature	Empathize: the ability to deeply listen and create a dialogue to reach hidden needs	Design for personal significance *(personal engagement)*
Second constellation: sense of mastery and competence	Design is human- and meaning-centered in nature	Empathize: applying a 'people-first' approach, addressing individual competences and capabilities	Design for virtue *(identity affirmation, self-esteem);* Design for personal significance (*identity affirmation*)
Third constellation: sense of self-determination	Design is co-creative and inclusive in nature	Collaborate: connecting with others to influence the results	Design for personal significance *(control/autonomy)*
Fourth constellation: organizational commitment and support	Design is co-creative and inclusive in nature	Collaborate: being involved in creating solutions	Design for personal significance *(interpersonal connectedness)*
Fifth constellation: meaningfulness of one's job	Design is transformative and betterment-oriented in nature	Envision: helping organizations incorporate a future oriented, long-term perspective into their objectives	Design for virtue *(being a morally good person, identity affirmation, self-esteem);* Design for personal significance (*perceived impact, significance of work*)
Sixth constellation: exploration and assertion	Design is emergent and experimental in nature	Prototype: visualizing and materializing processes and outcomes to make intangible insights, ideas and concepts tangible, sharable and understandable	Design for personal significance *(pursuing personal goals)*
Seventh constellation: broader context	Design is holistic and contextual in nature	Simplify, structure (applying a 'gestalt-view'): selecting, connecting, and leveraging the relevant resources and knowledge to manage the complexity of the project, therewith taking the full context into account	Design for human flourishing (*individuals who live their fullest potential*)

Firstly, design being human- and meaning-centeredness in nature can be of relevance for improving employees' experience. Several sources describe the importance of context and tailoring interventions to individual circumstances needs in order to increase EWB (i.e., Knight, Patterson & Dawson, 2017; Lyubomirsky, 2001). If there is a lack of fit between the individual needs and demands and those of the environment, work-related stress can be an outcome (Cooper & Cartwright, 2013). According to Buchanan (2015), the true value of design is its ability to focus the attention of organizations on all of the people served by the organization.

Secondly, the principle of collaborating, - explained as design being co-creative and inclusive in nature, or as designers that create innovative outcomes through co-creation with relevant stakeholders (Sanders & Stappers, 2008) - can be expected to have a positive impact on people's well-being. A reason for this is that

stakeholders are in this case involved in creating their own solution, and have the opportunity to influence the results that they are going to work with.

Thirdly, design as being transformative and betterment oriented in nature, can help to have a positive impact on society and enhance people's lives (Buchanan, 2015). This desire can be related back to designers' personality characteristics, such as empathy and optimism (Brown, 2008), and is ingrained in designers' way of working through co-creating the world with the people that will be affected by the design. Enhancing people's lives. This principle seems relevant to EWB since meaningfulness of one's job is described as one of its' main antecedents.

A fourth principle that is relevant in the context of this study is design being emergent and experimental in nature, which seems to fit with the recommendation to perform interventions to increase EWB to learn from them and put them into action (Hassenzahl et al., 2013). While psychology is crucial to understand well-being, designers' skills might be useful to put this understanding into action (Lyubomirsky, Sheldon & Schkade, 2005). Design being explicative and experiential in nature seems to fit with the needs for exploration and assertion, which is about having the ability to play and work (Kets de Vries, 2001). This motivational need is associated with experiencing a sense of competence, of personal growth and development (Warr, 1987).

Finally, the principle of design being holistic and contextual in nature fits with EWB, as there is emphasis on recognizing and understanding the systems an individual is part of, in order to be able to improve it (Ojasalo, Koskelo & Nousiainen, 2015; Swan & Luchs, 2011). Based upon this first analysis of the two worlds coming together, it seems like there is a natural fit between the principles underlying design and increasing EWB, as visualized in Table 2.

Strategic design practices

In order to advance the current understanding of how design can be integrated and leveraged for improving employee experiences, we explored the design practices that can be directly linked to the design principles explained in Table 2 and the paragraph above. Design practices are routinized ways of working based on design principles (Karpen, Gemser & Calabretta, 2017) – e.g. envisioning in a human-centeredness manner, using a collaborative approach. There seem to be quite a few practices that can easily be linked to the challenge of increasing EWB when exploring the parallels with design principles and strategic design practices. At first sight, these practices, as described by Calabretta, Gemser and Karpen (2016), naturally seem to fit with the intended outcome, with similar arguments as design principles, and are visualized in Table 2. For sake of the similar argumentation, we will share examples for a subset of strategic design practices.

It seems for instance that the strategic design practice that fits the need to explore and assert (Condition No. 6), can be naturally linked to prototyping. Prototyping refers to designers' practice of visualizing and materializing their processes and outcomes to make intangible insights, ideas and concepts tangible, sharable and understandable to different stakeholders (Brown, 2008; Karpen, Gemser & Calabretta, 2017; Luchs, 2015). Another example is that one can clearly see the parallel between empathizing and the effect this can have on people, when addressing individual needs (Condition No. 1) or a sense of mastery and competence (Condition No. 2). Empathizing enables designers to apply their ability to deeply listen and create a dialogue to reach hidden needs (Michlewski, 2008). Designers can take a 'people-first' approach through which they can imagine solutions that are inherently desirable and meet explicit or latent needs, by generating solutions that are meaningful for users (Brown, 2008, Buchanan, 2015). Envisioning (related to Condition No. 5) refers to designers helping organizations incorporate a future oriented, long-term perspective into their objectives. Simplifying, which can be linked to the need for understanding the broader context (Condition No. 7), can also be explained as structuring or applying a 'Gestalt' view ("the whole is something else than the sum of its parts", Koffka, 1935, p.176). This view refers to selecting, connecting, and leveraging the relevant resources and knowledge to manage the complexity of the project, therewith taking the full context into account.

Positive design ingredients

Positive design is used as an umbrella term for all forms of design, design research and design intention in which the effects of design on the well-being of individuals and communities are explicitly addressed and intended (Desmet & Pohlmeyer, 2013; Pohlmeyer, 2013). These effects can be achieved by evoking valuable experiences through design processes and design outcomes. Positive design processes and outcomes can enable well-being by directing one's intentions towards desirable goals, and by inspiring and empowering

human engagement activities that are meaningful for the individual and the community (Desmet & Pohlmeyer, 2013). The process of designing for well-being is different from a traditional design process since it focuses on opportunities instead of problems (Desmet & Pohlmeyer, 2013). Design should be seen as medium that can address different components of well-being in multiple ways (Pohlmeyer, 2013). The Positive Design Framework (PDF), developed by Desmet & Pohlmeyer (2013), presents three universal ingredients that stimulate well-being: 'design for virtue', 'design for personal significance', and 'design for pleasure'. Design for personal significance for instance, can encourage people to live in accordance with their personal values, and commit to ideally self-concordant goals, in order to foster feelings of purpose (Sheldon & Elliot, 1999). This ingredient of personal significance can be linked to the need for addressing individual needs (Condition No. 1). The PDF framework was applied by Lu and Roto (2015) to set experience goals for meaningful work tool design, leading to a PDF for work tools. This PDF for work tools aims to guide designers of work tools to define meaningful experience goals at the starting point of their design. Design appears to have a pronounced potential to contribute to well-being in an indirect, facilitating manner: as enablement, or as support, as highlighted in the Design Well-being Matrix. This matrix illustrates the diversity of possibilities to design for EWB by connecting design roles to well-being components. In order to establish (enduring) success, positive design can only have an impact if the user is actively involved. A profound comprehension of the user context and translation to daily interactions is needed (Desmet & Pohlmeyer, 2013; Pohlmeyer, 2017). Following these conditions, the focus of this paper is on positive design's role as enablement and support. The portfolio that is developed is intended to be used in an active work-setting. Enablement is the result of an activity, and support can for instance take place in the form of a game. The positive design ingredients that are expected to be naturally connected to the different constellations - with similar arguments - are visualized in Table 2. In this table, we follow the approach of Lu and Roto (2015) to set employee experience goals in order to create an environment in which employees can thrive.

Results, conclusion and discussion

As discussed in the introduction, how the positive impact of design on EWB can be achieved, is underspecified in literature. In this paper, we provide a principle-practice-ingredient (PPI) portfolio from which six guidelines, in the form of design practices, for improving the employee experience can be distilled. The primary EWB dimensions (i.e., organizational commitment, personal growth, autonomy, and mastery) can for instance be linked to the design practices; empathizing, collaborating, prototyping and leveraging sensorial aspects, which seem most relevant to apply to increase well-being at work. Combining these guidelines with experience goals based upon positive design ingredients (Lu & Roto, 2015) (i.e. empathize with personal engagement or identity affirmation) can guide the early phases of a design process, to spark inspiration and empower concept generation. As described by Liedtka (2018), the role of design in workplace innovation provides a social technology. It not only contributes better outcomes for employees in the form of their experiences, it also provides significant value by nature. Adopting a design approach for improving employee experiences that puts people first sheds new light on contemporary processes and ways of working. Structurally listening to the voice of employees for instance, as part of design user research, brings along a ripple-effect in the form of a change in culture and mindset. Focusing on employee experiences instead of employee products breaks down physical, digital and service walls, as it touches many parts of a business.

From this portfolio we can conclude that the role of design in addressing employee innovation challenges is of great potential. Barrett, Davidson, Prabhu & Vargo, 2015 also pointed out that design practices are becoming progressively more essential. We demonstrated the natural fit between the intended outcomes, conditions for increasing EWB, and applying a design process. Design practices therefore seem to have the ability to address employee experience challenges, offering designers a structured method to analyze and transform the complexity of EWB's holistic concept.

As mentioned in the introduction, contemporary workplace well-being programs seem to have limited effect. In addition to organizations applying short-term fixes, another reason could be the lack of organizational knowledge on how to increase EWB in their daily practice. According to McKinsey "there is not a lot of good, independently validated science around what works" ('Wellness at work', 2017). Next to a missing academic discourse on how design can enable a thriving employee experience, the limited interventions that have been done in this field lack empirical evidence. Or, as Micheli, Wilner, Hussain Bhatti, Mura, and Beverland (2018) explained, empirical evidence of the impact of design is still lacking. Thus, applying the proposed guidelines in real-life settings, and measuring the impact of doing this, provide an interesting research outlook.

Next stages in the PhD-project are to prototype and apply design interventions, and validate the impact of these interventions in order to develop initial guidelines to increase EWB. We are currently experimenting with prototyping interventions in a workplace tool design project. One of the challenges in this project is to gain a better understanding of applying positive and strategic design methodologies in practice. How can these methodologies be made relevant for increasing EWB in a meaningful way? We have done a small pre-test on how applying the practices could work when designing the workplace tools. In the first creative sessions with future users, the collaborating practice was leading the process. The aim of these sessions was to envision how teamwork could be stimulated in the workplace tools of the future, by generating ideas. The collaborating approach that was used to build further on each other's' ideas, was positively evaluated amongst participants. A design researcher that was leading the session reflects;

> *Employees that participated in the session really appreciated to work like this. I noticed, and they also said it, that they liked having their say and sharing their feelings.*

In order to further specify the design practices guidelines for this specific research context, it seems that building upon the learnings of Participatory Design is a potential interesting approach. Participatory design assumes that workers are in the best position to determine how to improve their work and their work life and views computer-based applications not in isolation, but rather in the context of a workplace (Schuler & Namioka, 1993). Participatory design is described in the literature as beneficial for redesigning work methods regarding well-being (Vink, Imada & Zink, 2008). It demands active participation and people who are affected by the design should have an opportunity to influence it. The user is seen as partner (Sanders & Stappers, 2008). One of its characteristics is that the quality can be improved with strong and effective participation of the people involved, as is the purpose of the workplace tools design project. Therefore, trying to integrate the participatory design learnings in search for the right design practices to increase EWB is recommended for future research.

When exploring the specific design practices in detail one could argue that the need for integrated functioning, for human flourishing, and the need for tailoring to individual needs, seem to be conflicting. Design for human flourishing intends to encompass the entire life of people and communities. The need for tailoring experiences to individual needs however, could also apply in specific situations. Positive design research, that addresses design for human flourishing, has been inspired by positive psychology (Desmet & Pohlmeyer, 2013), a stream in literature that is not accepted by the research community unequivocally. In fact, one of the biggest critiques on positive psychology is the 'one size fits all' approach, even though personalization based on people's need could work better (Bolier et al., 2013). Positive psychology is defined as "a scientific understanding and effective interventions to build thriving in individuals, families, and communities" (Seligman & Csikszentmihalyi, 2000, p.13). Thus, exploring the use and effect of simultaneously applying the proposed design practices that are related to these needs, is one of the recommendations for future research.

Another potential critique on the principle-practice portfolio is that a few antecedents of work-related well-being were left out of scope. We intentionally excluded externally generated goals, availability of money, and physical security, as we did not find a clear link between these antecedents and design practices.

In line with Dorst's (2015) finding that innovators have increasingly been turning to design for help, the field of Human Resource (HR) management acknowledges the need for a shift in mindset (Cappelli & Tavis, 2018). The traditional HR practice is changing, and employees are more and more brought into the design process for co-creation and iteration to meet people's needs, instead of predominantly relying on 'experts' to build HR programs. Bersin (2016) explained this shift as changing the approach from instructional to experience design. As an example Bersin mentioned a telecommunications company using design thinking to come up with a solution for the high staff turnover in its retail stores. Based upon our research findings, designers could complement (HR) managers in developing employee experience strategies for well-being, using their practices to analyse and transform the complexity of EWB's holistic context.

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Evolution of Design Thinking Capabilities

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Design and especially design thinking are becoming a strategic source of competitive advantage. From its business theorization in early 2000s the adoption and awareness in both academics and practitioners' world is unmeasurable. Todays the attention of academics is no more only on the process and its phases, inspiration, ideation and implementation but more and more attentions are positioned on the team dynamics and the more hidden aspects of such methodology. As a matter of fact, literature shows that design thinking is not unique but it can be framed in at least four different kinds creative problem solving, sprint execution, creative confidence and innovation of meaning. The investigation aims at discovering which are the different capabilities characterizing the different kinds of design thinking. Through a survey on the Italian market of service providers of design thinking services the paper shows the different skills, competences and attitudes that are more relevant for each of the four kinds of design thinking. This is valuable for both practitioner and academics because it enriches the knowledge on the team composition in terms of capabilities, a still blurred element of the design thinking literature.

Keywords: Design Thinking, Design Capabilities, Design Attitudes, Design Skills

Introduction

Design is increasingly becoming a strategic source of competitive advantage, to the point that scholars and practitioners investigate the managerial practices that firms employ to seize opportunities resulting from the adoption of design principles in companies (Capaldo, 2007; Dell'Era and Verganti, 2010; Verganti, 2017). The emergence of new paradigms such as human-centered design (Buchanan, 2001), participatory design (Sanders and Stappers, 2008) and especially design thinking (Brown, 2008; Martin, 2009), highlight the transforming role that design can play in the field of innovation. The growing number of publications in academic journals (Brown and Wyatt, 2010; Kolko, 2015) and the emergence of new approaches such as Circular Design or Design Sprint (Knapp et al., 2016) shows how the debate around this topic is still evolving and sometimes controversial. On the practitioner side the recent acquisition of Lunar by McKinsey or Fjord by Accenture represent just two examples of a broader phenomenon.

The attention toward the booming of Design Thinking is not only of interest for practitioners but also for scholars. As a matter of fact, since its framing back in 1991 by Rowe it evolved and changed a lot. Researchers pointed out many different processes to perform and realize a Design Thinking process but still an ongoing debate is present in both practitioners and academics word about the ideal structure and framing of such a process (Liedtka, 2015). Both in the literature and in the practitioner field huge resonance is given to the IDEO view on it, to the point that the several researchers recognize in Tim Brown the father of the Design Thinking first embodiment (Brown, 2009). In particular, at that time design thinking has been defined as a formal

method for practical, creative resolution of problems and creation of solutions (Brown, 2009). This definition clearly shows the fact that this paradigm allows to address wicked problems (Camillus, 2008) by adopting a creative problem solving approach. This is not the only aim for adopting a design thinking approach. As a matter of fact, it is evident nowadays in the practitioners' world how this approach is relevant for several different aims. When the goal is to learn in a fast way if the idea is valuable or not several approaches are relevant such as the Lean Startup approach (Ries, 2011), the Agile Stage Gate (Cooper and Sommer, 2016) or the Design Sprint (Knaap et al., 2016). These are united by the fact that they all look at a fast, sprint execution of the process in order to speed the time to market of the ideas. This in order to reduce the uncertainty and be sure that the idea is valuable. As it is event the sprint execution that join the above paradigms is strongly linked to the design thinking by the fact that nowadays the process is a subsequence of divergent and convergent phases as well as the activities are somehow similar. Moreover, lately Design Thinking has been adopted by companies in order to foster innovation and better aligned the vision of companies. In this strategic usage of Design case such as PepsiCo or 3M are pioneers with the formalization of the figure of Chief Design Officer. This figure is the promotor of the design thinking paradigm not only for solving wicked problems or in sprint executing an idea but to create the confidence inside people that will join the projects. This further evolution of the design thinking is ladled by researchers Creative Confidence (Kelley, D. and Kelley, T., 2013). Finally, what is emerging is that another aim for embracing design thinking as a paradigm for innovation is the identification of a new direction (Verganti, 2017). In this later approach the mindset and the practices of design thinking are steered toward a higher goal that is the envisioning of the new strategy for the organization. This envisioning process can leverage the strategy (Verganti, 2008) or the technology (Dell'Era et al., 2017).

What is clear in today's market is the plethora of these paradigms of design thinking that differ not only for the aims and the underpinning principles but also for the skills, competences and attitudes that are required for adopting them.

So, the main aim of the paper is to address this topic by exploring the different capabilities that are needed in order to offer different design thinking services. As a matter of fact, this avenue of research is interesting for both practitioners and scholars do to the fact that shift the attention from the process to the people and so enriches the knowledge of both in terms of skills, competences and attitudes that connote the different paradigms.

In order to address such a complex topic, we design a survey in order to gather such information and we decided to focus on the Italian market due to is crucial role in the design environment thanks to the mediatic attention toward several global initiatives such as the Milan Design Week and the Compasso d'Oro award.

The evidences gathered refer to the different skills, competences and attitudes that are relevant in order to deliver different design thinking services. So, after pointing out the four main paradigms, creative problem solving, sprint execution, creative confidence and innovation of meaning the investigations highlighted which set of capabilities were relevant across the different approach. As a result, the paper summarizes in a comparative perspective the most relevant skill, competence and attitude for each of the four approaches. This enriches the knowledge around the design thinking evolution for both practitioners and scholars due to its focus on the people characteristic more than on the process one.

The Paper is structured as follow. After a brief overview of the four paradigms of design thinking a literature review regarding the main skills, competences and attitudes will be reported. Then a dedicated section details the methodology adopted for both the data gathering and the data collection. Thus, the empirical results will be reported before the comparative discussion. Finally, the conclusion with the main contributions and the future avenues of research will be specified.

Theoretical Background

Given the aim of the paper the theoretical background has a twofold objective. First it aims at showing how design thinking has evolved over years from an academic perspective and how four main paradigms can be identified inside the emerging literature. The second is the identification of the relevant set of skills, competences and attitudes that are relevant for better exploring the four paradigms identified.

The origin of design thinking goes back to Rowe, that in his studies in 1987 defined this label. From then on, several researches have been published and the academic attention has grown exponentially to the point that today's in the academic world can be identified different paradigm of the same approach. In particular in this

study we will refer to four kinds of design thinking called creative problem solving, sprint execution, creative confidence and innovation of meanings. These four paradigms are defined in the academic world as approaches toward innovation that leverages on different principles and practices but that are united by the fact that they leverage on a "designerly" way of thinking at innovation (Cross, 2001).

In particular the first kind defined as creative problem solving takes its origin from the idea of facing wicked problems (Buchanan, 1992; Coyne, 2005) with creativity and naïve mind. In particular this approach was framed by Tim Brown that in 2009 framed this approach by pointing out the main underpinning elements. These are: the central role of the human, the iteration and the extensive usage of methods to foster creativity in the ideation phase. Thereafter further researches on design thinking as creative problem solving were performed in order to point out different aspects by adopting different perspectives the processes (Çetinkaya et al, 2013; Johansson-Sköldberg et al., 2013) or the people (Liedtka, 2015).

The second is the one that takes roots from the agile way of manage innovation (Cooper and Sommers, 2016). It is defined as sprint execution and leveraging on the idea that as far as the process is managed internally by the Research and Development team the uncertainty is relay high force the company in looking outside the boundaries by interacting in a fast and sprint way with the market (Knapp et al. 2016). As it is evident by deepening the approach sprint execution is the umbrella under which all the methodologies that focused a lot on Minimum Viable Products and iteration are inserted. This is the reason why this is the second approach of design thinking chronologically speaking. As a matter of fact, even if the lean startup approach (Ries, 2011) is aimed at supporting startups in developing solutions there are profound similarities in the two approaches that allow to generalize this kind of design thinking as sprint execution do to the focus on the fast experimentation and test of ideas in the market (Zeratsky, 2016).

Design Thinking can aim not only at solve wicked problems or execute in a fast way solution it could also support people in feeling more confident in proposing innovation. This usage of design thinking is the one that goes under the umbrella of creative confidence (Kelley, D. and Kelley, T., 2013) and it aims at fostering the individual creativity of the components of the team. So, the design thinking paradigm in this case it is not used to propose new ideas or test them in a fast way but in this case the idea is to use this methodology to incentivise people to be more confident in proposing ideas (Kelly, T and Kelly, D., 2012).

Finally, what comes out from the analysis of both the literature and the market is that the design thinking paradigm can be used also for identifying the new direction for companies (Verganti, 2017). In this case the principles and the aim of the approach is completely different from the previous one even if the "designerly" approach is still present. In particular this last paradigm of design thinking is the one that allow companies to identify new more meaningful direction for their business and so steer their strategy toward a more valuable vision (Verganti, 2009; Dell'Era and Magistretti, 2018).

What emerges from the brief overview previously reported is that in the literature and in the market, there are four kinds of design thinking that despite different aims they all leverages on the central role of the human, the idea of challenge the ideas and to have a defined process to reach the final solution. In particular the four paradigms refer to four different questions. Indeed, the creative problem solving aims at answer to the what question, sprint execution at the how, creative confidence at who and the innovation of meaning at why. These because the first is more oriented on the generation of wild ideas the second to the understanding of the functions of the idea challenged, the third is oriented at empowering the people and the last one at identifying the reason why people should love the new solution.

After having identified and defined the four kinds of design thinking that were the entry point of our investigation we now focus our attention on the capabilities that each of it will require. In order to do that we will review the literature related to three categories of capabilities labeled as skills, competences and attitudes. The reason of this classification is related to the fact that the first are more related to the background of the person and so are more tangible elements while the latter are more close to the soft skills and are inherent to people.

In particular when talking about design thinking the most important set of skills are user analysis, cultural insights, visualization, prototyping, testing and business modeling. These are the one that are recognized as relevant by scholars and practitioners. In more detail, the first, user analysis, is the capacity to gather and cluster insights obtained from users or clients (Veryzer et al., 2005). The second, cultural insights, is the capacity to spot and sense emerging cultural trends (Kolko, 2010). The third, visualization, is the capacity of communicating ideas and thoughts through sketches, images and drawings (Goldschmidt, 1994). The fourth,

prototyping, is defined as the capacity to transform ideas, even not fully developed ones, in tangible and working artefacts (Seidel and Fixson, 2013). The fifth, testing is the skills that allows one to organize the learning extracted from market tests (Ward et al., 2009). The last one, business modeling is the capacity to identify customers, partners and suppliers so that value creation and appropriation are both maximized (Chesbrough, 2010).

The second sets of capabilities considered are the competences. As a matter of fact, in order to properly manage the different kinds of design thinking in the literature it is reported how the competences of the people involved are fundamental in order to reach a valuable result (Danneels, 2002). In particular in this case the set of capabilities considered are framing/reframing, collective leadership, creativity, criticism, brokering and storytelling. The first one refers to the competence in iteratively define and redefine the problem in order to deeply understand the faced challenge and identify new solutions (Schön, 1984). The second is collective leadership defined as the competence in mobilizing human, cultural, and technological resources in order to pursue a shared vision (Denis, et al., 2001). The third competence regards creativity and it is the capability to thinking outside of the box and proposing original ideas (Dorst and Cross, 2001). The literature than shows how criticism is also a crucial competence in design thinking as far as asking questions and providing effective feedback in order to dig deeper in the reasoning is relevant to address different problems (Verganti, 2016). In addition to these considering that design thinking is primarily a designer methodology the competence of brokering: defined as the capability to bridging solutions adopted in different settings and in gaining inspiration from different fields is relevant (Hargadon, and Sutton, 1997). Finally, the competence of sharing ideas trough storytelling is considered by scholars as a relevant competence to be considered in creating the team for delivering design thinking services (Liedtka, 2015).

In addition to the two previous set of capabilities by reviewing the literature and interacting with real companies become evident how the attitudes are also relevant in delivering design thinking projects (Rowe, 1991). So the attitudes that emerged as relevant are optimistic mindset, tolerating failure, embracing ambiguity, troublemaking, pragmatism, empathy. By optimistic mindset scholars refers to the attitude to think optimistically toward innovation results (Carlgren, et al., 2016). The second attitude considered is tolerating failure which stands for the acceptance of failures and willingness to learn from them (Holloway, 2009). In addition to those also embracing ambiguity as the attitude to accept to work on solutions that are not completely defined up to the end of the process is considered relevant by academics in design thinking projects (Sgourev, 2013). Moreover, troublemaking is an attitude that is believed as relevant as the embracing of ambiguity. As a matter of fact, the attitude to challenge continuously the solutions proposed by others is crucial to deepen in the reasoning (Knapp, et al., 2016). The fifth relevant attitude is pragmatism defined as the capability to concretely face problems through the quick identification of feasible, even if simplified, solutions (Romme, 2003). Finally, the empathy (Gruber et al., 2015) so the attitude to look at problems from the standpoint of other people (usually the end user) is the last but most important attitudes of all the four kinds of design thinking due to its centrality in the paradigm of human centered design.

The above overview of skills, competences and attitudes shows the fact that in the literature the capabilities that are recognized as relevant in order to offer design thinking services are present. What is missing is the link between these sets of capabilities and the different four kinds of design thinking previously highlighted. So, the aim of the paper is to enrich the knowledge of both practitioner and academics on which are the different capabilities characterizing the different kinds of design thinking?

Research Methodology

In order to answer to the previous mentioned research question, the paper adopted a survey methodology (Forza, 2002). This seemed, to be the best way to manage the investigation due to the fact that the skills, competences and attitudes emerged from the literature on design thinking and also the 4 kinds of design thinking are present in the academic literature. In particular the survey was framed by the authors leveraging the insights coming from the literature and 47 in depth cases studies analysed in the Italian market. Even if the cases were aimed at a different scope and the evidences are going to be insert in a different paper it is worth to mention that the fruitful discussion between the authors and the companies that offer design thinking services in the Italian market facilitated us in defining the structure of the survey. In particular the first draft of the survey was defined by the authors and then submitted to an international panel of academic experts in order to validate the construct. As a matter of fact, the initial numerosity of the sets was bigger than the 6 constructs that at the end were inserted in the survey. So, after the trial and the validation the survey the final

structure was as follow. The first part was more related to gather information about the respondents than the focus was shifted to the different sets of capabilities that the service providers of design thinking believe are relevant to properly offer the different kinds of design thinking. In particular the structure adopted to perform this second half of the investigation is the most articulated one. As a matter of fact, in order to answer to the above-mentioned research question, we asked informants to allocate 100 points over a set of 6 skills, 6 capabilities and 6 attitudes when the four different kind of design thinking where faced. In order to be more robust in the data gathering we decided, accordingly to the suggest received during the trial, to ask indirectly this aspect. So, we submitted to the managers 4 different briefs that were differently for the actions required and we asked to the informants to point out first the most important skill for that brief than the competences and finally the attitudes. So, at the end each informant allocated 100 points for 4 briefs three times (skills, competences and attitudes). The next section details both the data collection and the data analysis.

Data collection and data analysis

Due to the aim of the investigation and the focus on understanding the relevance of the different design thinking capabilities the survey was performed on the Italian market. In particular only service providers of design thinking services were addressed. This is justified by the fact that the aim of the investigation is to understand the skills competences and attitudes that are relevant in the four different kinds of design thinking previously reported, creative problem solving, sprint execution, creative confidence and innovation of meanings. Accordingly, the survey was submitted February 2018 to more than 500 managers of strategic consultants, design studios, technology developers and digital agencies operating in the Italian market. After a first round 80 replies were gathered and so two rounds of reminder in the period March and April were performed. This brought 100 more replies that after the cleaning of the database from incomplete or incorrect replies caused a reduction to the final number of 130 useful data points that means that 26% percent of the population addressed was reached.

After the collection of the data the process of data analysis started and in particular we divided the analysis into two subsequent phases. First, we considered the three sets of capabilities respectively skills competences and attitudes individually. Second, we compared and contrast the different capabilities among the four kinds of design thinking in order to better compare the capabilities more relevant for each approach. In order to do that the average points allocated by each respondent to the particular brief was considered. So, the mean was used in order to enrich the knowledge of both practitioners and researchers on the most relevant capabilities to offer different design thinking capabilities.

The next sections will report this evidence first by detailing skills by skills than by comparing and contrasting them.

Empirical Results

The empirical results report the evidences coming from the analysis of the 130 answers gathered from the survey. In particular we will follow the structure of the survey itself in reporting the results. So, starting from the skills, we will advance with the competences and finally we report the attitudes. In particular in each section we report the insights for each kind of design thinking pointing out the most relevant one.

Skills

Starting from the skills the set considered in the analysis are the one reported above in the literature and in particular are user analysis, cultural insights, visualization, prototyping, testing and business modeling. These were selected among the large number available because they are crucial and relevant when design thinking is offered. Figure 1 reports the average number of points allocated by the respondents on the four kinds of design thinking in particular in red is reported the allocation on the creative problem solving, in blue the sprint execution in yellow the creative confidence allocation and finally in green the innovation of meanings.

What emerges from the analysis is that in the creative problems solving managers that offers design thinking services believe that user analysis is fundamental to manage such approach. This is coherent with the theory reported above that stress the fact that this kind of paradigm focuses entirely on the central role of human and his needs. For what concern the sprint execution on the contrary the most important skill is the prototyping. Managers averagely allocated 23 points on this stressing how this skill is fundamental to fast comprehend if the idea is valuable in the market. Also, in this case the answers gathered are aligned with the

theory previously exposed. Managers offering design thinking services suggest that when the aim is to support innovators in creating ideas the skill of cultural insights is crucial. This is relevant because people in this approach should be motivated in looking at external trends and gather them in order to better understand the motivation of the people. Finally, when the focus is in offering design thinking services with an innovation of meaning approach the business modelling is the most important skill. This because the reason why people should love the new direction and consequently the solutions proposed should be deeply explored in terms of pain, gains and value proposition.

Figure 1: Skills relevant in each of the four kinds of design thinking

Competences

When the attention is moved from skills to competences and so to capabilities that are more personal and less related to personal background the set explored are framing/reframing, collective leadership, creativity, criticism, brokering and storytelling.

In particular, in the creative problem solving approach the informants pointed out as the most important competence the creativity. This is aligned with the idea that in this kind of design thinking the number of idea generated is quintessential. In the sprint execution the capabilities of framing and reframing and brokering existing solution are equally mentioned as relevant by service providers in the Italian market. These two competences are in line with the idea that in a very short period of time service providers should support companies in solving complex problem by framing and re framing it very quickly. Moreover, the ability to bring existing solution in the ideation phase is something crucial for sprint execution this because otherwise there is not time to properly develop the prototype and testing it. In addition to that Figure 2 highlighted how collective leadership is the crucial competence for creative confidence and how this competence is the most important for service providers that want to offer this kind of design thinking services. As a matter of fact, creative confidence aims at facilitate the creation of innovation by working on the people so the competence of inspiring a collective leadership is crucial. Finally, in innovation of meanings the managers reached by the survey shows how the creativity is important also in this paradigm of design thinking. This is aligned with the idea that this approach is inside out and so without creativity is difficult to generate a new direction that people would love.

Figure 2: Competences relevant in each of the four kinds of design thinking

Attitudes

The last section of the empirical results reports the attitudes that were indicated on average as relevant by the service providers that replied to the survey. In particular the item considered in this analysis were the optimistic mindset, tolerating failure, embracing ambiguity, troublemaking, pragmatism, empathy.

In particular for wat concern the creative problem solving approach the respondents pointed out as the most important attitudes the optimistic mindset and the empathy. These two are due to the fact that this approach more than anyone else requires a deep ability in entering into empathy with the final users and moreover requires an optimistic mindset in order to design the set of possible solutions to the wicked problem identified. Figure 3 then reports how in sprint execution the most important one is pragmatisms and this attitude is linked to this kind of approach by the fact that consultants involved in such approach must be oriented on delivering tangible solutions and practically test the hypothesis. Finally, in innovation of meanings the respondents to the survey spotlight as the most important attitude the optimistic mindset. This is in line with the idea that people could not love a product that you do not love which is one of the pillars of such kind of design thinking.

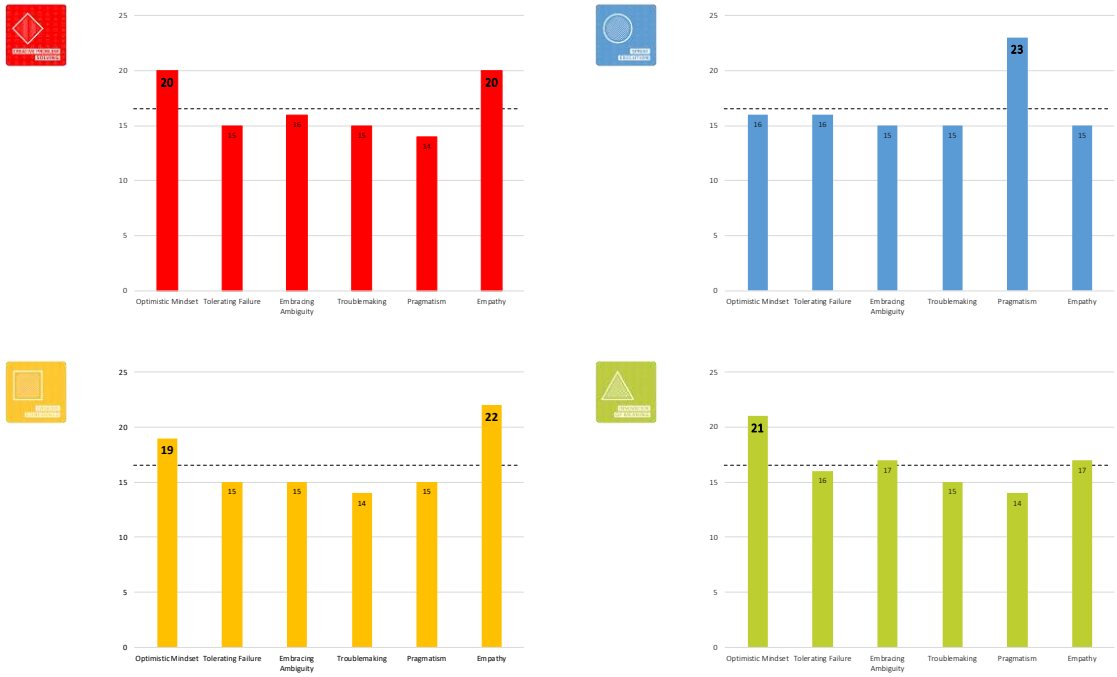

Figure 3: Attitudes relevant in each of the four kinds of design thinking

After having reported briefly the results gathered from the analysis of the 130 responses next section will better compare and contrast the different responses and points out the main contribution both on practices and theories.

Discussion

The following section aims at comparing and contrasting the different skills, competences and attitudes among the different paradigms. This will enrich the knowledge of both academics and practitioners on the relevant capabilities in offering design thinking services.

Starting from the skills the comparative analysis in the creative problem solving is interesting how the skills supporting the divergent phase (user analysis and cultural insights) are almost equal in relevance to the one supporting the convergent phase (prototyping, testing and visualization) the sum is almost 80 points and are 40 for diverging and 40 for converging. This is extremely interesting because on one side support the idea of the double diamond of the Design Council that implicitly says that the traditional creative problem solving is equally distributed on convergence and divergent phases (Brown, 2008), on the other side shed lights on the skills that companies should cultivate in order to effectively promote such paradigms. On the contrary in sprint execution the most relevant are the one related to the converging phase 53 points compared to the 28 of diverging. This is aligned with the idea of the agile approaches (Ries, 2011; Cooper Sommers, 2016) but it stresses the role of the prototyping and test skills. As a matter of fact, the evidences reported in figure 4 shows how this skill are crucial for a sprint execution. If the team is not trained and does not manage properly the creation and testing of hypothesis the success of such approach is a hard to follow. This evidence enriches the literature on experimentation (Thomke, 2003) by stressing is relevance also in the design and innovation field. As a matter of fact, 130 managers of companies offering design thinking services believe that the prototyping and test skills are crucial nowadays. When it comes to creative confidence is evident how the user analysis and cultural insights are more relevant than the remaining ones that are more oriented toward the solution. This insight corroborates the growing attention of design thinking in leadership and organizational behaviour (Martin, 2010; Liedtka, 2015). Indeed, not only researchers are trying to better comprehend how this kind of approach can create a better engagement of people in innovation but also practitioners are really interested in it. What is really interesting is the centrality of the cultural insights. This shows how managers perceive the skill of grasping trends and understanding where people want to go in order to facilitate the creative confidence, this is important because enriches the consideration of the Kelly brothers of just considering the primary role of tools and motivation (Kelly, T and Kelly, D., 2012). Finally, the innovation of meaning is the paradigm that shows, despite for the testing which is undoubtedly irrelevant, a more balanced relevance for

the skills. This insight is for sure relevant because it enlarged the evidence of such a kind of design thinking shifting the focus from the process (Verganti, 2016; Verganti, 2017) to the people participating in it.

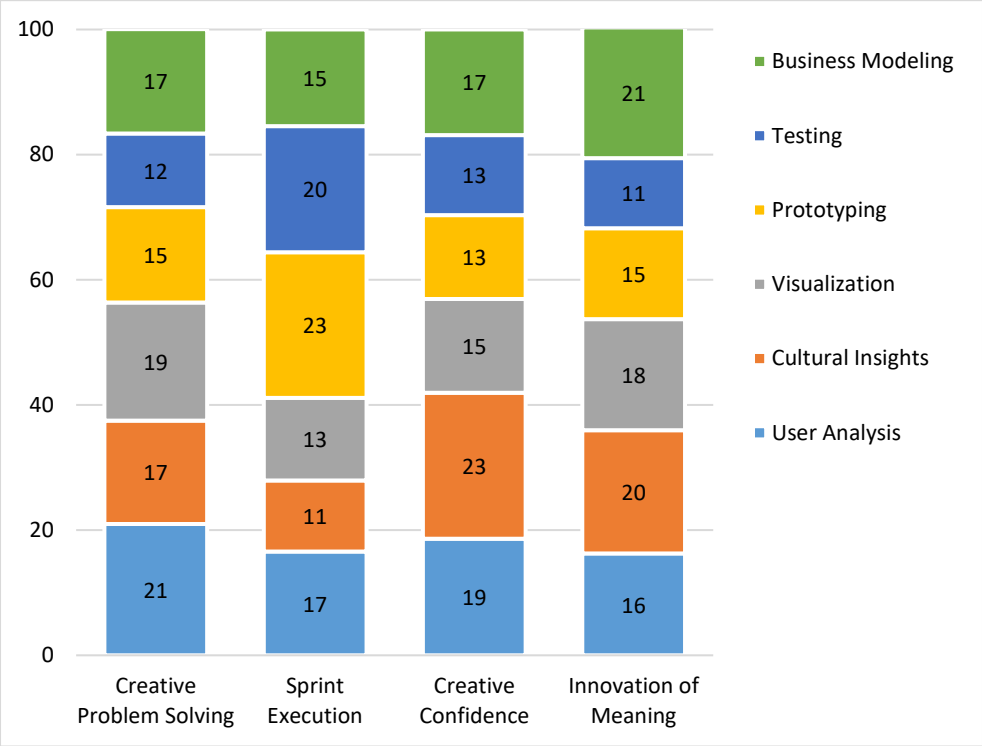

Figure 4: Comparative analysis of the key skills

Advancing the analysis from skills to competences and so from the background of the people to a less sizable capability the competences and the contributions of the investigation evolved.

The most relevant insight emerging from figure 5 is the fact that when it comes to competences, differently from skills, the distribution is more equal among the different 4 kinds of design thinking. As a matter of fact, the only paradigm that requires a different distribution is the creative confidence that differently from the other three shows a peak in the collective leadership. Another interesting evidence is the fact that both creative problem solving and innovation of meanings are requiring a higher creative competence compared to the other approaches. This is due to the fact that creativity is both required in the initial phase of the creative problem solving and innovation of meaning even if the aim of the two approaches is different. Indeed, in creative problem solving the creativity is a competence required for generate a high number of new solutions (Jonson, 2005) while in innovation of meaning creativity is crucial to envision a new direction and considering that it is an inside out approach (Verganti, 2017) is fundamental that the people involved in the project master this competence very well otherwise the first envision of the new direction will be less meaningful than expected. The comparative analysis shows how the competences varies over the four kinds of design thinking and this enriches the knowledge on the capabilities that are more relevant in order to offer design thinking services with different aims.

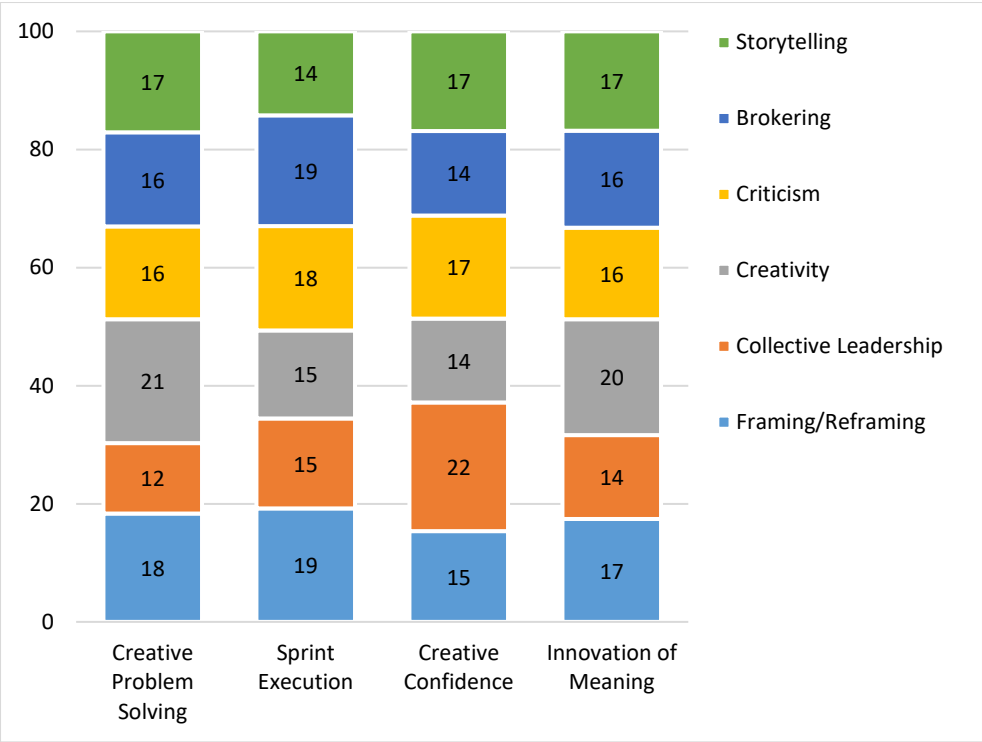

Figure 5: Comparative analysis of the key competences

Finally, the comparative analysis on the key attitudes reports how optimistic mindset is relevant in all the 4 kind of design thinking. The only one in which is just close to the average is in sprint execution while in the other 3 is way above the average. This is in line with the literature of design thinking that reports how this approach should embrace a positive perspective on wicked problems (Carlgren et al., 2016; Calabretta and Kleinsmann, 2017). Moreover, this investigation shows how this competence is cross approach and it is not just relevant in the creative problem solving but it reinforces the value of such soft skill across the different paradigms. The other interesting elements coming from the cross comparison is the fact that pragmatism is a key attitude for sprint execution while is less relevant in the other paradigm. this evidence is coherent with the idea of the agile and scrum methodologies (Sommer et al., 2015) as well as with the design sprint where the orientation toward the resolution of difficult challenges in a practical way is the core goal of these approaches. What is the added value of this research being the fact that in the sprint execution all the other attitudes are equally distributed while the 130 respondents believe that pragmatism attitude is of primary importance as attitude of the team. Finally, empathy shows a significant relevance in creative confidence and creative problem solving while it is less relevant in sprint execution and innovation of meanings. This aspect is interesting because entails a link between the focus of the approach and the role of people. This is for sure interesting because it stresses the relevance in the attitude of the people that should be involved. As a matter of fact, if the focus of the project is on the what (creative problem solving) dimensions or on the who (creative confidence) user needs both inside and outside the team are really important while if the focus is on the how (sprint execution) or on the why (innovation of meanings) the empathy is less relevant. This is counterintuitive because traditional view of design thinking (Buchanan, 1992; Brown, 2009, Martin, 2009) stress the centrality of the human and the crucial role played by the empathize phase while this investigation shows how the empathy is differently relevant in different kinds of design thinking.

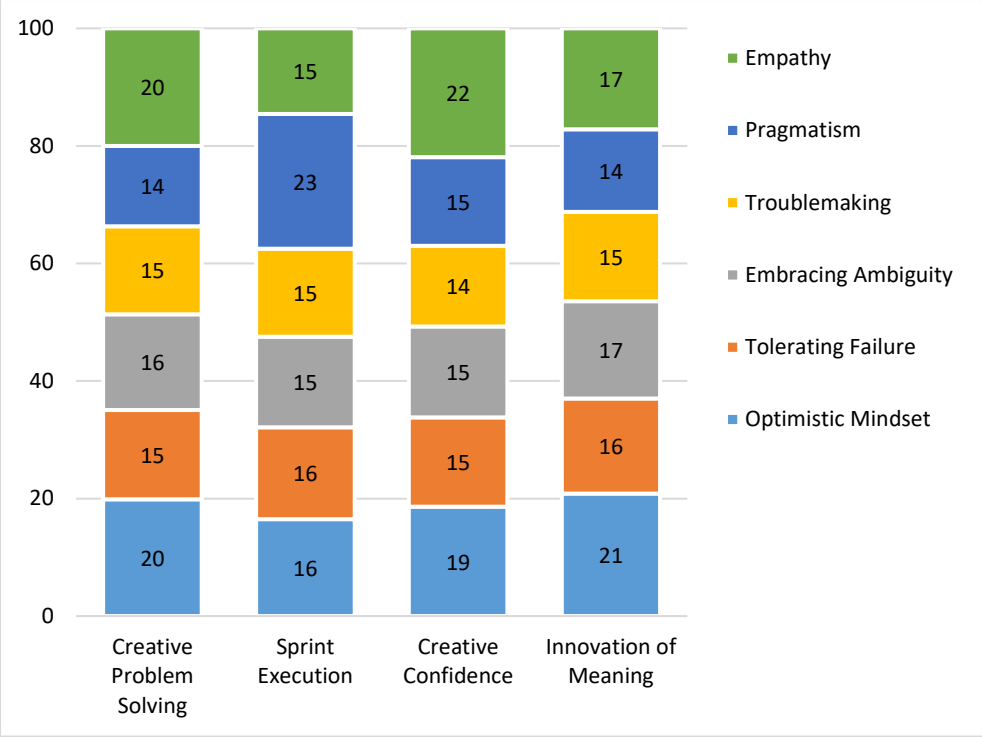

Figure 6: Comparative analysis of the key attitudes

Conclusion

As previously mentioned, the investigation aims at enriching the knowledge of both academics and practitioners on the different capabilities that are relevant and significant in order to offer different design thinking services. In particular by leveraging the results emerging from a survey performed in the Italian market the paper shed lights on the skills, competences and attitudes that are relevant in four different kinds of design thinking. As shared in the discussion part depending on the fact that the innovation project aims at answering to different questions the sets of capabilities that are more relevant are different. Indeed, if the question is what the possible ideas are to address a user need, how can we execute rapidly an explorative test of a solution, who are the people inside the organization that can be better engaged in the innovation process or why people should love the new direction the mix of capabilities required are different. So, by shedding lights on the capabilities the investigation enriches the theoretical knowledge of academics on the fact that the design thinking is evolving from a process to ideate and generate new ideas to a structured methodology to execute, engage and envision. This are the main elements behind the four kinds in order: creative problem solving, sprint execution, creative confidence and innovation of meaning. This is the first contribution of the study. In other words, supporting the fact that the four kinds are not only differentiated by the related aims, questions or process but are also different for the kind of skills, competences and attitudes required in order to be offered to companies. This is an important contribution to the growing streams of design thinking due to the fact that it contributes to a under researched perspective of it that is the capabilities of the teams involved.

Concerning the managerial implication of the study the investigation is important for the practitioners for two main reasons. First because it guides the managers that want to offer design thinking services in better comprehend which set of capabilities are relevant for the team. Second because it could suggest the facilitator of design thinking services on selecting the tools that are more aligned with the skills, competences, attitudes that are required by each approach. This both in term of increasing the probability that people would adopt them due to the alignment with their capabilities and for increasing their capabilities in that direction and so increasing the likelihood of a meaningful results.

Finally, similarly to all the existing academic articles also in this case there are limitation of the research. First the fact that the survey was delivered only to the Italian market could limit the generalizability of the research. Second the study is performed on four kinds of design thinking due to the previous research performed by the

authors and to the fact that this are the most popular one but there are no limits to the possibility of adding others kinds in future investigations. Finally, the sample size, even if quite focused and reliable is for sure not extensive. From these limitations are generated the possible future avenues of research. Of course, a survey that covers more nations could bring more insights, maybe also considering the impact of the national culture. In addition to these researchers could explore a different distribution of the capabilities in order to understand if the degrees of skills, competences and attitudes is valuable. Finally, an extension of the sample also involving the team level and not only the managers of the project could enrich the knowledge on the whole team capabilities and not only on the one perceived as relevant from the service provider perspective.

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The practice of 'managing as designing'

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Recent studies of 'design thinking' for management have criticized the current focus on principles and tools of design thinking, for creating an over-simplified view of a complex process. As a response, this paper sets out to study the empirical details of 'doing designing' in order to explore what 'managing as designing' involves in practice. Adopting a practice-based theoretical orientation, the paper presents findings from the design meetings of three residential refurbishment projects in the UK. The findings suggest that the management of design practices was accomplished through everyday interactions during which the nature and level of uncertainty of various issues were established, and the corresponding adaptive and innovative courses of actions were developed. Based on these insights, it is concluded that 'managing as designing' is primarily about facilitation of everyday organizational interactions, and leadership for the reconciliation of various concerns of multiple stakeholders.

Keywords: management, managing as designing, design thinking, practice

Introduction

Over the last two decades, management scholarship and practice have had a continued interest in 'design' to find ways of dealing with the challenges of continuous adaptation and innovation under uncertainty (Glen, Suciu & Baughn 2014; Marc, 2015). As a result, the concept of 'design thinking' has become prominent in management literature. In management literature, 'design thinking' predominantly refers to methodologies for creative problem-solving which involve a set of principles and practical tools to be applied to complex, ill-defined managerial issues. However, the current emphasis on principles and tools has caused a lack of consideration of the empirical details of 'doing designing' (Luck, 2012), which limits the understanding of what 'managing as designing' (Boland, Collopy, Lyytinen & Yoo, 2008) involves in terms of mundane interactions and activities in an organization. The present paper takes an initial step forward to address that lack by presenting explanations about how mundane interactions in design practices enable adaptation and innovation under uncertainty.

Using the observational data collected from the design meetings of three residential refurbishment projects, the paper demonstrates that managerial activities, which enabled innovation and adaptation under uncertainty, were enacted in practice through mundane sayings and doings of design stakeholders during everyday design interactions. The discussion emphasizes the importance of recognizing the role of unfolding everyday interactions for 'managing as designing' and reflects upon the definition of 'managing as designing' as well as its key practical challenges. It is concluded that 'managing as designing' should be primarily and equally concerned about (i) facilitation of the interactions among stakeholders to support knowledge

representation and negotiations, and (ii) leadership to reconcile the different opinions and concerns of various stakeholders. It is also concluded that more practice-based studies of 'doing designing' are required to further establish what 'managing as designing' involves in practice and to develop strategies for leading and facilitating everyday organizational interactions from a design perspective.

Design thinking and management

In the last two decades, design thinking has gained popularity as an approach to deal with complex challenges of practice in a variety of fields including education, medicine, and business (Dorst, 2011). In the world of management, design thinking has attracted significant attention as a response to the increasing complexity of markets and technologies, within which present day organizations strive to achieve and maintain competitive advantage (Owen, 2007; Kolko, 2015). The main promise of design thinking for management has been identified as enabling innovative problem-solving (Liedtka, 2014) for 'wicked problems', which are characterized by high ambiguity, complexity, multi-facetedness, as well as involvement of multiple stakeholders with loosely defined goals and constraints (Liedtka & Ogilvie, 2011; Glen et al., 2014; Elsbach & Stagliani, 2018). Wicked problems are seen as distinct from so called 'tame' problems which can be defined in homogeneous and non-ambiguous ways, and thus lending themselves to straightforward, optimal and/or standardized solutions (Coyne, 2005). The challenge with wicked problems is that, as initially suggested by Rittel and Webber (1973), their resolution does not have a definitive formulation, and rather relies on intuition and creativity because "the information needed to understand the problem depends upon one's idea for solving it" (p. 161). As a result, design thinking has attracted growing attention in the management world by providing a perspective (Owen, 2007; Dorst, 2011) and an accompanying methodology (Tschimmel, 2012) for enabling and exploiting the intuition and creativity required for dealing with 'wicked' managerial challenges.

However, as recognized by Owen (2007), and Elsbach and Stagliani (2018), if the nature of managerial challenges were imagined on a spectrum with 'wicked' and 'tame' at its opposite ends, any managerial challenge would invariably fall between the two extremes. As a consequence, in practice, design thinking in a managerial context does not imply total exclusion of analytical (i.e. inductive/deductive) thinking but rather the need for skillfully combining both creative and analytical approaches in tandem, depending on the evolving circumstances of the challenge in hand. The need for iteration between these two distinct logics is also apparent in the studies that investigate design thinking methodologies (e.g. Tschimmel, 2012) and those that conduct design thinking experiments (e.g. Seidel & Fixson, 2013). Along those lines, previous work on design thinking in management has established that this process of iteration is highly erratic (Beverland, Wilner & Micheli, 2015; Elsbach & Stagliani, 2018) and fraught with social, cultural and political challenges (Bjögvinsson, Ehn & Hillgren, 2012; Beverland et al., 2015; Kupp, Anderson & Reckhenrich, 2017), which advises against the use of standardized prescribed management scripts.

Although there is a growing volume of research on design thinking in management, there is a paucity of guidance on how to navigate the unfolding situations in practice in order to effectively accomplish the needed iterations (Kimbell, 2011, 2012; Carlgren, Rauth & Elmquist, 2016). As a result, a concern is voiced that the current understanding of design thinking in the management context adopts relatively superficial (Johansson-Sköldberg, Woodilla & Çetinkaya, 2013) and step-wise (Howard, Senova & Melles, 2015) representations of a complex process (Kupp et al. 2017). An important critique is that more focus is needed on the circumstantial and empirical details of design thinking in the management context, because this would provide a better understanding of how meanings are created and decisions are made as situations unfold in practice (Johansson-Sköldberg et al., 2013; Marcus, 2013; Carlgren et al. 2016).

Methodology

The research presented here explores how design thinking enables the management of ill-defined situations in practice. To this end, the paper studies how management was enacted in the observed practices of three construction design projects using a practice-based theoretical approach (Feldman & Orliskowski, 2011). A practice-based theoretical approach suggests that social reality is produced by peoples' actions in situated organizational practices (Orlikowski, 2010). This means that 'management' is not seen as a punctual or distinct act, and neither as performed by distinct individuals called 'managers'. Rather, management, like any other practical undertaking, consists of a set of empirically observable everyday actions and interactions that unfold in certain ways, thus leading to certain outcomes. Key to the adopted theoretical orientation is the relational epistemology (Emirbayer, 1997), which suggests that in practice, entities do not belong to universal categories

with fixed properties but rather gain their meanings as a result of the unfolding organizational whole of which they are part. This suggests that the world is composed of events and experiences rather than distinct entities, and each event arises out of, and is constituted through, its relations to other events (Langley, Smallman, Tsoukas & Van de Ven, 2013).

To explore what 'managing as designing' involves in practice, the research studied the design meetings of three high-end residential refurbishment projects in the UK. The architect was the same firm in all three projects. The observed projects were delivered to private clients who were by and large inexperienced, which made the role of the architects key in the management of these design projects. Observations for this research started after the completion of a year-long internship as Architectural Assistant in the observed firm, which provided the required interactional expertise (Collins, 2004) to make sense of the observed practices. This previous hands-on experience was also essential for the purposive sampling that was used.

Data collection mainly took place through two types of observation during the regular weekly design meetings of the projects. The first type of observation is passive observation whereby the researcher only observes decision-making and does not interrupt the process, allowing the researcher to observe instances and interactions that others within the cultural system cannot (Dainty et al. 2010). The second type of observation is participant observation whereby the researcher becomes part of the decision-making process and has the opportunity to interrupt when necessary. Becoming a participant involves being part of the cultural system, which in turn translates into a better first-hand experience of the organization (Lloyd & Deasley, 1998) and better comprehension of the decisions being made (Millen 2000). Besides the two types of observations, the researcher extensively took notes, as a tool to evoke memories of the events later and as a means of interpreting the events after further consideration (Jackson, 1990; Pink, 2005). Alongside participating in meetings and analyzing the minutes and e-mail correspondence, the researcher was also engaged in reflective conversations with the relevant informants in the case study organization. Data collection was carried out over a one-month period. Within this month the researcher attended seven meetings, which lasted approximately three hours each, so a total of twenty hours was observed. Each meeting had subsequent minutes produced by the project architects and following emails which would question any decisions that were misunderstood or altered after the meeting. The data collection method for the research is represented in Table 1.

Table 1: Data collection method

Projects	*Data collected*
Project 1	- 2 Meetings, each approximately 2.5 hours long. 1st Meeting: (Architect, Client at the client's house) To discuss the design with the client - a combination of passive and participant observation techniques used. 2nd Meeting: (Architect, Client at the office) The purpose of the second meeting was to discuss progress – passive observation technique used. - 2 Subsequent meeting minutes - written by the architect (after each meeting). - 3 Emails, regarding follow up queries from the meetings.
Project 2	- 2 Meetings, each approximately 3 hours long. 1st Meeting: (Architect, Contractor, Basement Specialist at the office) To discuss about pipe problem – passive observation technique used. 2nd Meeting: (Architect, Contractor, Basement Specialist at the office) To cut costs – participant observation technique used. - 2 Subsequent meeting minutes - written by the architect (after each meeting). - 2 Emails, regarding follow up queries from the meetings.
Project 3	- 3 Meetings, each approximately 3 hours long. 1st Meeting: (Architect, Contractor, Engineer on site) To generally discuss design issues – passive observation technique used. 2nd Meeting: (Architect, Contractor, Engineer, Client on site) To discuss design with client - combination of passive and participant observation techniques used. 3rd Meeting: (Architect, Contractor, Engineer, Client on site) To discuss progress - a combination of passive and participant observation techniques used. - 2 Subsequent meeting minutes - written by the architect (after each meeting). - 1 Email, regarding follow up queries from the meetings.

The research uses qualitative content analysis to develop insights into the practice of 'managing as designing'. Drawing upon Schreier (2012), initially two themes of exploration are selected following a deductive strategy that draws upon the adopted practice-based theoretical orientation. These themes are 'establishing uncertainty in practice' and 'the practice of innovating and adapting under uncertainty'. After the selection of the themes, the themes are developed based on the sense that the researcher made of the collected data. Hence, in line with the analysis, as well as the practice-based theoretical orientation, in the following section, the two themes are presented through a set of events. The implications of the themes are then discussed to reflect upon the definition and challenges of 'managing as designing' in practice.

Findings

In this section, findings of the research are presented under two themes. The first theme is 'establishing uncertainty in practice' and the second theme is 'the practice of innovating and adapting under uncertainty'. Using practice-level interaction data, the first theme demonstrates how uncertainty was experienced, judged, and organized in everyday design practices. Building upon the first theme, the second theme then demonstrates how innovation and adaptation were accomplished in practice based on the previously established understanding of the uncertainty. Importantly, when considered together as an ongoing cyclical process, the two sets of interaction provide a practice-based view of 'managing as designing' showing how establishing the problem (i.e. establishing uncertainty) is part of developing a solution (i.e. innovating and adapting under uncertainty) and vice versa.

Establishing uncertainty in practice

Findings from the observed meetings suggested that, in design practices, practitioners established the nature and extent of the uncertainty of an issue through their interactions with others. For example, Event 1 below, which is from a design review meeting between an architect and a client, demonstrates that when the issue in hand was straightforward for all the interacting parties, decisions were made quickly without experiencing any uncertainty. Decisions like this did not even appear in the minutes of the meeting, as the minutes mainly captured pending decisions due to some sort of ongoing uncertainty.

Event 1 (Project 1 – Meeting 1, 100-103)

100	Client	Do we need a USB portal for the sockets?
101	Architect	Better to have the option, won't change size and the
102		cost will be minimum.
103	Client	Great. Let's do it.

On the other hand, uncertainty was experienced when one or more of the interacting parties did not know enough about the issue in hand to agree on a course of action as shown in the following event from the same meeting.

Event 2 (Project 1 – Meeting 1, 250-257)

250	Client	Budget is critical, maybe we shouldn't have under-floor
251		heating if it means that we have to remove all the
252		radiators. Also, if we keep the radiators where would
253		they go? How much is underfloor heating?
254	Architect	We will see the quotation at tender, not sure from the
255		top of my head. We could get rid of another costly
256		element. However, it is difficult to make the decision
257		now without having further information of the costs.

As Event 2 demonstrates, such interactions did not merely reveal the presence of an uncertainty which hampered decision-making, but also they were the means to establish the nature and extent of the uncertainty. By establishing the uncertainty of the issue in hand, these interactions also determined the possible (and acceptable) ways forward. In Event 2, the decision about the heating system could not be made due to the uncertainty about the cost of various heating-system options, and this diagnosis led the interacting parties to postpone the decision until they see the quotations in tender.

The events below (Events 3 and 4) present interactions from the same design review meeting (A1, 340-354) and from the follow-up email (E1, 10-19), and provide another example of establishing uncertainty through interactions which then suggests an agreeable way forward. Similar to the previous event, the uncertainty is established to be about the cost implications of alternative design solutions. However, in the events below, it becomes apparent that the architect had multiple considerations when judging the nature and extent of the uncertainty as opposed to the client having one major consideration, which was the cost.

Event 3 (Project 1 – Meeting 1, 340-354)

340	Client	See here, on this elevation, there is glass covering
341		the staircase. Would it be possible to expose the
342		staircase? Wouldn't this make it cheaper?
343	Architect	You need the fire glass so as to isolate the basement
344		from the ground floor, allowing the space to be fire
345		protected.
346	Client	Isn't fire glass more expensive? Could we have the
347		separation of the floors at another point?
348	Architect	No. But perhaps we could redesign the stairs so that
349		there isn't such a large area with glass. So we could
350		have glass in the basement and then only a glass
351		balustrade on ground floor. Any other option of boxing
352		the ground floor will be cheaper but won't look very
353		good. Let's put it in for tender and then decide.
354	Client	Ok, but the best option is the cost effective one.

Event 4 (Project 1 – Email following Meeting 1, 10-19)

10	Client	I thought that we were having (fire) glass only at the
11		basement level with the ground floor to be boxed in
12		rather than replaced with glazing to save costs?
13	Architect	We mentioned that at some point but I really think
14		putting a wall up will completely destroy the space. We
15		need to open up and make the descent to the
16		basement inviting.
17	Client	I am concerned that we are adding further to the cost
18		but I guess we will have to see what the tender prices
19		come out at and value engineer at that stage.

The events above (Events 3 and 4), suggest that the architect operated at multiple levels of analysis bringing richness in the process of establishing the uncertainty. This suggests that establishing uncertainty was not an isolated process of simply comparing the knowledge required with the knowledge available. Rather, it was a co-construction process where various concerns, which were based on practitioners' expertise and understandings of the situation, were expressed; and therefore, addressed.

Event 5 below is particularly interesting because it reveals that uncertainty did not always refer to a lack of knowledge, but it could also be a matter of knowledge representation and/or persuasion. Besides, similar to the previously presented events, this event once again demonstrates that the way in which the uncertainty was established, determined the way it was addressed.

Event 5 (Project 1 – Meeting 1, 50-63)

50	Architect	We need to get rid of the fixed island as the current
51		clearance is not enough. Also, the bench is reducing
52		the versatility of the space.
53	Client	Is it too much to have a table and a sofa?
54	Architect	A solution for you to have a flexible space which has
55		an island, table and sofa would be to re-create the
56		linear space into a U-shaped kitchen, with the table
57		acting as an island. This will enable the rest of the
58		space to allow for a sofa and more seating

59		arrangements [drawing to show ideas].
60	Client	To be further convinced I would like some 3D
61		drawings, as I cannot visualise the space as proposed
62		at the moment. Also good to have these options in 3D.
63	Architect	Ok sure. I have to persuade you; this is the best option.

Overall, these events suggest that, in practice, 'uncertainty' was not a generic issue about a general lack of knowledge about the developing design. Rather, it was enacted in practice in uniquely situated ways based on the unfolding interactions that were driven by the varying expertise, understandings, and so, concerns of, the interacting parties. As a result, establishing the unique nature and extent of the uncertainty provided the frame in which innovation and adaptation could be accomplished. Next, the focus of the analysis will shift to the details of the interactions through which such innovation and adaptation were enacted.

The practice of innovating and adapting under uncertainty

As implied by the findings presented in the previous section, once the uncertainty was established for an issue in hand, the way in which it was established had already created a frame in which innovation and adaptation would/could be achieved. This was because establishing the uncertainty involved establishing the concerns around a decision. Hence, according to this explanation, adaptation meant adapting to various concerns that were deemed important by the design team, and innovation meant finding the solution that adequately addressed such concerns.

The events presented in the previous section have already provided some examples of this dependency between the practical actions for adaptation and innovation, and the way in which uncertainty was established. For example, when the client raised his concerns about the cost in Events 2, 3, and 4, the decision was to wait until the tender to see the quotations. In these instances, pausing the decisions around the heating system and the type of the balustrade were the enactments of 'adaptation' in practice. Similarly, pausing the decision to address the cost uncertainty was what enabled the solution's relevance for the client's needs, which was key to enabling an 'innovative' solution.

However, the findings of the research suggested that the dependency between 'establishing uncertainty' and 'adapting and innovating under uncertainty' was not linear but cyclical. This meant that establishing uncertainty framed the potential ways forward for adapting and innovating, but the act of establishing uncertainty itself relied upon the previous decisions relating to adaptation and innovation because such decisions shaped practitioners understandings and concerns around a particular issue. Hence, the meanings of 'uncertainty' and 'adaptation and innovation' co-evolved in practice. This aspect of design practices is exposed in the event below through the references made to the shared past of the interacting parties (i.e. an architect, a basement construction specialist, and a representative of the main contractor). Here, the references made to the past decisions helped developing an actual understanding of the uncertainty around the issue in hand. Then, this updated understanding of the uncertainty paved the way forward for an adaptive and innovative decision that progressed the design acknowledging the lessons learnt from the past discussions and decisions.

Event 6 (Project 2 – Meeting 1, 110-143)

110	Contractor	Need to know the diameter of pipes to make a good
111		judgment call about the required depth and length the
112		excavation requires.
113	Architect	If we don't know the dimensions required we cannot
114		redesign need your expertise [points at basement
115		specialist (BS)].
116	BS	Perhaps we could have a diverter.
117	Architect	We had tried that previously, but it didn't work.
118	BS	So then we could drop the ceiling height to
119		accommodate the length of the pipe.
120	Architect	Can save cost doing this option. However, we need to
121		consider the depth issue with reaching the water level.
122	BS	In that case you can consider using piles instead, even
123		though the costs may increase.
124	Contractor	How about underpinning instead, it can be considered

125		as temporary works which is cheaper?
126	BS	The problem with underpinning is that you have to keep
127		it dry, so if we don't know the level of the water it might
128		not work as a viable option.
129	Architect	Also, underpinning will require further drawings, so it
130		will increase both the costs and the completion date.
131		As an alternative however, how about if we raised
132		everything by 300mm? There is room for the head
133		height in the basement to be reduced.
134	BS	You could drop the level of the main instead so the
135		level of the height will not be affected.
136	Contractor	Only a water company can tell you the level of the
137		water. If it's low then we could just drop the main.
138	Architect	The ideal scenario would be to get rid of the piles and
139		move the mains downwards.
140	BS	Yes, that is the most cost effective option. If the pipe
141		can be moved, great, if not we need to do the piling
142		option. We need to find out where the water is and then
143		we can meet again to make that decision.

The event above illustrates that, in practice, innovating and adapting were not punctual acts. Rather they were about continuously advancing the understanding of the uncertainty based on various perspectives that had a stake on that issue and taking a series of decisions based on this developing understanding.

However, the situated and path-dependent understanding of 'uncertainty', also meant that, with time, the previously made decisions reduced the number of alternative ways forward by knitting different parts of the design increasingly tighter. In such cases, adaptation and innovation were still derived by the interactions of practitioners with different expertise but in more constrained ways as shown in the following two events.

Event 7 (Project 3 – Meeting 1, 10-21)

10	Engineer	To have sufficient circulation ventilation you will require
11		a new unit and pipe to make it work.
12	Architect	How much will this cost?
13	Engineer	(sum) pounds.
14	Architect	That is quite a lot. How about we push the floor above
15		slightly back to allow for trickle ventilation?
16	Engineer	No, that won't be a cheaper solution as the wires have
17		already been built into the floor.
18	Contractor	How about we ensure that the windows on this floor can
19		be opened?
20	Engineer	I am afraid that the one I am suggesting is the cheapest
21		option. No other alternative I am afraid.

Event 8 (Project 3 – Meeting 1, 50-66)

50	Architect	Can we use this depth for the electrics meter and the
51		AC?
52	Contractor	Yes but the depth of the AC is more, so the space will
53		seem disproportional with both in the same room.
54	Architect	Ok. How about the distance between gas and
55		electricity?
56	Engineer	Not enough room, you need to leave a substantial gap
57		in the utility room.
58	Contractor	How about placing it here, on this side of the wall?
59	Engineer	Yes, we could slightly adjust the timbers so that it
60		would fit.
61	Architect	Could we move the timbers even more so that the AC
62		can fit in here as well?

63	Contractor	That is possible. How about the AV racks? We need
64		space for those as well.
65	Engineer	We could put the AV racks in the media room
66		horizontally instead of vertically, so they don't take up space.

Most of the times when issues were discovered with the previous decisions, these could be addressed within the constraints of the previously taken decisions as shown in Events 7 and 8. However, sometimes rewinding of the decisions was required to return to a previous state of uncertainty which would then release a wider set of options for adaptation and innovation as shown in the event below.

Event 9 (Project 3 – Meeting 2, 50-58)

50	Client	I need more storage in the utility space.
51	Contractor	We had a discussion two weeks ago about how much
52		wiring is required to go here and how this is the
53		optimum solution in terms of electrics and AC. That will
54		mean that you won't get as much storage as you
55		initially wanted.
56	Client	Storage is premium, anything you can do will be
57		appreciated.
58		[Contractor and architect look perplexed]

Overall, the findings suggest that the capability of design to adapt and innovate was a result of simultaneously working with different understandings and extents of uncertainty around different issues through multiple ongoing interactions between multiple stakeholders. In this context, adaptation and innovation were not punctual acts but ongoing accomplishments which relied on progressing the stakeholders' understandings of 'uncertainty'. Although this enabled the much-needed flexibility and experimental learning, this way of progressing also sometimes required rewinding of the decisions due to the changing concerns of stakeholders and/or discovery of previously unforeseen or miscommunicated issues.

Discussion

In management literature, 'design thinking' predominantly refers to methodologies that consist of a set of principles and tools that lever creative problem-solving for ill-defined challenges. A closer look at the practice of 'doing designing' reveals how managerial activities were accomplished as part and parcel of everyday design interactions, thus enabling insights into what 'managing as designing' involves beyond the use of design perspective merely as a problem-solving methodology for certain complex issues. This section will start by discussing the implications of the findings on the definition and practice of 'managing as designing'. The first part of the discussion builds upon the first theme presented in the findings section (i.e. 'establishing uncertainty in practice') and reflects on the definition of 'management' within the context of 'managing as designing'. Building upon the second theme presented in the findings section (i.e. 'the practice of innovating and adapting'), the second part of the discussion reflects on the key practical challenge of innovating and adapting while 'managing as designing'.

Managing as designing

Boland et al. (2008) claim that applications of a design perspective to management should consider design as a process rather than a noun. Adopting a practice-based view of 'doing designing', findings of this paper sheds some light on what this means. First of all, the findings of this research suggest that 'managing as designing' is not as much about maximizing exploration in all circumstances as implied by the majority of the previous studies on 'design thinking' for management. Rather, the findings suggest that, 'managing as designing' is first and foremost about the capability of establishing the uncertainty associated with an issue in order to come up with a decision-making process that suits the perceived nature and extent of the uncertainty. From Event 1, it is clear that some of the issues that were faced were perceived as straight-forward and did not require effortful exploration. Whereas in other events (e.g. Event 3, 6) the significant effort put into exploration of potential solutions was apparent, when there was an uncertainty which hampered decision-making. Therefore, it can be argued that application of design perspective to the management of an organization is essentially about establishing the environment and mechanisms that can filter and sort the issues depending

on the nature and extent of the uncertainty that is associated with them. By doing this, the observed design teams simultaneously worked at various levels of uncertainty, thus optimizing their use of time and effort, and only engaging in effortful negotiations when an uncertainty was noticed based on their professional and/or interactional expertise. This argument is in line with Kupp et al. (2017) who suggested that, in order to reach its full potential, design thinking in business must be more closely aligned with the realities and social dynamics of established businesses. Hence, in order to use design perspective as an organizational management approach, it is necessary to reflect upon the existing knowledge and interactional repertoires of the organization with the purpose of establishing the environment and mechanisms that can effectively notice, filter, and address issues based on their nature and extent of uncertainty.

The findings also emphasize that 'uncertainty' associated with issues was not something absolute; but rather uncertainty was established through the interactions of the practitioners who have a stake on that issue. Based on this, Event 5 demonstrated that uncertainty can be a matter of knowledge representation and/or persuasion among the interacting parties. Furthermore, Event 4 showed that experts with different backgrounds operated at multiple levels of analysis of uncertainty even if they did not explicitly bring these levels into their discussions with other practitioners. These findings highlight that 'managing as designing' should primarily be about enabling adequate means and processes of communication as opposed to setting abstract managerial goals and/or performance criteria based on long-term planning. Methodologies of 'design thinking' provide a sense of the variety of communication means and processes that can be used while establishing and addressing uncertainty. However, in line with the point made above, this paper suggests that organizations must develop their own communication means and processes based on their existing professional and interactional strengths and expertise. This implies that 'managing as designing' fundamentally requires a sound understanding of the multiple levels of analysis at which various organizational actors operate when judging uncertainty. Such an understanding would be the basis for the management to identify which existing interactional patterns are useful and needed for 'managing as designing', which ones can be abandoned, and what new patterns of interaction might be useful.

The key practical challenge of 'innovating and adapting'

The findings highlight the interplay between innovating and adapting while 'doing designing'. The events showed that adaptation and innovation were not punctual acts, but they were rather enacted through design interactions. This meant that they were not exclusive and separate from each other but rather they were implied by each other. When decisions are paused in Events 2, 3, and 4, this can be seen as an adaptation to the uncertain environment, but it can also be seen as the necessary course of action for enabling an innovative solution that consider the needs of the client. On the other hand, in Event 6, various design specialists negotiated the potential ways forward to fit various elements in a limited space and came up with an innovative solution. However, this discussion had a strong sense of 'adapting' to the existing design constraints that were due to the previously made design decisions. In both cases there were both adaptation and innovation, however, in the first instance a design decision was not made, and design exploration was left open, whereas in the second one a decision was made within the constraints of the previously made decisions. There is also some evidence in the findings that previously made decisions could be reversed occasionally when the benefit of doing such was judged to be higher than adapting to the previously made decisions. However, this meant rework and extra time, which could be frustrating for design practitioners, due to returning to a previous state of uncertainty.

Therefore, the key practical challenge of 'innovating and adapting' in design practices can be articulated as the judgement of whether adaptation to uncertainty or adaptation to constraints are required for various instances. As illustrated in Event 9, in such cases, various stakeholders may have different opinions regarding the course of action to follow due to their peculiar concerns. This does not only mean a challenge of knowledge representation and/or persuasion but also reveals that, while 'managing as designing', a higher-level prioritization of certain types of concerns can be useful to reconcile various individual concerns of different stakeholders. Nevertheless, such priorities must be set and articulated attentively in order to avoid the suppression of the richness of having various opinions. For example, in several of the presented events, it was apparent that lowering the cost was the top priority for the client, who was the project sponsor, and therefore, the most powerful actor in the presented settings. This higher-level prioritization helped reconciling various views, and so, had a strong influence on the ways in which practices unfolded. However, on the other hand, Event 4 explicitly showed that the architect had concerns about 'destroying the space' for the sake of

reducing the cost, which revealed the risk of suppressing the richness from various opinions through such higher-level priorities.

Conclusions

Over the last two decades 'design thinking' has attracted significant attention from the managerial world based on the promise that it provides methodologies to tackle complex, ill-defined business problems. The focus on principles and tools of 'design thinking' in management literature has recently started to attract criticism due to the instrumentalist view of design that it favors, which lacks an adequate consideration of the empirical details of the complex process of designing. As a response, this paper presented findings of a practice-based inquiry into the design meetings of three residential refurbishment projects in the UK. The analysis of rich empirical data on design interactions revealed insights into the practice of 'managing as designing' by exposing how uncertainty was experienced, judged and addressed as well as how innovation and adaptation were enacted, through everyday design interactions. The findings suggest that 'managing as designing' of an organization is essentially about establishing the environment and mechanisms that can filter and sort the issues depending on the nature and extent of the uncertainty that are associated with them. A fundamental requirement to enable this is to have the adequate means and processes of communication to support the interactions. However, the key practical challenge of 'managing as designing' is identified as the conflicting needs of addressing various concerns presented by multiple stakeholders and reconciling such concerns, while assuring that there is progress towards an adaptive and innovative solution.

Based on these arguments, it is concluded that management under a design perspective should be primarily and equally concerned about (i) facilitation of the interactions among stakeholders to support knowledge representation and negotiations, and (ii) leadership to reconcile varying opinions and concerns of various stakeholders. It is also concluded that more practice-based studies of 'doing designing' are required to further establish what 'managing as designing' involves in practice, and to develop strategies for the facilitation of, and leadership in, everyday organizational interactions from a design perspective.

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Research Perspectives IN THE ERA OF Transformations

Exploring the Fourth Order: Designing Organisational Infrastructure

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Companies are organised to fulfil two distinctive functions: efficient and resilient exploitation of current business and parallel exploration of new possibilities. For the latter, companies require strong organisational infrastructure such as team compositions and functional structures to ensure exploration remains effective. This paper explores the potential for designing organisational infrastructure to be part of fourth order subject matter. In particular, it explores how organisational infrastructure could be designed in the context of an exploratory unit, operating in a large heritage airline. This paper leverages insights from a long-term action research project and finds that building trust and shared frames are crucial to designing infrastructure that affords the greater explorative agenda of an organisation.

Keywords: corporate infrastructure, fourth order design, action research, design process, innovation

Introduction

In recent periods, as companies aim to establish *organisationally fit* or *resilient* exploitive organisations (Martin, 2019; McGinn & Hacket, 2019), it has become increasingly attractive for organisations to create specific innovation labs (Blindenbach-Driessen & Van Den Ende, 2014). These labs perform the needed exploration of new strategic possibilities to lower the risk of disruptive innovation (O'Reilly & Tushman, 2013). Some companies' plan their explorative capacity by using the logic that they know from exploitative activities. An example is Unilever's R&D organisation, where R&D is split up in research streams that mirror the commercial organisation but are separated in a stage-gate manner. Alternatively, some organisations' experiment with other organisational designs such as corporate venturing units or cross-disciplinary teams with mixed results (Tushman, Smith, Wood, Westerman, & O'Reilly, 2010). The foreclosure of the Disney, Coca-Cola, Turner and Microsoft innovation centres over the past 3 years (Berengian, 2017), is testament to the challenges of creating organisations that afford the creativity and risk-taking associated with innovation while supporting the need for effective outcomes (Pisano, 2019).

In recent years, driven at least in part by *Design Issues* editor Richard Buchanan and catalysed by the special issue of *Design Issues* 'Design and Organisational Change', a number of (design) scholars have come to a common understanding. To:

> *Emphasize design as a professional practice that is consciously moving into the domain of organisational design and organisational change, drawing from areas of design practice that are more*

closely identified with design as it is commonly understood in the design community, including architecture, industrial design, information design, and interaction design. (Buchanan, 2008, p. 4)

These scholars posit that a design approach, taken to a strategic level, may result in both a different change process and different organisational structures (Gruber, De Leon, George, & Thompson, 2015) which can be better suited to support exploratorive activities.

Despite a number of publications that mention this movement of design (Buchanan, 2015; Dunbar & Starbuck, 2006; Gruber et al., 2015), few papers explicitly display how organisations could be 'designed' or what the expected benefits might be (Buchanan, 2008, p. 8). This research leverages the insights of an 18-month action research engagement to display such a process. Additionally, we introduce the concept of organisational *infrastructure* as design material. In this paper, we thus aim to explore: (1) what are the components of organisational infrastructure, and; (2) how can we design with these components? This paper thus contributes an initial methodology, a sequence of steps and an underlying philosophy (Kettinger, Teng, & Guha, 1997).

Literature Review

Organisations

According to Puranam, Alexy and Reitzig (2014) who have accumulated heavily cited definitions of an organisation, an organisation is "a multiagent system with identifiable boundaries and system-level goals (purpose) toward which the constituent agent's efforts are expected to make a contribution" (p. 163). Underlying this definition is the assumption that organisations are formed to allow a group of individuals to achieve more than they would alone (Junginger, 2008; Puranam, 2014) and that within large organisations, sub-organisations may be identified, with separate actors and goals.

For example, the airline that was studied in this project has a clear group of members (in-house and contracted employees), boundary (activities performed by the company) and purpose (to survive as company by raising capital through the business of transporting customers and goods). Additionally, within this airline, we could identify specific sub-organisations such as the department that is responsible for ground handling (which focusses on a minimum number of delays) and the department that is responsible for the operations inside the plane which focusses on customer- and-employee satisfaction.

In line with Tushman and O'Reilly (1996) an organisation can be described by looking at four aspects: the (1) culture, (2) structure, (3) strategy and (4) the processes used to create value for end-customers (Stoimenova & De Lille, 2017). All of these four aspects can be 'designed' in a way if design is viewed as the act of making plans (Dorst, 2017). For example, many tech-companies currently focus on realizing 'an engineering culture' of which the design is materialized through the definition of a number of values. Of these four, this paper focusses on solely infrastructure, as a variation on structure, as it has received the least attention from design scholars so far.

As Buchanan (2015) states: "most of the research and applications of design have focused on attitudes, skills, methods, and techniques" (p. 5). Whereas design scholars have published on how a design approach can improve an innovation culture or mind-set (also named *design attitude*) (Kochargaonkar & Boult, 2014; Michlewski, 2008; Yee, Jefferies, & Michlewski2017), innovation processes (or *design thinking*) (Lievesley et.al (2017), and strategy for innovation (also coined as *strategic design* (Calabretta, Gemser, & Karpen, 2016). Yet how one practically goes about the design of an organisation's infrastructure remains largely under-researched (Brown, Buchanan, Doordan, & Margolin, 2008)[1,2].

[1] Exceptions are the papers in the *Design Issues* special paper from 2018: Design and Organisational Change (Boland et al., 2008; Buchanan, 2008; Junginger, 2008) and scarce other papers (Brown & Martin, 2015; Junginger, 2005) in which the design process is presented as a complimentary activity to the design of more concrete products and a conference paper (Kronqvist & Salmi, 2011) in which infrastructure is designed in conjunction with a new innovation process.

[2] Organisation Design is a related but different topic as it aims to compare the effect of organisational structures and developmental processes, for organisational designers to then implement (Dunbar & Starbuck, 2006). We specifically focus on the process of creating new designs, explicitly leveraging local context. Nevertheless, we aim to build a bridge by leveraging knowledge from the organisation design field, for example by adopting Puranam's (2014) micro-structural approach to organisations.

Organisational Infrastructure

Similar to how product designers need knowledge of materials and experience designers need to understand the components available to them, so do we search for the materials of fourth-order design. It is to this end, that we aim to introduce organisational infrastructure as design material.

Much like structure, the word 'infrastructure' has been used on many occasions in a wide variety of media and has lost much of its meaning (Prud'homme, 2004, p. 3). Infrastructure, according to the Oxford living dictionary (n.d.) and the *business* and *academic content* Cambridge dictionary (n.d), describes the systems and services that are needed to operate or work effectively. In contrast, a description of structure focusses on the arrangement of- or relations between parts of a system (Oxford living dictionary, n.d.). Infrastructure thus provides more focus and detail on the elements themselves and the interaction between the system and the user is of crucial importance[3]. If we take the budgeting systems as example, we are more interested in how the budgeting system works and what 'the rules of the game' are, than how the budgeting system relates to the HR system.

Infrastructure is the "built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space" (Larkin, 2013, p. 328). Infrastructure is often approached functionally (Torrisi, 2009): we don't design roads, bridges or tunnels, we design *a highly effective transportation system for an engaged society.* Similarly, when considering the design of organisational infrastructure (infrastructuring in participatory design[4]), we aim to conceive a means for communication, rather than the meetings structure or hierarchical design. A budgeting system, again, provides an example: it is a means for employees to receive capital for their projects – which in turn provides a means for innovation outcomes. In sum, we engage with infrastructure not because of the elements themselves, but because (when coupled with labour) they are a means to support and maintain work to be done (Agid, 2018; Prud'homme, 2004).

Designing in the fourth-order

As Gabay (2018) illustrates after an extensive literature review (as indicated in Table 1), designers have a distinctive approach to problems if compared to a typical business approach. As a result, a design process is human-centred, future-oriented and visual (De Lille, Roscam Abbing and Kleinsmann, 2012), focussed on creating new opportunities over selecting from existing alternatives and it emphasizes co-creation (Aguirre, Agudelo, & Romm, 2017) and prototyping (Carlgren, Rauth, & Elmquist, 2016).

Table 1: Contrasting business and design, adopted from Gabay (2018)

Criteria	*Business approach*	*Design approach*
Value	Exchange-value: quantitative, objective (revenue, costs, profits)	Use-value: qualitative, subjective (experience, emotions, desires)
Focus	Customers, market (age, gender, size)	Humans, culture (personality types, backgrounds, traditions)
Tools	Analytical, numerical input, (ROI, BEP, NPV, CLV), 'Planning Oriented'. Support 'yes or no' decisions	Intuitive, observation, imagination, empathy (ethnographic research, journey mapping, prototyping), 'Action Oriented'. Reveal and connect new information
Attitude towards uncertainty & failure	Uncertainty: Fight (reduce, eliminate or control) Failure: avoid or eliminate	Uncertainty: Embrace (explore, experiment) Failure: accept

[3] Additionally, Prud'homme (2004, p. 4) and Star (1999) provide a number of specific qualities of infrastructure such as embeddedness.

[4] The verb *Infrastructuring* has also received increasing attention within participatory design literature (Hillgren, Seravalli, & Emilson, 2011). Although these authors' do refer to some similar qualities such as a long-term focus and embeddedness, our conceptualization is organisation-based.

Logic	Deductive, inductive	Abductive
Activities	Exploitive	Explorative
Work Processes	Linear, clean, short	Iterative (circular), messy, long
Thinking	Convergent	Divergent, convergent
Bias	Reliability (inability to include new relevant information)	Validity (no consistency in processes and measurements)

As designers' have been tasked with increasingly complex and wicked problems (Muratovski, 2015), scholars have realized the suitability of the approach due to how it reframes problems and solutions (Dorst, 2017) and its human-centeredness (Norman & Stappers, 2015). However, designers will also need to develop new methods to use their skills in this new context (Björgvinsson, Ehn, & Hillgren, 2012; Norman & Stappers, 2015).

In *Wicked Problems in Design Thinking*, Buchanan (1992) distinguishes between four (4) areas in "which design is explored throughout the world by professional designers and by many others who may not regard themselves as designers" (p.9). These areas (as visualized in figure 1), have no hierarchy and may be seen as working domains in practice (Golsby-Smith, 1996). In recent years, a number of authors have suggested that an increasing number of designers act on the *Systems, Organisations and Environments* level (Boland, Collopy, Lyytinen, & Yoo, 2008; Cooper & Junginger, 2009; Gruber, De Leon, George, & Thompson, 2015; Kronqvist & Salmi, 2011; Muratovski, 2015). In this level, organisations are seen as products which can be designed (Buchanan, 2008). Designing at this level focusses on systemic integration and the performed activities, which may be spurred by design on other levels, are geared towards finding a new 'organizing thought' and the resulting organisational changes (Buchanan, 1998, 2001; Junginger, 2005).

According to Golsby-Smith (1996), fourth order designers need to deal with three unique features in their approach: purpose, integration and systems (or community). First, the fourth order designer needs to understand and influence the *field* which revolves around processes and tasks, consisting of system level values and a purpose. Second, design in this order seeks integration with connected systems and activities. Third and last, is a focus on people or communities, in which discussion is not only fostered but the direction and facilitation of the conversation is key.

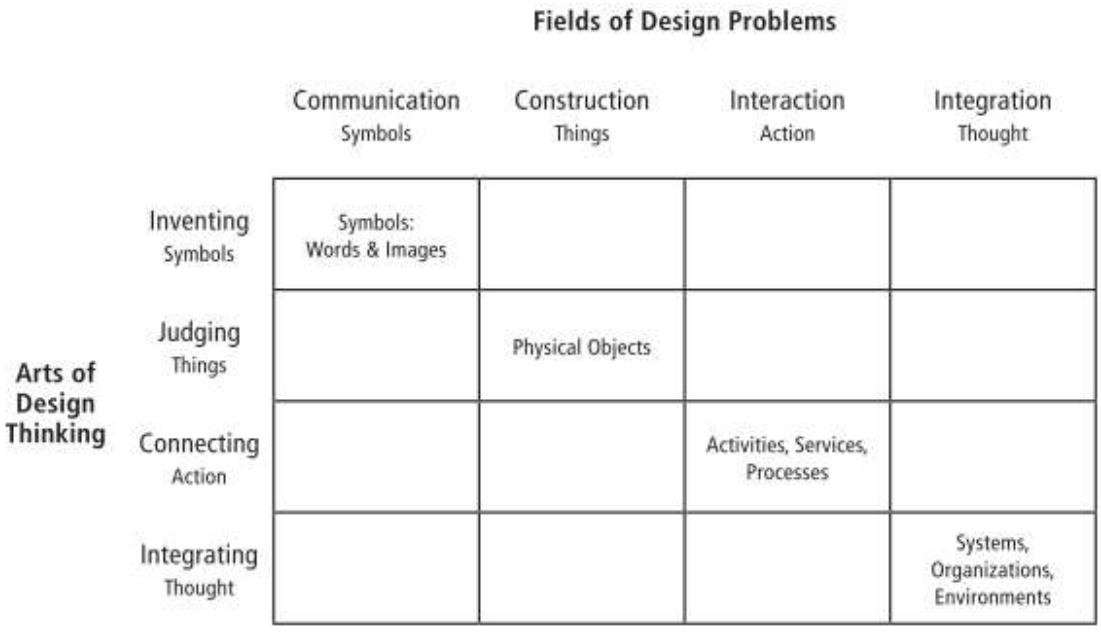

Figure 1: Four orders of design (Buchanan, 2015)

Research Design & Methodology

To explore what organisational infrastructure consists of and how it can be designed, an action research approach was applied (Reason & Bradbury, 2008). This approach fits the explorative nature of the study and the importance of the contextual (social) embedding of the phenomenon to be studied (Coghlan, 2011). The overall research design is similar to that used by a 'Design Innovation Catalysts' as described in detail by Price (2016). Crucially, a long-term engagement was set-up between the first author, a designer by education, and a large airline (from hereon: FlyCo). Over an eighteen (18) month period, the researcher conducted three individual *Action Research Cycles* (Lewin, 1946).

This paper reports on the insights gained in the third and final cycle, where the action researcher was asked to act as manager of an innovation team and use his knowledge and experience of design to come up with a new organisational infrastructure. During this cycle, the first author became 'an insider' (Brannick & Coghlan, 2007; Ottosson & Björk, 2004) and spent four days of every week as line manager of a small team, responsible for creating and prototyping operational innovation. The researcher joined meetings with directors and executive vice presidents, but also spent a significant amount of time with project level and operational employees. He thereby gained access to a vast amount of internal data sources, including strategic documents and was able to record rich insights into the dynamics of the organisation (Brannick & Coghlan, 2007).

Qualitative Data Generation and Collection

During this period, the design researcher author carried a digital diary in which he took field notes of observations from one-on-one meetings and group participatory observations. This primary mode of data collection is used to gather:

> *In-depth descriptive details of people (including oneself), places, things, and events, as well as reflections on data, patterns, and the process of research. These details form the context and quality control that shape multiple qualitative data points into articulated, meaningful, and integrated research findings.* (Brodsky, 2008, p. 324)

The observations were captured in plain text, drawings, schemes, pictures and film. The author thus aimed to record not only observable facts, but also his own experience of the process of designing infrastructure and theory building (Herr & Anderson, 2005). The observations were captured on a password protected digital device and standard company in-house measures could be followed to ensure data security. Additionally, semi-structured interviews with fellow managers were done to canvas the organisational infrastructure and how innovation was realized (Sarpong & Maclean, 2012). Finally, a second researcher interviewed (and performed a focus group with) the team-members regarding their experiences as innovators within the company and as participants in the infrastructure design process.

A number of measures were taken to increase validity and reliability of the research design, which focused in this case on minimizing reactivity, 'going native' and alignment (Langley & Klag, 2017). To improve construct validity, both data and methodological triangulation were performed (Blandford, 2013). Additionally, by member checking our findings with the participants of the study, possible interpretations were evaluated from multiple perspectives to increase rigor (Baxter & Jack, 2008). Finally, to avoid a distorting subjectivity effect, on the fifth day of the week a 'critical friend' (in this case colleague) was used to discuss findings and conclusions (Herr & Anderson, 2005).

Foci: Components of Organisational Infrastructure

To be able to collect data in the field regarding organisational infrastructure and in line with this papers' aim to contribute to a practical understanding, the concept of organisational infrastructure is further broken down into a limited set of observable components. As this research explored the concept of organisational infrastructure as design material, the specific materializations of the components were not completely predetermined by literature. Rather, throughout the first two cycles of this action research project, the four (4) tasks of organisation (Puranam et. al, 2014) and the qualities of infrastructure (Prud'homme, 2004; Star, 1999) were used as guidelines to identify organisational infrastructure components at the studied company. Table 2 provides an overview of the identified components of organisational infrastructure.

Table 2: Identified components of organisational infrastructure – building on Puranam et al. 2014.

Component title	Example questions
The division of tasks	
Team composition	What different functions work together in a team or on daily basis?
Team responsibilities	What is a team held responsible for? What do they need to complete?
Hierarchical structure	Who reports to whom? Who evaluates whom?
Location	Where do people work on a daily basis? How do people communicate?
The allocation of tasks	
Project selection criteria	How are projects selected? Which projects are prioritized and why?
Formal roles	What are official internal titles, what terms are used in job vacancies?
The provision of rewards	
Budget systems	How are budgets allocated? When and through which systems do teams request budget?
Team Key Performance Indicators (KPI's)	How are teams evaluated? On which aspects or by which measurements?
Professional development paths	How and on what basis are employees promoted or (financially) rewarded?
The provision of information	
Hierarchical structure	(see above)
Meeting structure	Who is invited to which meeting? When do these take place?

Qualitative Data Analysis

As this paper focusses specifically on the infrastructure design process, only data from evens that were explicitly related to this process were included in the analysis. An overview of which data was in- and excluded for the analysis for this paper can be found in the appendix. In total 26 pages of field notes from one-on-one meetings, 29 pages of field notes from group activities (such as meetings) and 40 reflective notes were analysed. Together, this adds up to just under 100 *temporal observations* of the design process (Langley, Smallman, Tsoukas, & Van De Ven, 2013). Additionally, seven (7) one-hour interviews were included in the data-set.

A qualitative data analysis process was performed over a two-step process as proposed by Braun and Clarke (2006). First, the authors spend an extensive amount of time to get familiar with the data on a high, process level. This was done by mapping key events of the process and the related insights of these moments as prescribed by Poole, Van de Ven and Holmes (2000) (and exhibited in Figure 2). Secondly, a thematic analysis was performed, which involved searching for themes in the data based on reoccurring patterns and testing these themes on the entire data set.

Figure 2: Data familiarization through process mapping

Findings

A key characteristic of action research is an element of change which is introduced by the researcher. As a result, and as exemplified by Lüscher and Lewis (2008), action research is often reported in a narrative form where events and reflection are combined (Reason & Bradbury, 2008). In this manner, the following sections describe how organisational infrastructure was designed.

The Context and Design Challenge

As a traditional, network carrier, FlyCo faces constant competitive pressure from low-cost airlines. Specifically, FlyCo is challenged to continually improve its operational performance, both in quality (i.e. avoiding delays and cancellations) and in quantity (i.e. optimizing the amount of flights per aircraft per day). To this end, an innovation team was established. This team (team Y) uses (co-creative) design and lean start-up methodologies to find and quickly prototype new operational tactics to be implemented in live operation. Table 3, at the end of the end of the findings section displays the organisational infrastructure of the team before the redesign process.

At its initiation, Y focused on realizing results quickly, by utilizing a lean governance structure, close ties with top management and by holding to a credo of 'learning by doing'. The team and especially their managing director noticed over time that an increasing number of innovations that were prototyped weren't further developed and implemented whilst there was no apparent reason or decision to kill development. After initial prototyping, these projects would end in *the Valley of Death* (Markham, Ward, Aiman-Smith, & Kingon, 2010). As the director would later recount: "…the former manager of the team, he would use his network and willpower to get stuff done. He would just keep nagging at every table until it was realized. That doesn't work anymore" (field note, 17/08). The *Valley of Death* was becoming an increasingly important problem, one field-note of another meeting with this director shows "We need to make bottom-line impact. Otherwise, others will do it" (field note, 24/04). Crucially, the lack of implemented innovation started to influence the credibility of the team (field note, 20/05 & 29/5).

Additionally, an increasing number of departments within FlyCo became interested in the way of working that team Y developed and wanted to apply those same methodologies. However, articulating, translating and transmitting a way of working required new capabilities and the team found it challenging to organise this activity within their current infrastructure (field note, 04/06).

After a personnel change, the managing director was left searching for a (temporary) manager. After inquiry by the author into replacement, the director asked him to consider the job (field note, 16/05). The author would be tasked with determining a strategy for Y to go "into a new S-Curve" and together with the team and the director, design a suitable organisational infrastructure.

Process overview

Over period of six months, a number of sessions were organized by the first-author to support the infrastructure design process, as exhibited by figure 3. These sessions were structured and presented as a co-creative design innovation process. By this framing, the author hoped to invoke the same open-minded, creative and critical mind-set that the team was known for and thought themselves to be (internal communication, 09/09). Additionally, by doing this, the author explicitly framed the process of infrastructure design as similar to the process of product innovation design. These sessions were preceded by a number of meetings in which the assignment was presented by the managing director and the challenges were further elaborated by the parting manager of the team. After the strategic sessions, three one-on-one meetings were held between the author and the manager to finalize the design. Finally, the results were presented to the team.

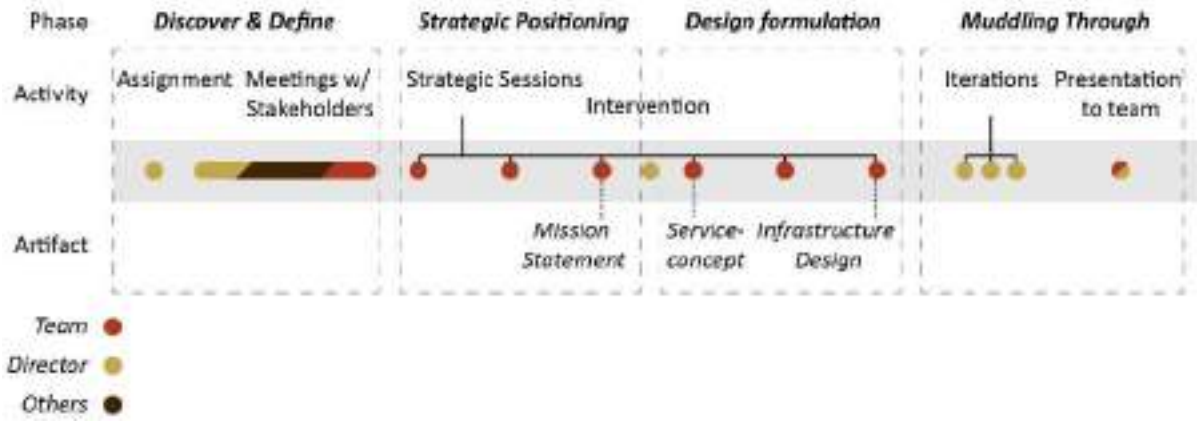

Figure 3: Infrastructure design process

Four phases of the design process

The design process can be divided into four phases which differ in the type of activities that were performed, and the stakeholders involved. The first phase included the analysis of the status quo and the problems to be solved by the new infrastructure. Following this, a higher abstraction level was assumed in which a new strategic direction was created for the team. This direction was embodied in the formulation of a new mission statement. After this phase, this strategy was gradually given body by defining the *service concepts* needed to attain the strategy and constructing the necessary infrastructure. Finally, this plan or infrastructure design, was presented to the managing director. At this point, a final process of iteration and negotiation began as a final design emerged. In the next paragraphs, each of these four phases will be examined in more detail.

1) Discover and Define

Initially, the author met with the departing manager, former and current employees of the team and again with the director. During these unstructured interviews the challenge to be tackled was explored. Through open-ended questions, starting from the current challenges of the team, asking about the historic development of the organisation and collectively looking forward towards possible solutions, the author aimed to uncover both explicit and implicit dynamics (Sanders & Stappers, 2012). Additionally, the author participated in regular team meetings and observed during meetings and informal discussions. This allowed the author to see the described organisational dynamics and uncover additional information that may have seemed irrelevant for the interviewees.

Over this period, the challenge to be solved was explicated from different angles. Some indicated team culture as an important factor: "scaling-up prototypes is just not in the mind-set of the team" (field notes, 07/05).

Others pointed towards “unclear targets” which “weren’t defined” (07/05) or according to some “didn’t focus on implementation… If they would, the process would change” (field note, 15/05). Still others mentioned that work pressure interfered with actions to ensure implementation (15/05). Finally, additional challenges surfaced during this period, such as internal team struggles (field note, 16/05). In sum, the design brief expanded considerably over this period as the context became clear. This process may be best compared to what in design process descriptions are often called the *Discover* and *Define* phases (Liedtka, 2015).

Two observations during this period are particularly recurring and thus worth noting. First, there seemed to be many different ‘frames’ (Dorst, 2017) through which to look at the Y team and their challenge (within and outside of the team). According to some, Y was a team that had unique research capabilities and therefore could educate the business on their needs. It was referred to as the team that came up with the concepts that people didn’t know they wanted, or the team that co-created solutions with employees. As described by Dorst (2017), these different frames influenced the perceptions of the challenges to be solved and the ‘criteria’ with which the new design would be judged.

A second observation was a disrupted bond between the members of the Y team and the director, due to a decreased level of (field note, 12/06). This also appeared to be related to a figurative ‘distance’ between the Y team and the rest of the department (field note, 25/05). This situation complicated the entry of the author into the team (as he was hired by the director) but also complicated the process in general, as for example, team members weren’t forthcoming about their concerns and viewpoint on the problem to be tackled (field note, 12/06).

2) Strategic Positioning

After the author spent his first months on the job, the director posed a question to the entire team: “Do you accept my assignment? Will you design a strategy and think of an organisation which shows how to design innovations…takes these innovations from concept to implementation and… brings your way of working to the rest of the organisation?” (field note, 19/06). This was the trigger for the first-author to organize a series of strategic sessions in which the team co-created a new strategy and organisation.

In total, six (6) sessions were organized by the author, of which three (3) focused on crafting a strategy and three (3) on designing the organisational infrastructure. Participants in these sessions were the PO’s, the author and an employee from the larger department who represented an outside view. During these sessions (which lasted on average 3 hours), (silent) brainstorms were held and a constructive and critical discussion was fostered to come to agreed-upon statements.

In the first session the author presented his findings of the first months as context. These were presented in the form of statements. For each statement, the team debated on whether they agreed and/or whether changes were needed. These statements generally focussed on the merits and dangers of designing a strategy in general and what would make a good strategy. Statements included were for example: “without a clear strategy, we will have prioritization issues” or “a strategy will help us to communicate better with Business Owners” (internal correspondence, 26/6). The team also initiated a brainstorm on what would be the downsides of determining a strategy, and thus what the strategy should not result in. These included statements such as: “a strategy might result in tunnel-vision.” (field note, 18/07). Finally, the team felt the need to determine what ‘a strategy’ would include. A decision was made to adopt a strategy design tool which defines four linked elements:

1. Where are we now?
2. What is our vision of this team and department?
3. What projects will get us there?
4. What are our guiding principles in getting there?

The second meeting focused on getting ‘on the same page’ (internal communication, 19/07). Beside exploring the strategies that were made in previous sessions and exploring the current business context, the author touched upon a number of examples from other companies. Also, the team agreed upon a number of major themes to focus the strategic efforts on: (1) mindset, (2) tools, (3) methodology and (4) organisation.

The third and final meeting focused on defining a new vision and mission for the team. Out of a silent brainstorm, a clustering exercise and a thorough discussion, the team came up with a statement which described why the team existed and what it intended to achieve.

With the formulation of this statement, the team effectively decided on which frame to pursue during the next phase. This was important as team members mentioned earlier that they found it challenging to think about and propose decisions regarding their own infrastructure due to the uncertainty of their situation and the complexity of the problems they were facing (field notes 24/07). Without a specific frame to pursue, decisions regarding infrastructure seemed impossible to make (reflective journal, 26/07).

3) Infrastructure Design Formulation

The last three strategic sessions had the aim of translating the new mission to more concrete infrastructure. This phase was initiated with a one-on-one meeting with the director, in which he indicated an expectation to implement a piece of infrastructure. This element had been discussed in earlier sessions and seemed to compliment with the new mission. Following this intervention and a session in which the team defined a *service-concept*[5]*,* two (2) sessions were organized in which the concept was translated into elements of the organisational infrastructure.

This discussion was facilitated with the use of a template adopted from Van Assen (2019). Eventually, three 'products' were defined. In the final two sessions, an organisational infrastructure that would facilitate the 'production' of these products was proposed. Again, this infrastructure was eventually 'coloured-in' by answering a number of questions collectively and coming to a final answer through discussion. Questions that were likened those presented in table 2 (internal correspondence, 06/08).

A noteworthy observation is that in the *service-concept* session, fierce debates erupted in which team members realized that their frames on the team (and implicitly on the problem to be solved) did not match. Even though the team members had agreed on a mission statement, a chasm appeared between two groups of team members. Eventually, the author had to make a decision. When this was done, the rest of the infrastructure elements, such as team roles, responsibilities, resourcing and KPI's fell into place[6]. As one of the team-members mentioned: "It's weird…we are just talking from our toes, really from the inside…we're just writing down stuff that we already know implicitly" (Memo, 24/08). Finally, what is interesting to note about these sessions, is that the team uncovered that to be able to implement their solution, they needed to include the infrastructure design of another team into the scope. This conclusion essentially broadened the scope of the both the problem and solution space. This co-development of problem and solutions is typical for a design process.

4) Muddling Through

In the final phase of the infrastructure design process, the author presented the work that was done and the results to the director. The new mission statement, service-concept and infrastructure was presented with the aid of visualizations which acted as prototypes. Subsequently, the author and director performed another round of iterations to make the design fit with the progressed insight of the managing director and other developments that were taking place in the department (field notes 13/09). Finally, the new design was presented back to the team. At the time of writing, a selection of elements of the design have been implemented. Within the context of fourth order design, this final phase should be considered an integral part of the process. Currently, the managing director and newly appointed manager are muddling through: opportunistically and incrementally implementing elements of the design (Norman & Stappers, 2015).

In this final phase, the previously mentioned trust issue re-occurred. This especially surfaced when the final design was presented to the team. First, they mentioned that they missed the connection between what they had felt owner of through co-creation and what was presented back to them (field notes 05/10). Second, the team indicated that they found it challenging to work with and towards a design that wasn't completely detailed yet, as long as they couldn't trust that their vision was aligned with that of the director (field note, 22/10).

Another resurfacing issue was that the author and director appeared to have different frames. This became especially apparent in a discussion on team composition. Whereas the director preferred a composition which was more fit for the development of solutions (exploitation), the author proposed a team that would be

[5] To define a 'service concept', is to decide if the team were a miniature company, what would it offer, what would it need and how would it organize itself?

[6] According to Dorst (2017), this is common on design processes. Once a working frame has been identified, solution elements are easily identified.

equipped for research and ideation (exploration) (20/09). This was eventually resolved by adopting a new frame, in which teams develop over time to perform both functions subsequently (internal communication).

The Infrastructure Design

Table 3 illustrates the previous organisational infrastructure of team Y as well as the new infrastructure that resulted from the design process (infrastructure that was altered is bolded for emphasis). This table indicates the nature of the changes that were applied as well as the scale of the changes. As can be seen, the new design differs on many aspects from the original design.

Table 3: New Organisational Infrastructure of Y Teams – changes in **bold.**

Component title	*Infrastructure of Y teams*	
	The division of tasks	
Team composition	• Full-time former operational staff • Part-time operational staff (gate-agents, baggage staff, etc) • Access to an internal team of software developers	• Full-time former operational staff • **Full-time analytical staff** • Part-time operational staff **when needed** • Staffed with **in-team software developers when needed** Full-time former operational
Team responsibilities	• Analyse operations to define bottlenecks • Design & Prototype concepts to prove feasibility, viability and desirability • Spreading way of working to other departments	• Analyse operations to define bottlenecks • Design & Prototype concepts to prove feasibility, viability and desirability • **Support a new team which spreads way of working** • **Develop and implement solutions** • **Evaluate operational impact**
Hierarchical structure	• Reporting to a director, who reports to the COO in the operational organisation (as opposed to the support or sales organisation) • In a department with high-tech product teams that develop software tools for the optimization of the operation • Not formally connected to other innovation teams	• **Reporting to a product manager,** who reports to the director • In a department with high-tech product teams that develop software tools for the optimization of the operation • Not formally connected to other innovation teams • **Supported by a *capability lead***
Location	• At the airport, close to *the action*, far from other teams in the department	• **Co-located with other development teams** • **With a lab at the airport, close to '*the action*'**
	The allocation of tasks	
Formal roles	• Product Owners[7] (PO's), expected to set, manage and perform activities needed to develop concepts and	• **Challenge** Owners, expected to set, manage and perform activities needed to **tackle 1 challenge** and related stakeholder

[7] Adopted from the 'agile' methodology but adapted to a context of prototyping.

	stakeholder management. Also responsible for daily management of the builders • Builders, operational staff that design features and prototypes and perform tests.	management. Also responsible for daily management of the builders **in their team** • Builders, operational staff that design features and prototypes and perform tests
Project selection criteria	• Yearly objectives are set for the team in agreement with business owners[8] • Manager of team gathers challenges related to objectives from business owners • Team selects projects based on a number of factors[9] • Product Owners take-up challenges whenever they have time left with no distinction for the business in which the challenge lies	• Yearly objectives are set for the team in agreement with business owners • **Challenge owners** gather challenges related to objectives from business owners • **Challenge owner** selects projects **related to their challenge** based on a number of factors[10]
	The provision of rewards	
Budget systems	• Yearly budget set for staff and costs of prototyping • Separate budget 'envelope' to finance software support, based on high-level plans for half a year	• Yearly budget set for staff and costs of prototyping
Professional development paths	• Unclear	• Unclear
Team KPI's	• Number of prototypes tested at scale & implemented in the organisation • Number of departments that are engaged	• **Amount of progress made on objectives set by business**
	The provision of information	
Hierarchical structure	• (see division of tasks)	• (see division of tasks)
Formal meeting structure	• Bi-weekly update with small portion of operational innovation staff • Weekly team meetings with PO's and team manager • Bi-weekly update with other PO's from the department • Team manager meets weekly with management team of department	• Bi-weekly update with small portion of operational innovation staff • Weekly team meetings with **C**O's and team manager • **Product manager** meets weekly with management team of department

[8] This was as it was presented and designed, the data shows however that objectives were only set once at the start of the team and the team added objectives along the way.

[9] The expected operational impact, technology, priority as indicated by business owners and *wow*-factor.

[10] A new set of criteria was developed, including expected operational impact and cross-departmental engagement.

• (Bi)-monthly update meetings with business owners	• **Challenge owners meet regularly with business owners**

Conclusion & Practical Implications

This paper introduced the concept of organisational infrastructure and explored its potential as part of a widened view of fourth order subject matter. Four interlinked elements of organisational infrastructure are presented based on literature and observations. Also, we describe a methodology which uses these elements and includes four stages, consisting of interviews, co-creative sessions and a final 'muddling through' phase.

Even though this project has assumed a design process which likens to that of lower order design projects, some fourth-order elements are clearly distinguishable. First, throughout the process, the facilitated search for team and department *purpose* is recognizable as proposals for mission statements and infrastructure designs brought to light differences in what the purpose of the team should be. Second, there is a recognizable attempt to reach integration, which culminated in the 'muddling through' sessions, but which is also recognizable in the fact that the scope of the project was enlarged with another department. In this case, the search for integration also allowed for an organisational design to emerge which explicitly recognizes and facilitates an ambidextrous operation.

Two notes of caution for the application of the presented approach to organisational infrastructure design should be mentioned. First, it is important to have established a bond of trust between those that are part of the organisation that is being redesigned and the designer. Overcoming ambiguity and uncertainty, which are typical elements of design processes, is challenging when the object to be designed is the infrastructure of an organisation. In this context, we do not design a tool to work with, *but what to work on, how to work and who to work with*. This personal level of involvement seems to magnify moments of uncertainty and a lack of trust in either the process or the designer thus introduces considerable challenges. Involvement of all stakeholders on a more regular basis, the authors' feel, may mitigate this challenge.

A second implication from the discussion of the results is the perceived effect of not explicitly agreeing on a reframed problem statement. During the described process, the author, director and team did not openly agree on *what problem* the infrastructure design should solve and thus which frame to operate from. As a result, conflicting frames re-appeared a number of times, confusing and frustrating stakeholders when viable solutions to problems were ignored or undervalued because of diverging frames.

This research also indicated towards two (2) possible benefits of designing organisational infrastructure. First, similar to Junginger's findings (2005), the co-creative approach to organisational infrastructure design resulted in engaged employees who felt ownership of change. With this sense of ownership came an openness from employees to quickly adopt the designed change. Second, the explorative and iterative approach allowed for the problem and solution to co-evolve. By allowing this, a more holistic and coherent design could be developed. However, despite the noteworthiness of these observations, future research is needed to establish these more firmly.

Finally, this paper presented the results of an ongoing analysis and as such includes only a sample of the available data. Future research will involve further qualitative data analysis of all three action research cycles and write-up regarding the journey of FlyCo as a company undergoing transformation via design. Further research will be performed to explore, amongst others, the interplay between the Y team and the rest of the organisation as a result of these organisational changes.

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Appendix:

Table 4: Overview of selection of data for data analysis

Included	**Excluded**
Field notes	
- Only third research cycle - Meetings and strategic sessions with director - Y team meetings surrounding major strategic events - Introduction meetings with former team manager and related business owners - Strategic sessions with Y - Trainings sessions with larger department (on implementing innovations)	- First and second research cycles - Introduction with management of other departments/units - One-on-one meetings on daily business - Leadership coaching meetings - Y team meetings in general
Interviews	
- Y team members and managing directors on organisational infrastructure	- Y team members and other FlyCo employees on general processes and innovation management
Reflective Memo's	
- All audio and visual reflective memos from the third research cycle	- All audio and visual reflective memos from earlier research cycles
Archival data	
- Working document strategic sessions - Presentation to director on organisational infrastructure - Mails, presentations and memo's related to major events in ARC 3	- Archival data, such as documents and presentations from earlier research cycles - Mails & memo's unrelated to organisational infrastructure or the assignment

Digital Britannia – Secret Histories and Hidden Practices

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Digital design practice is distinctive in its relationship to material and focus on fabricating that into interactive products and services. It's a discipline that has evolved from significantly different disciplines: Product Design and Human-computer Interaction (HCI). The foundational role that HCI played in the growth of digital design is largely hidden, as is the secret world of design practice. These two shrouded phenomena have evolved from early user interface research, through user experience, to today's post-agile world and tomorrow's open design. We report ten years of first-hand accounts to create a grounded, contextualised and evidence-based account of design in the real-world from the 1980s to today. This condensed history of digital design in the UK forms the basis of the concluding sections. The first traces the evolution of design practice over the last ten years. The concluding section presents a first-hand account of practice. This case study shows how design is now deeply permeated by business and development ideas and practices. The paper concludes with some ideas of how digital design practice might progress beyond this presently constrained condition.

Introduction

1980s Invention – from controls to interfaces

Human–computer interaction emerged in in the UK in the late 1950s. In 1959, Brian Shackel, published the first article in the area entitled 'Ergonomics for a Computer'. This was based on his experience designing what was effectively the 'user interface' of the EMIAC II, albeit one that consisted largely of knobs and lights. Shackel's influence in HCI continued to be felt in later years both in the industry-facing HUSAT research centre at Loughborough, and his role in establishing IFIP TC 13 and the INTERACT conference series in the early 1980s.

However, academic HCI in the UK owes perhaps its greatest debt to the Alvey programme. In 1983, and in response to the Japanese 5th generation computer programme, the UK launched its own half–billion-pound funding programme. This covered five core research areas including the 'Man–Machine Interface'. The choice of these areas was determined by a commercially savvy, industrial committee. The group foresaw the essential role of the human in future computing, something that computing academics at the time regarded as marginal.

This programme was largely responsible for the creation of major cross-disciplinary HCI research groups, including those at York and QMUL, as well as strengthening existing work in the area such as Loughborough, John Long's Ergonomics Unit at UCL (now UCLIC) and usability standards work under Nigel Bevan at National Physics Laboratory. Early work on accessibility can also be traced back to this time in the UK (Edwards, 1987) catalysed by Alan Newell's work at Dundee University. To this day, the 'children of Alvey', PhDs and researchers first employed in the programme, are widespread in the professoriate across the UK and contributed to growing early commercial adoption.

Another initiative of that period was the British HCI Group, (now a specialist group (Interaction) of the British Computer Society (BCS)), and the British HCI Conference. The latter was one of the core international venues at the time as well as nurturing the growing UK HCI community, both in academia, but also the initially small group of practitioners employed in agencies and companies such as IBM in the midlands and NCR in Dundee.

The close connection between research and practice continued into the 1990s with the UK joint industrial–academic CSCW programme. Whereas Alvey had fostered research connections between psychology and computing, the CSCW programme brought sociologists and management science into the interdisciplinary milieu, which was unusual if not unique in the world. This rich community attracted both Lucy Suchman, who brought ethnography into HCI, and Xerox Europarc to the UK. During this time, early courses in interaction design emerged coinciding with Bill Moggridge's tenure at the RCA.

By the dot-com years at the end of the 1990s, the British HCI community, in both academia and industry, was mature, and had a unique character of its own that often connected theory with more practical methods and design. The small but growing number of interactive agencies were filled with graduates of the UCLIC's MSc programme. Indeed, some of the children of Alvey, themselves became the hi-tech entrepreneurs of the dot.com boom.

1990s Refinement – from text books to standards

The rapid emergence of multimedia for both business and consumers in the early 1990s, extended HCI from the ergonomics of the workplace into the mainstream. Dix *et al* (1993) was a prevalent HCI textbook for the early masters' degrees in multimedia. Until this point the consumer had little access to technology, but as early handheld devices (e.g. Palm Pilot) appeared, and mobile phones became not just a tool for young professionals but a fashion accessory, ergonomics for consumer electronics converged with IT design.

The first edition of Dix, et al (ibid) is often thought to be engineering-driven, and iterative waterfall methodologies are not unusual for its time of publishing. Part I, Foundations, spends a hundred pages on "the science bit" and part III a similar amount on futuristic and emergent issues, but part II, Design Issues, spends three hundred pages on the process. Therein are multiple references to standards and guidelines (pp 161-168) for that which is produced, but also for the processes (pp168-188) for producing it, leading with Usability Engineering. This focus on design rules and guidelines is extended further in later editions of this book and also in Preece et al (1994), Benyon et al (2005), Sharp et al (2007), other definitive textbooks that followed.

Nowadays, the engineering focus is almost a curiosity. At the time, however, constraints of processor, memory and connectivity were considerable, and, in our experience, the risks of any failure were high and expensive. Personal computers booted from floppy disks, CD-R was an expensive (£20 per disk) and fragile technology. In 1991, a SCSI hard drive with the capacity of a CD cost over a thousand dollars. It cost $25,000 (and a flight to LA) to digitise an hour's MPEG-1 video to fill a CD-i in 1994. Any failure or unnoticed error in the digitisation, the authoring, the mastering, or the pressing, erased profit margins and drove many early multimedia companies out of business in the latter 1990s.

Nevertheless, it became clearer that good usability is a fundamental objective of digital design and that this should be achieved by conforming to standards both for content *and* for process. By INTERACT'99, the conversation had progressed to how to make usability, itself, usable. The gathered academics viewed usability as mature, the attendees from government felt that "Usability Now!", a decade earlier, had "transferred the technology" to industry, and local TV captured industrial exhibitors using "ease of use" to differentiate their innovations. Yet employers complained about graduate skill sets, and major product investments were still leading to marketplace failure due to poor usability or accessibility.

In the meantime, dedicated individuals such as Charles Brennan, Nigel Bevan, Jonathan Earthy, Martin Maguire and Catriona Campbell had succeeded in codifying, first into British and then ISO Standards (e.g. ISO13407 (1999) - *see below*), and then into government policy, definitions of process and content.

> *[…] an approach to interactive system development that focuses specifically on making systems usable. Whatever the design process, the allocation of responsibilities and roles adopted, the incorporation of a human-centred approach is characterised by the following:*
>
> - *the active involvement of users and a clear understanding of user and task requirements;*
> - *an appropriate allocation of function between users and technology;*

- *the iteration of design solutions; and*
- *multidisciplinary design.*

(ISO 13407, 1999)

At this time, the British HCI Group saw two opportunities - one, to create a website that would provide a global hub for usability knowledge and debate, and two, to update the standards used by business to define job roles and employment contracts. UsabilityNews.com went live in 2001, employing an editor/author part-time to create and collate content. Over the next few years it achieved a global following and was the conduit by which tales of practice fed back into the group. Initially these were detailed accounts of practice and increasingly via a steady and growing stream of detailed job vacancy descriptions. This information fed into the efforts led by Jonathan Earthy to have HCI more adequately reflected in the primary definition of skills in this sector, SFIA - The Skills Framework for the Information Age.

SFIA had grown out the BCS's Industry Structure Matrix (or Model) ISM (1986) and is used in many countries as the basis for employment contracts, identifying training needs, and demarcation of labour. In the UK, Sector Skills Councils (SSC) coordinate this effort, and most work domains have a relevant SSC. The challenge in design practice is that there are (at least) three relevant ones which sometimes overlap (SFIA, Skillset, CCSkills). SFIA, by 2009 defined 86 "skills" each at several levels of competency, with each of these based on underlying items of knowledge or other attributes. Bodies such as e-Skills or BCS then build more detailed definitions, with BCS's SFIAplus running to several thousand pages of detail. Employers then might define a job role as, say, requiring level 3 of skill X and level 4 of skill Y. While this may sound reductive, equality legislation has required human resource professionals to use objective ways of measuring the demands of, and capabilities needed for, a specific job. This enables equal pay, removes possible areas of ethnic discrimination, and provides the individual with a clear career ladder.

An HCI2009 Educators Workshop paper (McEwan, 2009) records that joint efforts from 2002, by BCS and the Usability Professional Association, to develop accreditation of competency in usability had foundered, both in terms of the legal implications of administering 'licence to practice', and the dearth of competency definitions in the upper (Professional) levels of SFIA. This effort subsequently led, however, to five rather than two HCI-related skills (and 20 separate role-levels) in version 3 of SFIA (2005), including at the most senior professional level. This success was not unqualified, as SFIA continued to use outmoded terminology, such as 'non-functional needs', and HCI and Usability were still excluded from relevant skill sets such as 'requirements engineering', and 'content creation'.

2000s – Augmentation – from labs to agencies

A handful of digital 'labs' emerged in the late 1980s, that provided HCI style offerings, such as usability testing. Some way distant from marketing, these evolved into the 1990s as highly specialised industrial and product design organisations (e.g. IDEO) or emerging technology service providers (e.g. Sapient). As Interactive CD-ROM production company's success peaked, their staff found a new niche as 'multimedia' web developers. The growth of a new kind of agency was sustained by the New Economy (Tapscott, 1997). Here the emergence of email, the internet, mobile communications and ever maturing software platforms created demand for 'digital' design and improved usability.

The commercial application of HCI had two effects. Firstly, it shifted and extended research agendas into commercial product and service contexts, thus opening up hitherto unaccounted for issues and domains such as use. Secondly, it spurred growth in what would now be called 'start-up' organisations, seeking to provide commercial variants of classically developed tools and methods. In 2001, the UK market for such services was limited to approximately 50 organisations, with the biggest concentration in London (Jefsioutine and Knight, 2003) including Oyster, FramFab and Wheel. These early pioneers were a mix of the traditional advertising agency, with some of the strategic mettle of their global counterparts (e.g. Frog and IDEO) and a close connection to academic HCI founded through the Alvey programme. Nowadays, that figure has grown tenfold.

In this climate, some students started their own commercial agencies (e.g. Amberlight) or gained employment in niche design oriented ergonomic and usability labs including User Focus and System Concepts. This diverse milieu found common cause in developing a small but influential community of practice through discussion lists (e.g. London Usability Group that first met in 2000) and catalysed the growth of the BCS HCI Group, UPA (now UXPA) and IXDA (now SDA).

A further significant shakeout of advertising-oriented agencies occurred during the dot.com bubble. Frenzied capitalisation in new, internet-oriented business led to a bonanza in web design. The resulting downturn and reaction against 'creative' fostered commercial interest in usability and process. 'Web 2.0' (O'Reilly, 2005) heralded venture capital's love affair with the tech start-up scene. Lessons learnt in the dot com bubble had a significant economic impact too. Behemoths such as Amazon and Apple were deeply scarred and shaped by that experience, including their embrace of design. The particular type of design that these companies, and the many agencies that serviced them employed was a hybrid. This HCI based fusion encompassed 'User-centred Design' (UCD), that drew on the distinctively British socio-technical tradition of Trist (1951), Scandinavian Participatory Design (Ehn, 1988), instrumentally oriented engineering approaches (e.g. Usability Engineering, Gould and Lewis, 1985) and experience oriented product design (e.g. Jordan, 2000).

2010s – Traction – beyond usability to service experience

Nascent agencies, internal teams and researchers adopted a loosely defined User-centred Design (UCD) process at this time. This methodology evolved across traditional disciplinary boundaries of computer science, design and even political activism. A common factor in these seemingly disparate elements was in front-ending audience research and testing with low-cost prototypes before undertaking any development work. This preliminary work reduced production risks and costs and was a good fit to the prevailing waterfall development methodologies of the time.

Participatory Design's emphasis on a common language using "low-fidelity" prototypes (Ehn and Kyng, 1991) not only fitted engineering methodologies and focus on risk mitigation (albeit downplaying the social democratic political agenda) but were also valuable in a commercial context. Cheaply made, early prototypes bought marketing 'ideas to life' and were thus useful in pitching for work, let alone aiding workplace democratisation. Low-fidelity prototyping also provided a bridge between traditional design disciplines and software development. Yet over time prototyping widened a gulf between design and development, that had been absent in HCI. Focusing on prototypes rather than working software gradually shifted the focus of design, firstly from collaboration with engineers at a philosophical and practice level and secondly from "making stuff in the here and now" to a future (idealised) state as is the orthodoxy in much academic design research.

UCD's future was now assured, albeit with a final important shift toward the experience economy (Pine and Gilmour, 1988). The result was a loose amalgamation of what were by now relatively robust design practices (e.g. wireframing) applied to a holistic definition of quality (e.g. Service Design and User Experience, respectively). The core set of practices extended into voguish notions of 'Design Thinking' that provided an innovation focused counterbalance to the discipline's risk mitigation strategies. UCD's future was also secured with the launch of highly successful consumer devices such as the iPad and the exponential growth of the tech giants of today. The speed and magnitude of this growth as well as further disciplinary accumulation of Lean and Agile has further obscured the critical role that HCI played in developing a global digital economy.

2015s – Reinvention – from abstraction to agile working software

This potted history would be incomplete without noting the critical role that agile development (Beck, et al, 2001) has had on digital design. While agility traces back to the previous century, its impact has accumulated over nearly fifteen years sparking a seismic change to practice and even the very nature of design outcomes. In a similar way to the Alvey programme, The Government Digital Service (GDS) incubated the latest incarnation of digital design that adds agility and a service orientation to UCD. From humble beginnings this organisation has established itself as a highly visible design-led organisation enabled to make strategic change in how citizens interacting with public services. GDS has also been critically important in growing the wider industry. As direct employer, it has sustained many seasoned practitioners, a mass of early career designers and developers, as well as a legion of mid-level contractors. GDS' close coupling of interaction design and software development reflects a broader turn against the kind of surface abstraction (making blueprints rather than services) characterised by service design orthodoxy. In other words, fusing agile development with experience design marked a return to HCI's core values of building working usable digital products and digitally enabled services. Lastly, outside of academia the number of commercial courses and accreditation initiatives grew significantly including the BCS UX Foundation Certificate, initiated by David Travis at User Vision.

Account of Practice

The role of HCI in digital design is a hidden history that can be retraced through rediscovering the rich materials found in various the conferences, publications and initiatives described in this section. Obscurity is compounded by a lack of first-hand accounts of digital design doing. These are stories of those involved in the doing of digital design as much as the pioneers who forged this potent blend of technology, creativity and a sense of social democracy. Indeed, few researchers have shed light on the everyday world of the digital designer and when they have done their conclusions lack a feel for the craft – a practitioners perspective. There is also a dearth of substantive data on practice. This means findings are hard to generalise out into broader insights and trends in the economy.

A number of studies were prepared to address this gap. These combined empirical exploration into practice as well as a case study type of account. Experimental work included secondary research data analysis, primary research (surveys, questionnaires and data-gathering workshops), practice-based research (practitioner workshops) and immersive research in an industrial setting. Together the resulting data, combined the breadth and veracity of society level trends (e.g. changes in working patterns such as the 'gig economy'), the narrow focus of targeted hypothesis driven studies (e.g. what methods do practitioners use most) and insights derived directly from practitioners and indeed elicited in the field of practice through immersive research.

As a longitudinal piece of work over a decade, it's has uncovered fluctuations in how design is practised from a number of perspectives that span recruitment to tools, methods and deliverables. The findings suggest that digital design has a core set of competencies that have remained relatively stable for nearly ten years. This foundational set of practices span research to development and has, through time, included relatively specialised roles in data analysis, research and interface development.

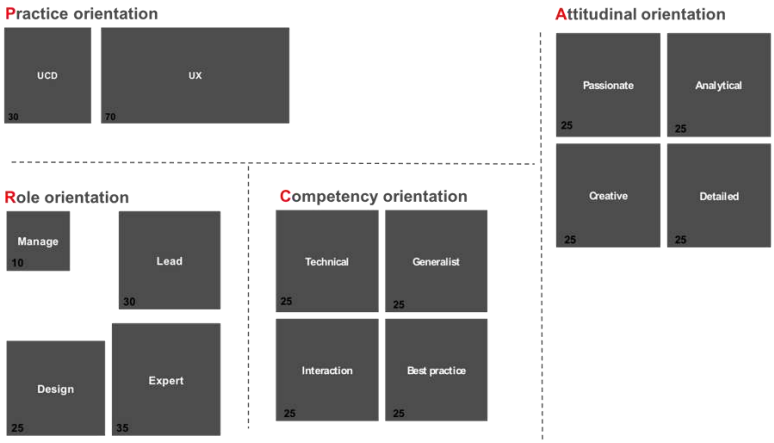
However, a fundamental shift has taken place during the period of study and that is the relationship between design and development. The HCI-oriented ways of working that influenced practice during the early studies in this work tightly coupled these two disciplines. For a while, the disciplines diverged, and design focused on abstraction, using futuristic blueprints to map out idealised future experiences.

This moving apart has begun to reverse now. Instead a focus on delivering working software (rather than descriptions of how it might be) has become a strong influence with the advance of agile. Now and looking to the future, this ebb and flow between the two ways of working is maturing into a truly hybridised discipline that manifests, arguably the best practices of both fields and where pace, innovation and deep collaboration are combined within a broad set of common tools and methods within a strongly holistic vision of the future and desired state.

JOB DESCRIPTION ANALYSIS (S1)

The first study (S1) addressed the lack of standard role definitions in digital design in 2010. This ambiguity caused problems for potential employers and employees alike. The research involved analysing a sample of job descriptions (n=48) from a number of organisations, selected from four regions (UK, Europe, US and Asia). The sample included a broad spread of role types ranging from research to development and were almost entirely drawn from the public sector as adoption outside of agencies and technology companies was extremely limited at the time. These were then categorised, and common role attributes identified. This was done 'ground up' from the data and supported the development of design role framework. This was operationalised through a job description matrix which was used to standardise job definitions.

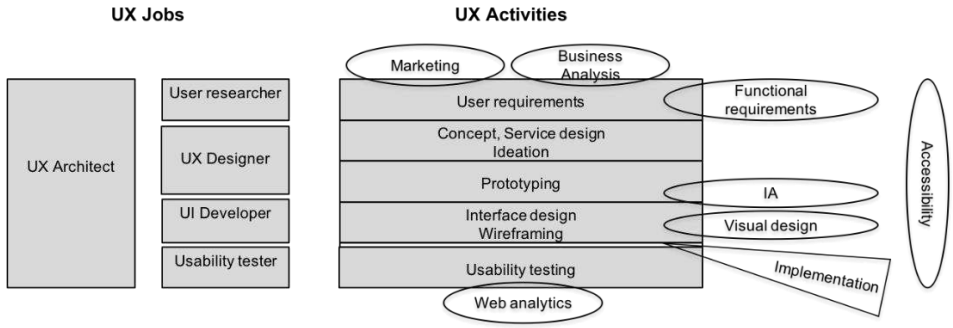
The framework consists of four dimensions including practice, competency, role and attitudinal facets (see below). The surveyed roles showed a broad spread of employment needs from research through to strategy. The demand for research was surprisingly low (6%) especially when compared to consultancy with the biggest proportion of roles relating to interface design and development. While senior positions were few (3%) these required the relatively short tenure of three to four years' experience. Many roles reflected the contemporary engineering paradigm noted in the history, with few mentions of design methods and practices. Instead a focus on HCI style methods including expert reviews and waterfall development was evident, as well as design to development workflows based on wireframing (see below).



COMPETENCY WORKSHOP (WS1)

An initial workshop (WS1) was facilitated to extend the analysis and validate the competency framework with attendees from academia, industry and recruitment firms. The outputs of the workshop (2010) provide a useful snapshot of perceived in-demand competencies and also prevalent methods and methodologies used in industry at that time. Perhaps unsurprisingly the outputs of the workshop aligned to traditional engineering paradigms for design and development. This was reflected in the prevalence of software development roles and terminology (see below) and a focus on functional requirements and business analysis. Design was tightly constrained as only relating to 'visual design', with a lack of facilitation skills or mention of 'design thinking' practices. Interestingly, however, was the explicit integration of design activities within development and relative lack of prototyping. This tight coupling between definition and working software would emerge much stronger with the widespread adoption of agile. There was also a strong focus on process that reflected contemporary work on developing standards at the time. Given the relative infancy of the discipline, it is also perhaps to be expected that that there was a strong emphasis on growing awareness, education and leadership and for strong communication skills (see below).

Core UX/UCD activities and associated professions



JOB ANALYSIS (S2)

The data from the workshop was used to refine the framework and operationalise it as a set of role definition criteria. These were used to standardise job adverts on Usability News. At the time, this website was one of the most reputable and visited sites for gaining information on the growing topic of user experience and finding jobs in this emergent industry. The high traffic into the site generated much data on the type and characteristics of design employment at the time. In just two years the site, had accumulated hundreds of standardised job descriptions from many potential employees and a sample of these (407) were analysed in 2013. In retrospect, it is interesting to note the prevalence of senior and middle management roles in the sample (71%) at this time with a (relatively short) expected tenure of five years. The high number of permanent to freelance roles (83 to 17%) is also surprising and counter to the largely freelance constituency of current employment patterns.

PRACTITIONER SURVEYS (S1,2 and 3 and) AND IMMERSIVE RESEARCH

While this study uncovered valuable insights into broad employment patterns it lacked detail on the specifics of design work in industry. To address this gap, an online questionnaire was (S1) used to survey practitioners' method use and also one to explore common design practices involving a range of senior practitioners (n = 28) with a range of skills and employment experience in 2015. The study found a shift from engineering practices toward a growing hybrid combination of agility, 'design thinking' and UCD methods. Interesting to note is the strong separation with development and the trend for more "designerly" methods such as workshop facilitation. Diminishing influence of engineering methods and software development practices is also noteworthy, with the requirements focus of the competency workshop five years earlier reducing. The growth in agile (scrum) goes some way to explain this as these would have replaced many of the more traditional waterfall activities such as requirement management. This might also explain the relative decline in blueprinting. Research was also strong, and the number of methods used expanded from the previous studies. Together these findings suggest practitioners were using an ever-diversifying set of methods, with a continued focus on design outcomes and also structurally managing collaboration with other disciplines and stakeholders. These broad trends can be traced in Table 1 and 2 that summarise the key data taken from the various studies that is also elaborated in the section below:

Table 1

Responsibilities	*(S1) %*	*(S2) %*	*(IR) %*	*(WS2) %*
Analytics	2	4	5	5
Research	6	9	12	39
Requirements	16	12	9	5
Development	24	16	12	11
Management	26	7	8	4
Design	26	52	32	36
Project Management	0	0	6	0
Facilitation	0	0	16	0
Total	100%	100%	100%	100%

Table 2

Deliverables	*(S1) %*	*(S3) %*
Persona/Scenarios	4	0
Reports	14	13
Prototype Development	12	9
Conceptual Models	12	8
Design Thinking	14	15
Blueprints	18	8
Wireframes	26	23
Scrum	0	18
Co-design	0	6
	100%	100%

IMMERSIVE RESEARCH (S3)

A full immersive 'account of practice' was undertaken as a case study to validate the survey and workshop findings. This was also grounded in a full literature review of six other practice-based studies (Knight, 2017). This work found a lack of similar research on the confluence of design and development. Combining practice-based data with insights from the literature review led to creating a set of practice-based constructs within an overarching descriptive theory. Together this describes digital design activity as a collaborative, goal directed activity; (Mission) that creates knowledge, capability and value (Agency) for clients' and users' needs (Vision) at pace (Velocity).

In agile, design activity often starts in a 'Discovery' phase or 'sprint 0' which delivers 'Little Design Up Front' and where designers originate enough assets to start development. Working in teams, variously known as 'pods', 'trios' 'cells' or the 'three amigos' designers are usually paired with a developer and product owner. Pods work in situ (or are 'co-located' to maximise communication), often using 'The Wall' to 'crit' work and run 'Show and Tells'. Designers' multifaceted role can be challenging; as they need to 'feed' developers' assets, maintain vision, and conduct research. Often, their contribution is limited to low-value 'production' activities. A lack of user research, marginalization of designers and dearth of design thinking is also a common challenge.

ACCOUNT OF PRACTICE (Case study)

While these general observations are applicable to many agile design practice, this study provides a valuable in-house perspective on it. This is especially important given the strong adoption of digital design outside of the traditional bounds of agencies and consulting practices. Exploring the experiences of a small team working in a largely agile software development context is also important given this is a common situation and structure in which designers work. Practice-based research was carried out in order to explore and understand the impact of agile on design. Immersive fieldwork (S3) was conducted over a one-year period in a digital design team within a large private company. The researcher was a fully participating member of this team during the period of immersion. Research activities included semi-structured observation, recording via coded notes, informal interviews, workshops and collecting relevant artefacts.

The team was involved running one of the most visited websites and apps in the UK. The team was responsible for research, design and delivery of these public facing touchpoints as well as some internal tools and systems including an intranet. The team was also supported by a number of third-party organisations. These included a human-centred design agency, an accessibility consultancy and a number of contractors. This external support helped on a number of larger projects, including contributing to the conceptual development of a new app. For research, a university usability lab was hired on occasions, as well as an online user testing platform. The team fluctuated in size during this time, ranging from its smallest incarnation of four designers to its largest size with the team augmented by an interaction designer, user researcher and consultant. The team worked on a variety of work, spanning operations, tactical projects and strategic programmes. In all cases, they worked in a larger multidisciplinary group of developers and business stakeholders within an agile framework. The tight integration with development and a strong project management culture strongly influenced how the team operated, the methods used, and the work delivered. Their relatively small number required building advocacy, continuously showcasing the work they produced and, most importantly, being willing and able to tackle anything that the business required with a minimum of resources and often with little previous experience to draw on.

The various data outputs from the immersive research was explored and validated in a summative workshop. This revisited key activities and events during the research period and explored themes (e.g. collaboration), specific topics and issues (gaining stakeholder buy-in) with the design team itself. Different projects were analysed in detail, and the group categorised these into project types. This helped to produce a high-level practice framework consisting of Strategic, Tactical and Operational design work. The first project type related to scrum being applied to large scale strategic projects, usually with sprint-based development following a period of 'up-front design', roadmap and strategy definition. In the case, this (Strategic Scrum) variant was applied to developing a complete and new mobile application. In this context the focus of design work was in defining and visualising a near-future oriented and innovative solution. Considering how project outcomes might fit within existing customer experiences was deemed less important than creating a futuristic vision for the company.

At the same time, the outcomes needed to be viable within a given technology stack and commercially sensitive timescale and also to the level of detail where accurate estimates for development and follow-on interaction design work could continue from. Practically, this involved design research including co-design sessions, experience blueprinting, the development of concepts, navigation models, screen templates and some prototyping with high-fidelity visuals. The mix of functional design work with brand was an important consideration as the project was dependent on senior management buy-in and financing of future work. This also meant that this work was relatively separate from development. While agile methods were applied in a design context, the result was not 'working software' but abstractions of the future built experience. The disconnection between design and development was less problematic here, however, as the focus was to scope out future work and develop a business case from estimated costs and customer feedback.

The second category related to more tactical work that involved redesigning component parts of an end-to-end journey. In the research, this kind of agile project (Tactical Scrum) was most often applied to single product lines on the company's website. Instead of the broad and strategic focus of the mobile app work, this activity was more focused on short-term gain and alignment to the existing experience, in some ways because it was delivered on a single technology platform. Taking one journey, this involved identifying 'pain-points' in the experience and then purposefully removing barriers to the user's flow from a 'landing page' through to task completion. Improvements were a combination of better designed pages and flows, but also through improved technical solutions as well as new product features. This distributed decision-making among different teams meant that design (and technical) solutions had to be regularly reviewed with other teams. The result was a less than perfect solution, but one that could be readily implemented, and which had broad support across the organisation because of the many stakeholders (not just the design team) directly involved in the work. This way of solutioning is widespread in agile projects and frames design as one of many strands within a collaborative activity. At some junctures, this necessitates design activities, thinking and solutions taking a lead and at other points allowing and, in some cases, facilitating other disciplines to do the same. Commonly applied techniques in this type of project typically align to 'Design Thinking' methods where there is a need to diverge, converge and reach consensus. Of all the different contexts for design, this is in some ways the most challenging as successful outcomes rely as much on social skills, communication and persuasion than traditional design competencies. At the same time, practitioners are also part of the delivery team and so cannot just help team's reach consensus, but need to be cognisant of how collaborative interactions impact their own deliverables.

The last type of agile project is perhaps the most commonly applied variant. This aligns to the common practice of 'small change' or 'Business as Usual', where a shared backlog combines purely technical, operational and design-led improvements together. In the case, this kind of agility was used to make small, incremental changes to easily adapted assets such as content and wording. Even then, modifications often involved substantial resources, but provided imperceptible improvements. Where this operational design activity (AKA Design Ops) provided value was when it was coupled to a broader and more strategic programme of change. In the case, this was exemplified by a workstream dedicated to solving common issues that the organisations call centre dealt with. Connecting small change to such measurable issues, not only provided evidence to prioritise tasks, but also helped create a focus on customer needs throughout the company.

This 'low-level' design activity is perhaps the most unfamiliar to the broader design community. Not only is the focus on micro-level aspects of the product or service, but the nature of the work means that design is a fractional part of the work. In some cases, (e.g. adding a register mark to a logo) it is hard to categorise as design, but in most cases is almost always carried out by people or teams who align to that practice. Agile is often considered as merely a development methodology that focuses on delivering at pace. In reality, this study not only shows a diversity in context for scrum-based working but also highlights how these different ways of working frame design activity. Traditional design is most closely associated to the first case, where the outcome is an abstract vision of the future. The second, sets design as a facilitator and the third as micro-level tweaking. The range of design activity is at odds with the design orthodoxy where it is primarily future oriented and focused on abstraction rather than tangible change. While these conclusions need further validation, the study provides an example of an account of practice too. Such research is needed to extend our understanding of the design economy at the level of practice.

PRACTITIONER WORKSHOP (W2)

While the case and supporting studies and literature review, provided deep insights into the fabric of contemporary design practice, especially in the context of agile development, it lacked validation to a wider

sample. The results of this activity were validated during a final workshop (WS2). This was run with participants with a broad range of experience who attended a professional networking event in November 2018 and mapped the different types of projects that practitioners are involved in. The findings reinforced both the case and other studies in that design is tightly integrated into software development and delivery of digital products and services. Furthermore, in line with the general trend of the research, practitioners' evidence greater diversity in method use, a strong tendency toward hybrid roles and ever widening employment, especially in the public sector. Other common contemporary patterns of practice include the need for small teams and individuals to be able to turn their hand to any business need (Team of one) and to be able to navigate and thrive in a diversity of organisational contexts, including where stakeholder knowledge of design is low.

Conclusion

This paper has attempted to bridge an important gap in design research and history. This account charts the important role that HCI has had on the growth of digital design between the 1980s and present day. Its influence extends beyond an instrumental focus on accounting for people in developing technology to one that promotes human values that are then practically operationalised through a set of robust tools and methods. These handed-down and evolved practices have shaped how designers work today. This paper has addressed the lack of 'accounts of practice' that show how designers work with these tools at the intersection between technology and people too. In describing the day-to-day work of today's designers, the research shows how agile and hybrid are challenging traditional disciplinary boundaries. Future research will validate and extend these findings out into the broader context of the design economy and inward to more deeply explore and map the field of practice.

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Research Perspectives IN THE ERA OF Transformations

Using Corpus Linguistics to Analyse how Design Research Frames 'Design Thinking'

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Academic research communities create knowledge which helps them to claim authority over their investigative domain. The knowledge is not necessary objectively true—often it is skewed to help communities to claim legitimacy. This paper investigates how the design research community frames 'Design Thinking', a key concept in design research. Existing literature identifies skewed methods which the community uses when framing Design Thinking. The literature suggests that creating an artificial separation between the ways that designers and scientists think helps the community to claim knowledge on Design Thinking. To further investigate how the community creates knowledge, this paper subjects abstracts from peer-reviewed journal papers which focus on Design Thinking to empirical analysis using Corpus Linguistics methods. The study suggests that use of 'nominals' and the creation of 'meta-knowledge' helps researchers to claim authority on Design Thinking. These practices appear however to perpetuate an artificial separation between Design Thinking and other design domains.

Keywords: Design Thinking, Corpus Linguistics, Discourse, Discourse Communities, Ways of Speaking

Introduction

The linguist John Flowerdew (2013) argues that knowledge claimed by given groups or institutions is never objectively true. Rather it is produced in a subjective manner. The knowledge is always skewed to suit the aims and objectives of the group (Swales, 1990; Rabinow, 1991). The term *discourse* is used to describe the skewed knowledge disseminated by a given social group (Flowerdew, 2013). The term *discourse community* denotes the collection of individuals making up such a group (Flowerdew, 2013; Swales, 1990). A discourse community creates discourse with the aim of occupying a particular intellectual territory termed a *domain* (Rabinow 1991). Members of discourse communities use written or spoken language to disseminate discourse (Flowerdew, 2013). Theorists use the term *ways of speaking* to characterise the language used by discourse communities when they are creating their discourse (Finken, 2003).

A discourse community is only sustainable if it can maintain its perception of truth and its hold over the production of knowledge (Rabinow, 1991). To do this, it must reject knowledge which threatens to undermine its position. In practice this means rejecting knowledge produced by other discourse communities which may compete for ownership of a given domain (Finken, 2003; Foucault, 1980). If successful, the process of knowledge creation undertaken by a given discourse community undermines the validity of knowledge

created by other discourse communities (Foucault, 1971). The process of knowledge formation enables a community to claim legitimacy and wield power (Rabinow 1991; Foucault, 1971). The importance of ways of speaking is such that theorists tend to define discourse communities by the ways in which they speak on issues which are key to the community (Flowerdew 2013). Researchers may, for example refer to, the *discourse of managerialism*, the *discourse of advertising* or *Christian discourse* (Flowerdew, 2013). It does not necessarily follow that members of a discourse community disseminate ways of speaking with the intent of being intentionally deceitful. Members tend to be immersed in the community's discourse and may not recognise that their claims may not be objectively true (Rabinow, 1991).

Academic Discourse Communities

The concept of discourse communities applies in academic fields. The sociologists Becher and Trowler (2001) have investigated the way in which academic disciplines construct discipline-specific discourse. Becher and Trowler (2001) argue that academic disciplines function as—in their terms—*tribes*[1]. In the main, tribe-members cement their identity through their ways of speaking: "the professional language of a disciplinary group plays a key role in establishing its cultural identity" (Becher and Trowler, 2001, p.46). This is not to say that academic disciplines are entirely homogeneous. The way that principles within a discipline are taught can differ from institution to institution (Becher and Trowler, 2001). There are also regional differences within academic tribes. Academics in certain nations may focus on creating knowledge on certain aspects of a discipline over others. Indeed, Becher and Trowler (2001, p.44, original emphasis) argue that "national stereotypes of a conventional (and relatively crude) kind" can influence some perceived differences in ways of working. However, despite regional differences, "strong resemblances persist between different branches of the same [academic discipline]" (Becher and Trowler, 2001, p.44). In this respect, disciplines have specific ways of speaking on knowledge associated with their domain. Historians tend to use the term "masterly" to commend a piece of research, whereas sociologists often term good research "thought-provoking" (Becher and Trowler, 2001, p.46). Ways of speaking allow members of academic discourse communities to cement the knowledge claimed by the tribe and to differentiate their field from other domains. Analysis conducted by Thompson and Hunston (2003) illustrate this process in action. Thompson and Hunston reflect on how a researcher in the field of *applied* linguistics cements the value of research conducted in his tribe whilst differentiating it from the field of *theoretical* linguistics. The researcher of the applied linguist (John Swales) is published in a journal which specialises in disseminating research on applied linguistics. In differentiating between his area and that of theoretical linguistics, Swales infers that "Both types of research are valid but applied [linguistics] research is more significant" (Thompson and Hunston, 2003, p7). This helps the applied linguist underscore the legitimacy and importance of his field whilst differentiating it from theoretical linguistics. His ways of speaking also invoke a sense of camaraderie with other members of the community, "precisely [because members of the applied linguistic community] write and read papers like this" (Thompson and Hunston, 2003, p7). Thompson and Hunston's (2003) research illustrates how members of academic discourse communities create skewed ways of speaking which reflect the aims of the tribe.

This paper examines ways of speaking the design research discourse community use when claiming knowledge on Design Thinking. To begin with, the author identifies existing literature which suggests the presence of skewed ways of speaking. The paper then uses a method termed *corpus linguistics* to uncover skewed ways of speaking in a data set of design research papers.

Existing Signs of Skewed Ways of Speaking in Design Thinking Research

The design research community commonly uses the term Design Thinking to describe the cognitive process used by designers when they are engaged in solving design problems. Design researchers often claim that Design Thinking differs from problem-solving processes used by natural scientists (Cross, 2004, 2011; Dorst, 2011, 2010). The work of Nigel Cross (2004; 2011) illustrates the position commonly taken in the design research community. Cross (2004) claims that scientists attempt to identify a problem fully and then work to solve it. Indeed, the focus on identifying a problem leads Cross to term scientific thinking a *problem-focussed* process. Cross argues that once scientists have identified the problem, they engage in trying to solve it. For

[1] Indeed, the title of Becher and Trowler's (2001) book is *Academic Tribes and Territories*

Cross (2004, 2011) the movement from identifying a problem to attempting to solve it implies that scientific problem-solving is *linear* in nature.

A host of design researchers claim that the linear, problem-focussed way of thinking used by scientists limits both exploration of problems and idea generation and can therefore produce unsatisfactory solutions (e.g. Cross, 2004. 2011; Dorst, 2011, 2010; Oxman, 2002; Stempfle and Badke-Schaub, 2002). Design Thinking researchers argue that designers do not attempt to identify a problem prior to beginning to solve it. Instead, designers work to understand a problem as they attempt to solve it (Cross, 2004). Therefore, rather than focusing on a problem, designers focus on finding the solution. This trait leads Cross (2004) to term Design Thinking a *solution-focussed* process. Dorst (2010, 2011) claims that designers work to identify the problem through undertaking a series of cyclic steps in which they iteratively return to the problem in order understand different elements of it. The presence of cyclic steps indicates that Design Thinking is *non-linear* in nature. Dorst claims that this non-linear, solution-focussed way of thinking enables design solutions to evolve progressively, allowing opportunity for reflective practice:

> *"[Designers] know that bringing the full force of evaluation to bear upon a fledgling idea is a very effective way of killing it, blocking any further exploration and stifling any progress in the project". (Dorst, 2010, p.133)*

The discussion within the design research community on *problem-focussed* and *solution-focussed* problem-solvers and *linear* and *non-linear* methods suggests that design research commonly constructs a dichotomy between scientific thinking and Design Thinking. Maciver et al. (2016) illustrate this dichotomy in the form of a table (Figure 1). In expanding on the dichotomy, Maciver et al. (2016) suggest that designers focus on using the *left* hemisphere of the brain whilst scientists predominantly use the *right* side; scientists employ *logic* to solve problems, whilst designers use their *intuition*.

Sciences	***Arts***
Mathematics, physics, engineering	Creativity, language
Logic	Intuition, subjectivity
Left brain	Right brain
Linear, sequential	Holistic, chaotic, divergent
Reductionist enquiry	Naturalistic enquiry
Facts, figures, formulae	Interpretive forms, subjective expression
One correct answer	Many solutions
Technologists - computer scientists, software engineers, information science experts, coders...	***Designers*** - product designers, interface designers, design researchers, graphic designers...

Figure 1: The Dichotomy between Scientific Thinking and Design Thinking. Taken from Maciver et al. (2016, p.3)

A small body of research questions the validity of the dichotomy between Design Thinking and scientific thinking. Research on *wicked problems* provides an example of this critique. The idea of wicked problems was famously developed by Rittel and Webber (1973). Rittel and Webber describe problems as being wicked when they involve many stakeholders. Rittel and Webber claim that the presence of many stakeholders makes problems very difficult to solve using scientific ways of thinking. Originally, Rittel and Webber applied the concept of wicked problems to town planning issue. More latterly, design researchers have tended to argue that a range of design problems can be thought of as being wicked (Downton, 1993; Cross, 2011). Design researchers often claim that designers' ability to use Design Thinking enables them to tackle wicked problems (Buchanan, 1992). Farrell and Hooker (2013) challenge the idea that designers can tackle wicked problems more effectively than scientists. Indeed, Farrell and Hooker argue that scientists commonly tackle wicked problems. They claim that negotiation between stakeholders was key in allowing natural scientists to diagnose the illness termed *chronic fatigue syndrome*:

> *It was [...] initially unclear whether chronic fatigue syndrome was caused by a bacterium or virus, a fungus or mould, in each case perhaps deeply embedded in tissue, or was due to a psycho-somatic condition, with any of these options difficult and resource demanding to pursue. Then, just as with design, the issue becomes which few of these possibilities is currently most worth pursuing and in which specific forms. Various options will be developed in more detail, their resource demands and risks analysed and their merits spelled out for consideration. During that process more specific versions of the initial general problem will be developed, some of them (e.g. the psycho-somatic option) perhaps requiring a significant reformulation of both what the problem is and what criteria a solution would need to meet. A critical debate will develop about these options, the upshot being that one or two of them will be selected to pursue, perhaps by individual laboratories, perhaps as cooperative ventures. (Farrell and Hooker, 2013, pp. 688-689)*

Farrell and Hooker (2013, p.701) suggest there exists an intrinsic relationship between the way designers and scientists think, for both are the "product of a common core cognitive process". In critiquing the dichotomy between Design Thinking and scientific thinking which is such a prominent feature of design research, Farrell and Hooker (2013, p.683) argue that influential work on Design Thinking is "fundamentally flawed".

New and Kimbell (2013) contribute a further criticism of the dichotomy which design researchers construct between between Design Thinking and scientific ways of thinking. New and Kimbell (2013) reject the oft-stated argument that Design Thinking is unlike scientific thinking. In evidencing their position, New and Kimbell argue that, commonly, Design Thinking research does not present a true representation of scientific approaches to problem-solving. Rather, design research commonly presents a skewed interpretation. New and Kimbell claim that in Design Thinking research, the ways that designers think is mistakenly "repeatedly characterized in opposition to a caricature of rationalist, analytical 'orthodox' approaches" (New and Kimbell, 2013, p.139; original emphases). To illustrate their argument, New and Kimbell (2013) criticise the position taken in design research on the issue of *empathy*. New and Kimbell illustrate how design research commonly frames the way in which designers generate empathy. New and Kimbell use the example of a hypothetical study in which designers try to create empathy with wheelchair users:

> *…design practice would perhaps involve the designer themselves using a wheelchair, or collecting data on the overall travel experience, and look [sic] for interactions with the wider process. (New and Kimbell, 2013, p.144; original emphases)*

New and Kimbell argue that this form of empathy is not unique to designers. Rather they suggest it has parallels with the form of empathy developed through a scientific, analytical approach to problem solving:

> *This type of empathy, however, might still only be 'cognitive'. For 'affective' empathy to be involved the process of seeing through others' eyes requires a deeper engagement: this requires sharing the emotional response of the other. In the wheelchair example, it would require the designer to share, perhaps, the level of anxiety that a user might experience in the situation, or anger […] It is not that one can rationally appreciate the fact of another's emotions, but that one has the emotions oneself. (New and Kimbell, 2013, p.145; original emphases)*

New and Kimbell (2013) therefore argue that when it comes to generating empathy, the way designers think is similar to the way scientists think.

Both New and Kimbell (2013) and Farrell and Hooker (2013) provide some insight into skewed ways of speaking in the Design Thinking research community. However, neither New and Kimbell's (2013) nor Farrell and Hooker's (2013) research makes use of empirical, analytical methods which are specifically designed to investigate ways of speaking in texts. This limits the potential value of their insights. This paper contributes to filling this gap in knowledge by subjecting a data set of abstracts from peer-reviewed journal papers which focus on Design Thinking to critical analysis with *Corpus Linguistics* methods. Corpus linguistics tools are specifically designed to investigate ways of speaking in texts and are commonly used in the social sciences to facilitate critical analysis of claims made by a range of discourse communities (e.g. Baker, 2006; Mautner, 2009; Hoey and O'Donnell, 2008). So far, the use of corpus linguistics in design research has been limited to only 2 small studies (Blythe, 2014; AUTHOR, 2016). Therefore, in addition to unpicking ways of speaking on Design Thinking, this paper further embeds the use of corpus linguistics in design research.

An Introduction to Corpus Linguistics

The field of corpus linguistics is a branch of linguistics. Corpus linguists analyse data sets consisting of spoken or written language. Corpus linguists argue that people "express[] an ideological position" (Stubbs, 1996, p.107) when choosing words or terms to use. Researchers therefore look for patterns in word use in the data set. Evidence of patterns can create cohesive insights into ways of speaking on the research domain (Hoey and O'Donnell, 2008).

Corpus Linguistics research began in the late 1960s. The British linguist John Sinclair (1933 – 2007) is credited as being a pioneer in this field (Hoey and O'Donnell, 2008). Sinclair's work came in reaction to an idea which was dominant during the era in which he worked, namely that investigation into patterns of word use could not provide insight into ways of speaking. Instead, in the 1960s, it was commonly thought that cognitive development dictated which words a person chooses to use (Carter, 2004). To illustrate, Chomsky (1969) argued that people prefer to use words which are easier to remember than those which are more difficult to recall. This, thought researchers in the 1960s, is why people tend to favour using shorter words over longer words. It was therefore commonly assumed that analysis of spoken or written language can only create knowledge on the physiological structure of the human brain (Carter, 2004). In the latter half of the 1960s, this dominant school of thought was challenged by Sinclair and a handful of other academics (Hoey and O'Donnell, 2008). Sinclair argued that humans choose to use words which reflect their affiliation with discourse communities (Sinclair interview cited in Teubert, 2004). Sinclair's research into ways of speaking overturned the prominent view and as a result there are centres for corpus linguistics in universities worldwide.

Corpus linguistics research often provides insights into how discourse communities exercise their power and the ramifications of these ways of speaking. Rule and Levine (2011) analyse ways of speaking in the world of high-end modern art. To do this, they research a corpus consisting of artists' statements. Artists' statements consist of texts which often accompany artwork displayed in galleries. Written by artists or their representatives, these statements summarise the artist's influences and the aims and objectives of the artwork. Analysis reveals that high-profile modern artists tend to be concerned with what they believe to be important human and environmental issues. The artists do not aim to solve these issues, instead, they aim to raise awareness of them. Artists use terms such as "interrogate", "problematize" and "blur boundaries" in the context of raising awareness (Rule and Levine, 2011, unpaged). Rule and Levine argue that use of these terms helps artists to consistently frame the political ruling classes as failing to confront pressing human and environmental issues. In this way, artists' statements tend to "convey[] the sense of political tragedy" (Rule and Levine, 2011, unpaged). Interestingly, artists' statements often contain noun-forms of words. To illustrate:

> *visual becomes visuality, global becomes globality, potential becomes potentiality, experience becomes experiencability. (Rule and Levine, 2011, unpaged)*

Rule and Levine (2011, unpaged) argue the use of these noun-forms mimics a form of "highbrow written French" used by French poststructuralist philosophers such as Jacques Derrida. According to Rule and Levine, their use represents attempts to elevate elite fine art gallery practice and to imbue it with a sense of intellectual authority and legitimacy. These ways of speaking enable modern artists to discuss global political issues with an assumed air of authority (Rule and Levine, 2011).

Concordancers

Corpus linguistics analysis is facilitated by specialised software termed *concordancers*. Examples include *AntConc* (Gries, 2009), *WordSmith* (Scott, 2014) and *Sketch Engine* (Brezina and Gablasova, 2015). Texts which are to be analysed are uploaded into the concordancer. Concordancers can only process text which has been converted to a Unicode format termed UTF-8 (McEnery and Xiao, 2005). UTF-8 files contain a homogenised form of text: UTF-8 supports only one font, one text size and a single font colour. In addition, it cannot support images—converting data to UTF-8 causes loss of images. Conversion also deactivates any embedded web-links. The resulting file is termed the *research corpus*. The format of the research corpus can make it more difficult for a researcher to identify the origins of text. This may help researchers to analyse texts in a more neutral manner, contributing to less biased analyses (Baker 2012).

Corpus Linguistics Tools

The field of Corpus Linguistics contains a large toolkit of quantitative and qualitative methods which facilitate critical analysis. (See, e.g. McEnry and Wilson (2001) for an excellent overview of the range of available tools.) Because of limited space, this paper only discusses tools which are used in the forthcoming empirical study. The tools are *Keyword Analysis* and *Concordance Analysis*. Both are used extensively—and in combination—in Corpus Linguistics research (McEnry and Wilson, 2001).

- Keyword Analysis

When creating discourse, communities tend to focus on using terms which are important in allowing them to construct skewed knowledge. The terms vary from discourse community to discourse community. (In the aforementioned example of modern art discourse, terms like *visuality*, *globality*, and *potentiality* help artists create their discourse). Such terms are therefore *key* in helping the community to form its discourse. The process termed *keyword analysis* aims to identify these terms.

To measure keyness, it is necessary to compare the frequency of appearance of terms in the research corpus with their occurrence in another corpus. This 'other' corpus acts as a 'norm' by which to judge word frequency in the research corpus. The norm is termed the *reference corpus* (Baker, 2004). Concordancers contain examples of reference corpora which facilitate the comparative analysis. One example is the *British National Corpus* (University of Oxford, 2010), a reference corpus containing 100 million words taken from a broad range of sources. Keyword analysis involves statistical measurement. Sketch Engine uses the following formula[2] (Figure 2) to calculate the keyness of a term in the research corpus:

$$\frac{fpm_{focus} + n}{fpm_{ref} + n}$$

Figure 2: The Formula used by the concordancer Sketch Engine to calculate keyness.
Taken from Lexical Computing, (2005, unpaged).

Concordancers represent the keyness of words as a numerical figure in keyword lists in descending order of keyness. Figure 3 provides an example of a keyword list. The list shows keywords associated with an article on the subject of 'software' found on Wikipedia. The reference corpus is a large corpus of standard English. The term *microsoft* is a highly-ranked keyword, indicating that the company 'Microsoft' is strongly associated with the domain of software.

[2] The author is not a statistician. Because of this, the author asked a statistician to re-write the formula in a way that a non-statistician could better understand. The formula can be written more clearly, as follows:

$$\frac{(\text{Frequency of word in research corpus, if it were comprised of 1 million words}) + 1}{(\text{Frequency of word in reference corpus, if it were comprised of 1 million words}) + 1}$$

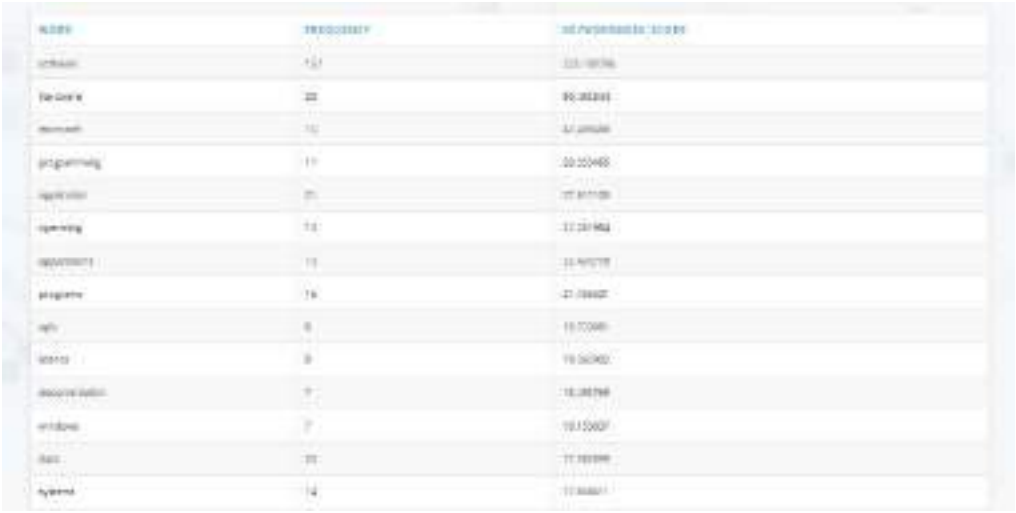

Figure 3: Example of a Keyword List, taken from Sketch Engine (n.d., unpaged)

When evaluating keyness scores, it is necessary to choose a tolerance to work to. The tolerance represents the likelihood that a particular word is actually key to the data set. Words with keyness scores above the level of tolerance are considered to be keywords (Baker, 2004). Often researchers work to a 95% likelihood of keyness (Gries, 2009). In statistical annotation, level of likelihood is described with a p-value (where 'p' stands for probability (Lancaster University, n.d.)). 95% likelihood is written as $p < 0.05$. $P < 0.05$ is associated with a minimum keyword score of 3.84 (Lancaster University, n.d.). Therefore, commonly, researchers will disregard keywords with a keyness score below 3.84.

Though keyword analysis helps researchers to identify terms which are important in enabling communities to create discourse, this tool does not provide insight into the context in which these terms are used. *Concordance analysis* provides contextual insights.

- Concordance Analysis

Qualitative analysis into the terms which accompany keywords in a given data set provides contextual insight into how keywords help to form discourse. In corpus linguistics terminology, qualitative investigation is termed *concordance analysis*. Concordance software facilitate concordance analysis by showing how keywords reside within sentences. Figure 4 illustrates an example from Hunston (2007). Figure 4 provides contextual insight into how the term *persistent* is used in a research corpus.

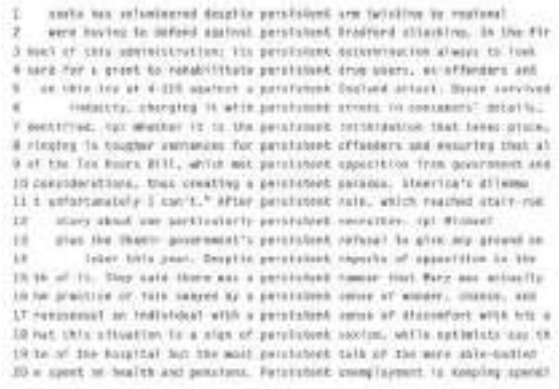

Figure 4: An example of concordances, adapted from Hunston (2007, p.254-255).

In addition to providing insight into how keywords reside in sentences (as in Figure 4), concordancers allow researchers to view more expanded sections of text which contain keywords. This facilitates more in-depth qualitative analysis. The combination of quantitative and qualitative analysis associated with corpus linguistics provides a logical approach to analysing ways of speaking in discourse communities (Baker, 2004).

The Data Set and Method

Conceivably, as the concept of Design Thinking has been important in design research for over 2 decades, it would be possible to analyse ways of speaking found in virtually any design paper, book or book chapter from the last few years. There is however comparatively little value in analysing texts which may mention 'Design Thinking' in passing. This practice would produce a diluted study with very limited insights. To increase the likelihood of creating valuable insights, it is more valuable to analyse a more homogenous sample which focusses on the research domain (Guest et al., 2006). In this study, this meant analysing papers which *focus* on Design Thinking. To do this, this study analysed papers which include the term 'Design Thinking' in the title of the paper. This strategy was used as researchers tend to rely on article title as the "main source of information" for judging article relevance (Jamali and Nikzad, 2011, p.653). Technology also supports searches conducted by article title. When using an online search engine to hunt for articles it is necessary to input terms which are relevant to the research domain. Search engines tend to prioritise searching for articles which contain these terms in the article title (Nagano, 2015; Beel et al, 2009). Users are more likely to access these results than results further down the results list (Nagano, 2015). These results are therefore more likely to contribute to the discourse of an academic community than articles which are found further down the list.

The widespread interest in Design Thinking means that articles which focus on this process are found in areas as diverse as *children's spirituality* (see, Tan and Wong, 2012), *medicine* (see, Patel et al, 2014) and *food science* (see, Olsen, 2015). Analysing papers which are published in a range of fields would however not provide insight into ways of speaking produced by the design research discourse community. One distinguishing feature of academic discourse communities is the specific avenues where members publish their work (Thompson and Hunston, 2003). This study analyses papers published in journals which include the term *design* in their remit. Design is characteristically a multidisciplinary area of research. Reflecting this, many design journals have multidisciplinary remits. This study analyses papers published in journals whose remits include *design, design and art* or *design and architecture.* The study does not include papers published in journals whose remit combines *design* with *engineering*. This decision results from the aforementioned idea that design researchers attempt to create a distinction between Design Thinking and scientific thinking. The author reasoned that including articles published in design engineering journals may reduce the likelihood of gaining focused insight into the design research discourse. The decision to exclude papers published in design engineering journals underscores the difficulty associated with creating a data set whose purpose is to uncover ways of speaking in a multidisciplinary discipline like design research.

The study does not include papers published in design conferences. Design researchers often publish in conferences with a view to extending the contribution to a journal article. Analysing journal papers may provide more of a definitive insight into ways of speaking than the process of investigating conference papers. In addition, the study only analyses papers which are published in peer-reviewed journals. The process of peer-review provides a definitive quality-check of research in an academic discourse community (Cope and Kalantzis, 2009). Because of this, analysis of peer-reviewed papers provides a more valuable insight into ways of speaking on Design Thinking than does investigation of non-peer-reviewed texts.

o optimise the search for data, the study makes use of 2 search engines: 'Google Scholar' and 'Locate'. The latter is available only at the author's workplace. Use of 2 search engines helped the author to find articles that either one of the search engines may have missed. The search for peer-reviewed journal articles was undertaken between 30th June and 7th July 2016. It identified 45 suitable papers.

Analysis of Abstracts

This study analyses only the abstracts of the papers in the data set. The purpose of the abstract in academic articles is to "reflect fully and accurately the work reported" in the paper (Pitkin et al., 1999, p.1110). Academic discourse is condensed in abstracts, because of this they can provide a rich source of data for researchers aiming to analysing ways of speaking (Thompson and Hunston, 2003). Indeed, analysis of abstracts have been used to investigate discourse in academic fields (e.g. Hyland and Tse, 2005; Blythe, 2014; Nagano, 2014; Ghassan, 2016).

Method

38 of the 45 papers contained abstracts. The individual abstracts were saved as UTF-8 files and uploaded into the concordancer *Sketch Engine*. Henceforth, the resulting data set is termed the *Design Thinking Data Set*. This corpus contains 5800 words. Keyword analysis and subsequent concordance analysis of keywords was conducted on the Design Thinking Data Set. The keyword analysis made use of a sub-corpus of the aforementioned British National Corpus as the reference corpus. The sub-corpus (termed *'Written Academic'*) contains a range of texts found in the "the 'Short Loan' collections of seven University libraries" (Burnard, 2007, unpaged; original emphasis). Short loan collections consist of academic texts which are core in their respective fields (Burnard, 2007). They therefore contain ways of speaking which are core to specific academic tribes. Specifically, the Written Academic sub-corpus consists of text from the following areas: humanities; medicine; natural sciences; politics; law; education; social and behavioural sciences; technology; computing; engineering. The corpus does not include text from art or design-based subjects. Therefore, using the Written Academic sub-corpus the reference corpus provides a good opportunity to uncover keywords used by the design research discourse community. The keywords analysis uses a tolerance of $p < 0.05$.

Results and Discussion

Figure 5 shows terms with a keyword score which is associated with a 95th percentile certainty of significance. To display the list effectively it is divided it into 2 columns.

word	frequency	Score
DT	13	2022.1
students'	5	778.4
designer's	5	778.4
designers	25	548.0
Thinking	9	350.9
design	211	266.6
constructivist	5	239.0
designing	10	214.2
Design	14	198.2
explorin	6	169.3
thinkers	8	131.4
pedagogy	6	145.5
thinking	86	139.8
digital	8	124.8
educators	6	118.4
architectural	5	101.6
solving	9	98.6
innovation	11	83.8
innovative	5	77.2
architecture	5	52.1
situated	5	51.3
paper	32	41.0
styles	5	33.5
students	34	33.1
explore	5	28.5
reasoning	6	28.4
learning	31	28.0
conceptual	6	25.6
representations	6	24.7
framework	10	20.7
classroom	6	18.0
offers	5	17.8
article	9	16.5
organizations	5	16.5
interaction	7	16.0
argues	6	14.9
concepts	7	14.8
media	8	14.6
domain	5	14.4
project	8	13.8
author	5	13.1
understanding	14	13.1
perspective	6	12.9
strategies	5	12.3
practices	8	11.6

word	frequency	Score
process	29	11.3
skills	9	11.2
criteria	6	10.4
employed	5	9.9
contemporary	5	9.9
search	6	9.7
theoretical	5	9.4
ideas	9	8.2
ways	12	8.1
student	5	8.1
literature	5	8.1
processes	7	8.0
development	21	7.9
research	19	7.8
traditional	7	7.7
style	5	7.6
thought	12	7.4
environment	5	7.3
practical	9	7.2
study	24	7.1
art	9	7.0
science	6	6.9
identified	6	6.7
key	5	6.3
presented	5	6.2
concept	6	6.1
how	22	6.1
knowledge	12	6.0
related	7	5.6
writing	5	5.5
practice	11	5.2
education	12	5.0
current	5	4.9
term	7	4.9
teaching	5	4.8
We	14	4.6
problem	11	4.6
questions	6	4.6
activities	5	4.6
results	7	4.1
using	8	4.1
better	5	4.1
role	8	4.1
through	15	4.0

Figure 5: Keywords for the Design Thinking Data Set

The keyword analysis uncovered 89 keywords, however space limitations prevent discussion on all these. The following discussion focusses on themes which relate to the aims of this paper. These themes are 'Creating meta-knowledge' and 'Speaking on Design'.

Creating Metaknowledge

The keywords ***reasoning***, ***framework***, ***criteria***, ***process***, ***processes*** and ***practices*** are used by researchers when putting forward broadly applicable descriptions of Design Thinking or Design Thinking steps. To illustrate, one researcher *"recognize[s] multifaceted **criteria** in the design process"*; another views *"design thinking as a **process** comprised of both linear and non-linear aspects"*. A further researcher notes a *"contingent set of **practices** carried out by professional designers"*. The tendency for researchers across academic disciplines to construct broadly applicable descriptions has been well documented (Kalfoglou et al, 2000). The pattern for researchers in the Design Thinking Data Set to create broadly applicable descriptions echoes this theme. When claiming broadly applicable descriptions, researchers across academic disciplines create what is termed *meta-knowledge* (Kalfoglou et al, 2000). To understand the importance of meta-knowledge in research fields, it is important to reflect on how academic discourse communities build an impression of legitimacy. Research communities attempt to describe and classify an intellectual territory which is associated with their domain (Betcher and Trowler, 2001). Creating broadly applicable descriptions of elements contained within the domain helps communities to claim more concrete ownership of the domain than do descriptions with a very limited application (Betcher and Trowler, 2001; Kalfoglou et al, 2000). In the Design Thinking Data Set, use of the keywords *reasoning*, *framework*, *criteria*, *process*, *processes* and *practices* helps researchers to make broadly applicable claims over the intellectual territory of 'Design Thinking'. Researchers in the data set are therefore creating meta-knowledge on their domain.

To recall, these keywords emerge from comparing the Design Thinking data set with a reference corpus comprised of texts from a range of academic disciplines. The presence of a host of keywords which enable researchers to claim meta-knowledge suggests that the Design Thinking research community may be particularly focussed on creating broadly applicable descriptions to engender a sense of legitimacy.

Speaking on 'Design'

The term 'design' can be used to refer to a verb (e.g. designing an object or service) or a noun (e.g. an undergraduate design course). The keyword ***design*** is used once as a verb in data set: *"graphic designers are increasingly asked to **design** innovative solutions"*. When professional designers or design students tackle a design brief, they tend to create a specific 2D or 3D artefact or service. Interestingly, in the data set, the verb-form of the term *design* does not refer to a specific object or service. Rather is refers to more abstract ideas—*"innovative solutions"*. This pattern is also seen when researchers use other forms of the verb *to design*. The highly ranked keyword *designing* (present tense) consistently refers to general and abstract ideas. Separate researchers refer to *"a model of **designing**"* and *"the different forms of thinking which can be observed in **designing**"*. Focussing on general or abstract ideas allows researchers in the data set to make broadly applicable claims when using the verb-form of the term *design*. Use of the verb-form of *design* therefore appears to help these researchers construct meta-knowledge on Design Thinking, further cementing their claims to ownership over the domain.

The process of speaking in abstract—rather than specific—terms may provide another function. It may allow researchers to separate the 'act of designing' associated with Design Thinking from the 'act of designing' associated with day-to-day design practice in professional studios and in classrooms. Put in a more distilled manner, the way of speaking on design 'as a doing word' may allow researchers to separate the domain of Design Thinking from those of design practice or design education. Framing the 'act of designing' as being associated with Design Thinking may further amplify researchers' claims to authority over their investigative domain.

Overwhelmingly, the pattern in the data set is for researchers to use the term ***design*** as a noun. Researchers use the term to signal a range of aspects as 'belonging to design'. It is possible to subdivide the issue of 'belonging to design' into 3 sub-categories: conceptual and intellectual ideas; practice-related classifications; people. Conceptual and intellectual ideas include *"the design process"*, *"design ideas"* and *"conceptions of*

design"; practice-related classifications include *"design disciplines"*, *"design professions"*, *"design tools"*; people with design-oriented affiliations include *"design teams"*, *"design experts"* and *"design professors"*. Betcher and Trowler (2001) argue that academic research communities use the strategy of sub-classification to deepen their claim to ownership over their domain. In keeping with Betcher and Trowler's (2001) theory, the use of the noun-form of the term *design* to create 3 sub-classifications may help researchers to deepen their claim to intellectual territory which they associate with the domain of Design Thinking. The process appears to allow researchers to overwhelmingly frame design as an intellectual domain (a 'thing') rather than as a practice (something that people do). This further underscores the idea that researchers may create a distinction between Design Thinking and design practice.

The overwhelming pattern for researchers to use the noun form of the term *design* echoes observations made by critical theorists who study how research communities claim authority over their domain. Billig (2008) reports a strong tendency for researchers across academia to focus on using the noun-form of words. This strategy (termed *nominalisation*) instils classifications or descriptions put forward by researchers with a sense of authority:

> *By turning verbs into nouns, speakers/writers can convey that the entities, denoted by nominalization, have a real and necessary existence (Billig, 2008, unpaged; original emphasis)*

The idea that nominalised descriptions come with a perceived sense of authority helps academics to frame an idea which is subjective as an objectively valid phenomenon: "speakers/writers turn processes into entities and typically assume the existence of such entities." (Billig, 2008, unpaged, original emphasis). This in turn affects how readers understand texts—readers can fall into the habit of assuming that nominalised descriptions are objectively correct (Billig, 2008). The term *market forces* is an example of a nominal in the field of economics. The term is used to denote fluctuations in finances without taking into account the actions of individual actors in financial systems. In this way, market forces have a life of their own, distinct from the actions of people who buy and sell commodities, products and services (Billig, 2008). Use of the term *market forces* has enabled economists to claim authoritative knowledge on financial systems without needing to defend the fact that they may not take into account the full range of transactions between people which create monetary systems. Use of the term *market forces* therefore enables economists to write this financial process into existence. Returning to the findings in the Design Thinking study, it is important to note that different design disciplines do not necessarily share "design ideas", "conceptions of design" or "design tools". To illustrate, fashion designers have different conceptions of design practice and use different design tools to automotive designers or interface designers. Furthermore, concepts like "design ideas" and "design tools" vary within a particular design discipline. Differences in design processes in the field which I teach—Automotive Design—illustrate this. Typically, in a vehicle design studio owned by a large, international manufacturer, the complete design of a vehicle is not carried out by any one particular professional. Instead, several different professionals with different specialist skills sets each work on different aspects of the overall design of a vehicle. The initial design phase is carried out by specialists who use sketching to undertake a 2D design process. Other specialists then use 3D CAD tools at a high level to create accurate 3D versions of the 2D designs. Therefore, there exists a *range* of design processes—the characterisation of each is dependent on where the specialist fits in within the overall workflow cycle and which tools he or she uses. Focussing on the noun-form of design enables researchers in the data set to frame these subjective concepts as objectively valid nominals which apply broadly across 'design' when they do not.

The results suggest that the use of nominals and the creation of meta-knowledge may enable researchers in the Design Thinking Data Set to claim authority over their investigative domain. However, the practice of claiming authority appears to require researchers to artificially separate Design Thinking and design practices when, logically, they must be intrinsically linked. The findings make it possible to speculate that use of skewed ways of speaking may help the design research discourse community to write 'Design Thinking' into existence.

Conclusion

Existing research suggests that creating a skewed separation between the way that designers think and the way that scientists think helps the design research discourse community to claim knowledge and intellectual territory on Design Thinking. This paper has used corpus linguistics tools to further investigate ways of

speaking that the design research discourse community use when claiming knowledge on Design Thinking. The findings in this paper suggest that use of nominals and the creation of meta-knowledge helps researchers to construct the domain of Design Thinking and claim authority over it. These strategies appear to have helped to create an artificial separation between Design Thinking and the domains of design practice and education. The findings raise the possibility that the community is writing 'Design Thinking' into existence.

Kimbell (2011) has argued that critical analysis of Design Thinking research is in its infancy. This is worrying given the influence of Design Thinking both within design research and in a range of wider fields. A lack of empirical enquiry using methods which are specifically designed to investigate ways of speaking may have contributed to the lack of critical analysis. This study has demonstrated the value of using one such method (corpus linguistics) in unpicking ways of speaking used in Design Thinking research. The author hopes that the findings help to enable design researchers to reflect further on how they may contribute to creating knowledge on Design Thinking in the future. The findings may also provide a valuable avenue for readers to reflect on existing Design Thinking research. The findings indicate the need for more empirical analysis of ways of speaking which are associated with Design Thinking research.

A limited amount of insight can be gleaned from analysing abstracts using corpus linguistics. Though condensed, abstracts represent only a proportion of the overall paper. In addition, corpus linguistics tools can ignore some extent contexts which do not relate to keywords and do not involve qualitative analysis of whole sets of data. The research in this paper represents part of a wider study which the author has conducted as part of their PhD. The wider study overcomes these issues.

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Track 4.f Introduction: Strategic Design of Sustainable Business Models

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Introduction

Concerns about the societal and environmental impact of how companies operate have generated increasing interest in more sustainable ways of doing business (Porter & Kramer, 2011). Research and practice from the past decade show that a Sustainable Business Model Innovation lens is suitable to embed sustainability into firms' objectives and operations (Bocken et al., 2014; Schaltegger, Lüdeke-Freund, & Hansen, 2012). Consequently, Sustainable Business Model Innovation has been emerging rapidly as a research field (Lüdeke-Freund & Dembek, 2017). Recent developments in this field build upon seminal work on Design for Sustainability from the past two decades to establish a connection with Strategic Design (Baldassarre et al., 2019; Geissdoerfer et al., 2016; Manzini, 1999; Tukker, 2004). Strategic Design is a research stream that studies how to leverage the discipline of Design in the context of Strategy and Innovation Management (Calabretta et al., 2016; Karpen, Gemser, & Calabretta, 2017). More specifically, it focuses on the application of design practices, principles and methods to the formulation and implementation of innovation strategies that benefit people and organizations alike (Calabretta et al., 2016). The connection between Sustainable Business Model Innovation and Strategic Design is mainly supported by the argument that the strategic and experimental nature of design enables the integration of stakeholders' objectives including sustainability concerns, while also providing the process dimension needed to move away from theory towards concrete practice and tangible impact (Baldassarre et al., 2017; Bocken, Schuit, & Kraaijenhagen, 2018). However, research on the role and contribution of Strategic Design to Sustainable Business Modeling is still in its infancy. Consequently, within this track of the 2019 edition of the Academy for Design Innovation Management Conference, we collected four research contributions at the intersection between Strategic Design and Sustainable Business Model Innovation. These contributions are summarized in the paragraphs below, followed by a reflection on all of them and potential directions for future research.

The first contribution from Baldassarre, Calabretta, Bocken, Diehl and Keskin reviews how the concept of Design for Sustainable Development has been evolving since its origins in the 1960s, gradually broadening its scope from the design of products to the design of product-service systems (PSS), business models and wider ecosystems. By taking a business perspective on this evolution, the review shows how designers have shifted their focus from designing products to designing solutions for business problems, thus assuming an increasingly strategic role within the organizations they operate in. This review is summarized into a visual framework, which is used as an input for a discussion with eight international academic experts on how the role of sustainable designers has evolved over time across these four nested levels of design. The findings point out that the role of Designers for Sustainable Development can be framed around five topics: strategic objective and its related perspective, language, key activities and main challenge. The strategic objective refers to the focus of designers in steering strategic decisions in organizations, the perspective they adopt in

approaching business problems and developing solutions, the language they use in communicating with different stakeholders, the key activities they engage during the design process, and the main challenges they face within this process. On a product design level, the strategic objective of design is to push organizations to think beyond the “form and function” of their products, and steer decisions towards changing their life cycle. This entails, for instance, adopting a technical language aligned with the R&D department, analyzing the life cycle of products and redesigning them accordingly. The main challenge is related to the reduction of material and energy flows associated with products. On a PSS-level, the strategic objective is to push organizations to think beyond the life cycle of products, and steer decisions towards changing tangible and intangible stakeholder exchanges such as knowledge, materials, energy and money. This entails bridging the perspectives and languages of different departments in order to analyze the stakeholders involved in the innovation process and design not only new sustainable products but also new services around them. The main challenge at this level is the implementing of sustainable product-service innovations. On a business model level, the strategic objective is to push organizations to think beyond products and services, and steer decisions towards (re)defining their purpose, how they function from an economic and operational standpoint, in order to pursue sustainability goals while making profit. This entails adopting a firm centric perspective and a strategy language in order to experiment with new business models. The main challenge is to ensure the financial viability of business models and scaling them up. On an ecosystem level, the strategic objective is to push organizations to think beyond their individual business, and partner with others in order to (re)define (un)sustainable market practices. This entails adopting a cross organizational perspective and speaking a policy language in order to analyze entire industries end ensuring cross sector alignments. The main challenge of this level is turning these initiatives and joint projects into new business entities.

The second contribution from Pinheiro and Jugend explores a knowledge gap on how to design new sustainable business models by linking Strategic Design with Circular Economy principles and a Product Portfolio Management logic. In the context of this study, the circular economy is referred to as a system aimed at minimising waste and making the most of resources through intentional design by reusing and refurbishing products, as well as through material recycling. Product portfolio management is referred to as the structured decision making process through which organizations choose to focus on and bringing to market specific projects, products and services. This study links these notions with Strategic Design and integrates them into a conceptual framework. Consequently, the framework is used as a conceptual lens to analyze the case of Brazilian company with one hundred employees operating in the wood industry. The product portfolio of the company is based on several products derived from wood and vegetable fibres, including gymnastics apparel, indoor and outdoor furniture. Some of the products within the portfolio are derived from recycled and reforestation wood. Using the lens of the framework, the study analyzes the drivers and barriers related to the Strategic Design of a Sustainable Business Models around such products with a specific focus on circular economy aspects. A first identified driver is the commitment of top management to prioritize circular products within the portfolio. A second identified driver is the dissemination of circular principles and sustainability goals across the company. A third driver relates to the compliance of the company with local legislation, which has recently started to promote the reuse of raw materials in the wood sector in order to preserve biodiversity in the country. Conversely, a main barrier for the design of a sustainable business model around circular wooden products is the lack of a wide range of technological possibilities to recycle the raw material in different ways that are functional to further diversify them and expand the product in this direction. Another barrier relates to difficulty in selecting suitable partners and suppliers across the supply chain to foster a business model that is fully Circular.

The third contribution from Ballie is a feasibility study focusing on how Strategic Design may support the development of circular / sustainable business model strategies. Specifically, the study looks at how Makerspaces might be used as educational hubs to experiment with new tools, skills, techniques and technology to develop circular design strategies for micro-manufacturing within the Scottish textile sector. The assumption is that Makerspaces might support the repurposing of textile waste within a redistributed manufacturing system (RDM). The research argues that design can play a strategic role in supporting the adoption of new mindsets, methods and models to enhance awareness and understanding of the need to design for a circular economy. The research activities comprised of field research and factory visits to engage with large Manufacturers to deeper understand systemic issues around textile waste. This was followed by hosting two Make-a-thon workshops within Makerspaces in both rural and urban environments – this provided an opportunity to connect with different stakeholders from across the supply chain and to invite them to input to make recommendations for conceptualizing Circular Fashion and Textile Archetypes. The insights drawn from this research act as a starting point for future work, reflecting on the implications of the

methods applied, concluding the circular economy is the same imperative whether people are focusing on ecology, economy or just their own business. In this research, she further demonstrates that connecting different stakeholders from across the supply chain is instrumental in supporting circular practices. However, the research unearths many contradictions in the current narrative about circularity in Makerspaces. For instance, the business focus of the CE, and the required Sustainable design strategies will require intensive resource management to implement a RDM system for local textile economies. Last but not least, the Makerspace as facilitator in this process has several advantages like a neutral place for stakeholders to meet and to prototype directly generated ideas. The other side of the coin is the business model of the Makerspaces as well as the sustainability (in the sense of long lasting) of the Makerspaces themselves: during the research, one of the two Makerspaces had to close down.

The fourth contribution from Cheung and Kuzimina focuses on the sustainability impact of service-based sustainable business models. In recent years, service-based sustainable business model innovations have been gaining increasing attention in design research. A prominent example of this research is the mobility services based on collaborative consumption. However, it is unclear how the implementation of such service-based business models, and related activities and practices, impact the sustainability and experience of the proposed service offering. In this study, Cheung and Kuzimina draw on the literature on service design, product-service system and sustainable innovation, and propose a design-driven framework to evaluate the sustainability impact of service-based business model innovations. This framework, referred to as 'sustainability evaluation service blueprint', provides visibility to the complex multi-actor service operations, creates an understanding of the existing structure of stakeholder interactions during service operation, and gathers insights into the captured and uncaptured triple bottom line values within the existing product-service lifecycle. The authors test and validate this framework through six expert interviews, and conduct a desk research to generate two case studies in the mobility sector. The results of this study reveal that sustainable value creation is a collaborative effort and require the knowledge and expertise of various interdependent actors. Moreover, the results show that public and private actors hold diverse perspectives and viewpoints on the collaboration process; as such, the development of shared guidelines for the design and development of service-based innovations is crucial for the emergence of trust and prevention of collusive dynamics. Finally, this study show that engaging stakeholders in sustainable value creation requires a simple language. Accordingly, the authors suggest to use the word 'benefits' instead of 'values' in communicating sustainability impact of service-based innovations. This paper offers a springboard for practitioners and researchers to uncover compelling insights, discuss latest service design developments, and envision future directions for integrating sustainability into service-based business model innovations.

In conclusion, the contributions summarized within this editorial provide a step forward in advancing emerging theory and practice at the intersection between Strategic Design and Sustainable Business Model Innovation. Specifically, the Sustainable Business Model lens may help Strategic Designers embed sustainability associated with newly designed products and services into wider firms' objectives and operations. First, the sustainable business model lens provides a holistic perspective on the way in which business is done, by highlighting the value proposition (what value is provided to whom?), value creation and delivery mechanisms (how is value provided?), and value capture mechanisms (how money and other forms of value are captured) associated with products and services (Bocken et al., 2014). Second, a business model perspective allows sustainable design (e.g. long-lasting design, modular design) to be more impactful and commercially viable. For example, 'Philips Light as a Service' allows longer-lasting LED lights to be sold as part of a service-contract, allows for longer term financial value from a longer lasting product, while reducing environmental impact by including maintenance, repair, and replacement services into the business model (Kramer et al., 2019). The Strategic Design lens allows business model researchers to develop and employ valuable tools and methods to put sustainable business models into practice. For example, the creative approach of design thinking can be used to stimulate new ideas and allow researchers and designers to focus on implementation (Guldman et al., 2019). Second, the action-oriented, stakeholder focus of strategic design is highly compatible with the needs of sustainable business model innovation, especially as it provides the necessary tools and approaches for enacting the related transformation (Baldassarre et al., 2017). Finally, experimentation as a concept emerging in design and business model research is a way to support internal transitions towards sustainability as well as starting to test which new business models in practice (Bocken et al., 2018). The research argues that design can play a strategic role in supporting the adoption of new mindsets, methods and models to enhance awareness and understanding of the need to design for a circular economy. Ultimately, we encourage future research along four main trajectories. In line with the first contribution of this editorial, we suggest to investigate deeper into the connections between sustainable design and sustainable business through a

systematic literature review across these two domains. In line with the second and third contributions, we propose to further explore how Strategic Design practices can be leveraged to bridge the knowledge gap on how to conceptualize and implement Sustainable Business Models and to support the transition towards a circular economy with a major focus on feasibility and viability aspects. Additionally, we encourage researchers to explore the role that designers can play in this transition, as suggested by the first contribution. Finally, as stressed by the fourth and last contribution of this editorial, evaluating the sustainability impact of new business model innovations is an aspect of crucial importance, and we accordingly encourage future research to focus on it.

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The evolution of the Strategic role of Designers for Sustainable Development

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Design for Sustainable Development refers to the application of a design process to solve a problem related to sustainability, such as creating a pair of shoes that can be recycled or managing waste collection in a large city. Since the origins of this concept in the 1960s, Design for Sustainable Development has been evolving, gradually broadening its scope over time from the design of products to the design of services, business models and wider ecosystems. In this evolution, designers have come closer and closer to business problems, thus becoming more strategic. In this paper, we explore this evolution from a business perspective. We visualize it into a framework and interview eight academic experts about the *Strategic role of Designers for Sustainable Development*. We find that the evolution can be framed around five topics: the strategic goal of designers, and their related perspective, language, key activities and main challenge. After discussing how the evolution took place around each topic, we draw implications for designers and managers who are willing to play an active role in the transition towards sustainable development.

Keywords: Strategic Design, Sustainability, Product Service System, Business Model, Ecosystem

Introduction

The research fields of sustainability and design have grown significantly in the last decades and increasingly crossed their paths in addressing contemporary societal challenges (Bhamra & Lofthouse, 2016; Ceschin & Gaziulusoy, 2016).

Sustainability is a concept that can be traced back to the 1960s, when increasing concerns about the impact of human activities on the planet started to arise around issues such as the pollution of natural ecosystems and the depletion of critical resources (Carson, 1962; Fuller, 1969; Hardin, 1968). In 1972, an academic report called “The Limits to Growth” argued that our planet is a finite system and human development must not exceed its limits if collapse is to be avoided (Meadows, Meadows, Randers, & Behrens, 1972). Sustainability is therefore defined as a dynamic state of development in which a complex system can thrive without collapsing (Meadows, Meadows, Randers, & Behrens, 1972). Afterwards, the United Nations defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). More recently, the transition towards sustainable development has been framed through a set of specific goals: the Millennium Goals (United Nations, 2009), later turned into the Sustainable Development Goals (United Nations, 2015), for countries and organizations to jointly pursue.

Design is a discipline with human centricity and the meaningful fulfillment of individual and societal needs as core principles. Therefore, its applicability to sustainable development challenges is straightforward. Particularly, design has a twofold nature: "design-as-an-outcome" and "design-as-a-process" (Kimbell, 2012). "Design-as-an-outcome" refers to an artifact, a physical object created by someone who is the designer. "Design-as-a-process" refers to a creative, yet rational process, to develop the solution to a complex problem (Buchanan, 1992; Simon, 1973). In this paper, we focus on how design-as-a-process can contribute to Sustainable Development.

We define *Design for Sustainable Development (DfSD)* as the application of a design process to solve a complex problem related to sustainability, such as waste management in a large city (Bhamra & Lofthouse, 2016; Manzini, 1999, 2009). Over time, academic research and industry practice picked up this concept in different ways, resulting in an evolution of *DfSD* (Ceschin & Gaziulusoy, 2016; Konietzko, Bocken, & Hultink, 2018). Our goal is to provide a comprehensive and up-to-date mapping of this evolution, by integrating the business perspective as one of its current and future drivers. Specifically, the scope of *DfSD* has become broader over time, moving from leveraging design principles and practices for addressing exclusively technical challenges to using such principles and practices for looking at sustainable development from the perspective of people behaviors and socio-economic systems (Ceschin & Gaziulusoy, 2016). In recent years, a new focus at the intersection between design and sustainable development research has emerged, which looks at design as a way of bringing business considerations at the core of sustainable development. This is the consequence of two occurrences: first a progressive realization in research and practice that the implementation of the sustainability transition requires its integration with business objectives (Maas & Boons, 2009; Whiteman, Walker, & Perego, 2013); second, the increasing role that design plays in driving the strategic decision making of organizations that strive for meaningful innovation (Brown, 2008; Calabretta, Gemser & Karpen, 2016).

In this paper, we want to integrate these recent developments and incorporate the business perspective as a driver of the evolution of *DfSD*. As a result, we propose and validate a four-level framework of how the role of designers in sustainable development has evolved by becoming more strategic in integrating business goals. We start from a comprehensive literature review to identify four nested levels of *DfSD*: Product Design, Product Service System Design, Business Model Design and Ecosystem Design. We subsequently use eight in-depth expert interviews to validate the framework and to further characterize the strategic role of designers in sustainable development from a business perspective. We conclude with some implications for designers and managers, and with some directions for future research.

Literature review

Product Design

The first level of *Design for Sustainable Development* is Product Design.

The global ecological and social concerns that had been brewing through the 1960s reached a crisis point in the 1970s, and affected design as well. Papanek's book, *Design for the Real World,* urged designers to introspect deeply about how they could contribute meaningfully to global social and ecological issues (Papanek, 1971). Papanek called on designers to be accountable for - and driven by - global ecological and social needs, rather than the consumer-led economy. As a consequence, the concept of "Green Design" for responsible consumers started to emerge. John Elkington formulated "*Ten questions for the Green Designer",* for a 1986 UK Design Council booklet, inviting reflection on the fact that each product has an impact associated to its life cycle, namely the way in which it is produced, distributed, used by people and ultimately dismissed. In the 1990s, the concept of "Green Design" evolved into the concept of "Eco-Design" (Brezet & van Hemel, 1997). Eco-design aimed to create a win-win situation by addressing both the ecology and the economy; it sought to minimize the negative ecological impacts of the product life cycle, while simultaneously offering financial benefits (so-called win-win situations) (Ceschin & Gaziulusoy, 2016). In Eco-design, the environment was given the same status as more traditional industrial values such as profit, functionality, aesthetics, ergonomics, image and overall quality (Brezet & van Hemel, 1997). It is just since 1995 that the term "*Design for Sustainability*" has received greater acceptance (Bragd, Baumann, & Boons, 2002). Many scholars, in describing *Design for Sustainability* draw heavily on a more broader and holistic scope than Eco-design by incorporating social, ethical and equity issues (such as wealth disparities and developing world factors) into design (Crul & Diehl, 2006; Crul, Diehl, & Ryan, 2009; Dewberry & Goggin, 1996; van Weenen, 1995). Initially, the strategic aspects of *DfSD* were minor and mostly related to identifying internal and external

drivers that could result in win-win situations in which the ecological benefit would result as well in economic benefits.

Summarizing the previous paragraph, we conclude that at the Product level of *DfSD,* the outcome of the design process is typically a "green" product with a life cycle that results in a lower environmental impact. An example of this is the Aeron Chair by Hermann Miller, which can be fully disassembled and recycled in all its parts.

Product Service System Design

The second level of *Design for Sustainable Development* is Product Service System Design.

In the late 1990s, several scholars and practitioners realized that a focus only on products would not be sufficient to achieve sustainability goals. Leveraging this and former Eco-design ideas, Manzini stated that *DfSD* should take into account not just products but also services (Manzini, 1999). As firms become responsible not only for production and delivery of products but also for other phases in the life cycle of products (e.g. offering maintenance services in the use phase and designing take-back systems for the end-of-life of products), they have more incentives to adopt life-cycle thinking during the design and development phase of products (Manzini & Vezzoli, 2003). Consequently, the concept of Product Service System (PSS) emerged. PSSs are defined as "a mix of tangible products and intangible services designed and combined so that they are jointly capable of fulfilling final customer needs" (Tukker & Tischner, 2006). PSSs Design for Sustainability then became a research field of its own (Tukker, 2004; Tukker & Tischner, 2006). This new perspective positioned design as a strategic competence for creating new business opportunities and new ways of fulfilling product functions through the design and combination of novel sustainable products and services (Manzini, 1999; Manzini & Vezzoli, 2003). In a PSS strategy, the starting point is not a product or service, but the final functionality or satisfaction of customer needs (Tukker & Tischner, 2006). In that respect, PSS are also referred to as 'function-oriented business models' (Tukker, 2004). Such a business model has implications for the ownership structure of products since the main activity of firms moves and/or extends from selling products to giving access to the use of products via, for example, leasing schemes or pay-per-service models (Tukker, 2004). Finally, the changes in the ownership structures replace material intensive products with intangible services. Thus, this potentially leads to the 'dematerialization' of the economy, which is associated with the reduction of material flows in production and consumption (Mont, 2002).

Summarizing the previous paragraph, we conclude that at the Product Service System level of *DfSD,* the outcome of the design process is a product - service combination that reduces the impact of the product while providing something better to people. An example of this is the "OV bikes", a bike sharing service from the Dutch Railways that reduces the use of cars by helping people who take public transport to reach their final destination.

Business Model Design

The third level of *Design for Sustainable Development* is Business Model Design.

After the emergence of the Internet in the business field as well as the steep rise of technology-heavy companies on the stock exchange, academic research on business models rapidly increased in the first decade of the 2000s (Osterwalder & Tucci, 2005; Wirtz, Pistoia, Ullrich, & Göttel, 2015; Zott, Amit, & Massa, 2011). The business model is a conceptual construct that describes how organizations propose, create, deliver and capture value (Richardson, 2008; Teece, 2010). In parallel, business model innovation was positioned as a way to tap into and even create new markets rather than a 'trade-off'(Porter & Kramer, 2011; Yunus, Moingeon, & Lehmann-Ortega, 2010). It was recognized that the construct provides an effective and systemic lens to investigate sustainable innovation and to discuss with organizations about the integration of sustainability into their objectives and operations (Bocken, Short, Rana, & Evans, 2014; Boons & Lüdeke-Freund, 2013; Stubbs & Cocklin, 2008). With increasing evidence on pressing sustainability challenges, sustainable business model innovation rapidly emerged as a research field (Bocken et al., 2014; Boons & Lüdeke-Freund, 2013; Dentchev et al., 2018; Geissdoerfer, Vladimirova, & Evans, 2018; Lüdeke-Freund & Dembek, 2017; Stefan Schaltegger, Hansen, & Lüdeke-Freund, 2016). This field places a prominent focus on design, which is mentioned repeatedly in some key publications as a strategic process for the creation of sustainable business models (Bocken, Short, Rana, & Evans, 2013; Boons & Lüdeke-Freund, 2013). Boons & Lüdeke-Freund recognized that the design of sustainable business models is a key challenge of the field (Boons & Lüdeke-Freund, 2013). Bocken and

colleagues explained that there are several archetypes of sustainable business models and that PSS is one of them, thus reinforcing the connection with earlier design literature on *DfSD* (Bocken et al., 2014; Tukker, 2004). Later work explicitly included design approaches in sustainable business modeling (Baldassarre, Calabretta, Bocken, & Jaskiewicz, 2017; Geissdoerfer, Bocken, & Hultink, 2016; Keskin, Diehl, & Molenaar, 2013). An analysis of this work shows that through the sustainable business model innovation field, *DfSD* research and practice has evolved beyond the Product Service System level, becoming even more closely connected with the business domain.

Summarizing the previous paragraph, we conclude that at the Business Model level of *DfSD,* the outcome of the design process is a (new) organization or a corporate venture driven by a social and environmental purpose. An example of this is Peerby, a company whose core mission is reducing the amount of products that are consumed while connecting people in the same neighborhood.

Ecosystem Design

The fourth level of *Design for Sustainable Development* is Ecosystem Design.

Across the first and second decade of the 2000s, the discussion on Sustainable Development has been increasingly leveraging a new paradigm defined as Circular Economy, which has gained momentum in business, policy and academy, not the least catalyzed by the Ellen MacArthur Foundation (Geissdoerfer, Savaget, Bocken, & Hultink, 2017; MacArthur, 2013). The origins of this concept can be traced back to the 1960s (Carson, 1962; Fuller, 1969; Hardin, 1968) and it refers to an economic system in which resource input and waste, emission, and energy leakage are eliminated or minimized (i.e. closing their loops) in order to achieve a positive environmental and economic impact simultaneously (Geissdoerfer et al., 2017; Lüdeke-freund, Gold, & Bocken, 2018). The transition to a Circular Economy requires the intentional design of new products and services, and experimentation with new business models to deliver them (Antikainen, Aminoff, Paloheimo, & Kettunen, 2017; Bocken, de Pauw, Bakker, & van der Grinten, 2016; Bocken, Schuit, & Kraaijenhagen, 2018). However, in order for these new business models to work in practice, it is essential to establish a collaborative capacity across organizations in the form of ecosystems (P. Brown, Bocken, & Balkenende, 2019; Kraaijenhagen, van Oppen, & Bocken, 2016). The term ecosystem comes from the fields of environmental sciences and industrial ecology, where it is used to depict relationships across businesses and their impact on the environment, exemplified by the concept of industrial symbiosis (Chertow, 2000; Frosch & Gallopoulos, 1989). The term has also been used in business and management literature to establish a connection with strategic innovation and business models (Adner, 2017; Talmar, Walrave, Podoynitsyna, Holmström, & Romme, 2018). In this context, ecosystems can be seen as “macro” business models in which multiple organizations create a value network and achieve together competitive advantage by jointly delivering a value proposition (Adner, 2017; Bocken et al., 2013; Clarysse, Wright, Bruneel, & Mahajan, 2014; Short, Bocken, Barlow, & Chertow, 2014; Talmar et al., 2018). More recently, these ideas on ecosystems have been leveraged by design literature as well, and reframed from the related perspective. Specifically, it has been pointed out that the discipline of design, the design process, design practices and capabilities, can be used beyond the definition of firm-centric business models, for the definition of ecosystems, or in other words coalitions, of organizations collaborating towards sustainable development and / or a Circular Economy (Baldassarre et al., 2019; Bocken, Boons, & Baldassarre, 2019; Den Ouden, 2012; Konietzko et al., 2018).

Summarizing the previous paragraph, we conclude that at the Ecosystem level of *DfSD,* the outcome of the design process is a coalition of organizations collaborating to drive the sustainable transformation of the economic system. An example of this is the “Adaptive City Mobility”, a national consortium of 13 organizations collaborating to implement an Electric Mobility System for cities in Germany.

Research question

We have explained that *DfSD* refers to the application of a design process to solve complex sustainability problems (Manzini, 1999, 2009). By looking at different streams of literature from different domains, we have explained that over time this idea has been picked up by academic research and business practice in different ways resulting in an evolution of *Design for Sustainable Development* into four nested levels of design (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018). This evolution is visualized in figure 1.

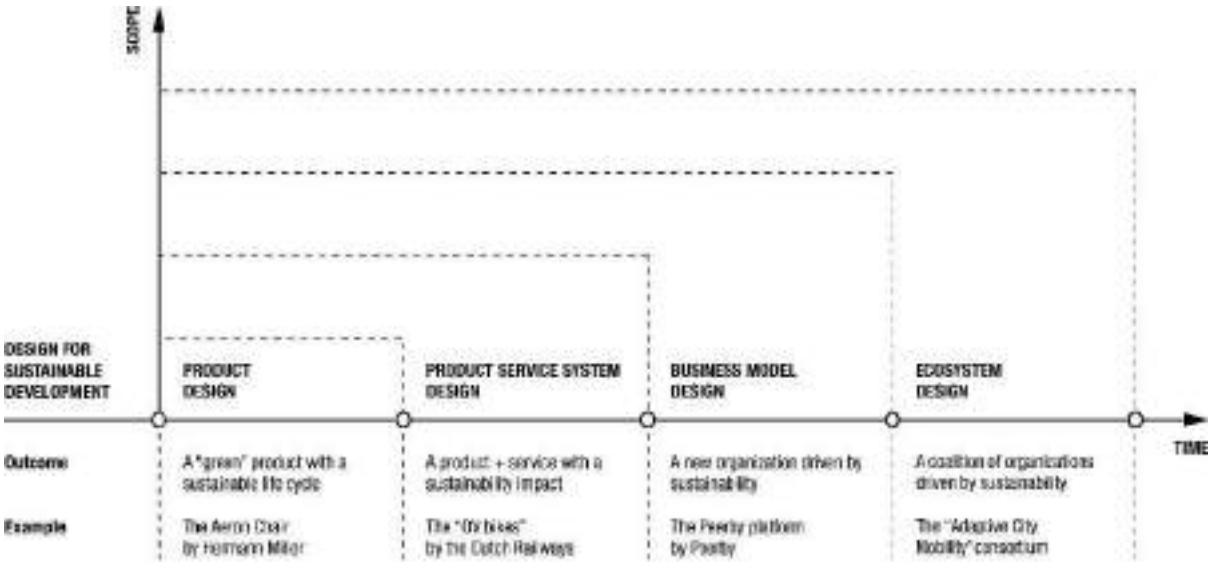

Figure 1: Framework of the evolution of Design for Sustainable Development. Based and adapted from: (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018)

Throughout this evolution, *DfSD* becomes increasingly strategic, establishing a connection with literature and practice from the domain of sustainable business (Baldassarre et al., 2017; Bocken et al., 2014; Manzini, 1999). Better understanding and leveraging these connections is of utmost importance if design researchers and practitioners want to play an active role as agent of change in the transition towards sustainable development (Manzini, 2009). Consequently, the goal of this paper is to explore the evolution *of Design for Sustainable Development* more in depth and from a business perspective.

Taking a business perspective on *DfSD* means looking at how designers can help in creating value for organizations while addressing sustainability challenges. Research has already studied how design practices and principles can play a strategic role in business domains like innovation (Calabretta, Gemser, & Wijnberg, 2017), branding (Beverland, Wilner, & Micheli, 2015), and shaping the organizational culture (Elsbach & Stigliani, 2018). However, how this might be the case in the context of *DfSD* and its evolution has not been analyzed yet. Consequently, we pose the following research question:

How has the Strategic role of Designers for Sustainable Development evolved over time?

In this paper, we leverage on a decision-making logic on the strategic role of design (Calabretta et al., 2017) and define the role of designers as 'strategic' when designers are able to get involved and influence strategic decisions on sustainable development. Strategic decisions are decisions implying high uncertainty in the final outcome, prolonged course of actions, significant resource commitment, and involvement of several decision makers (Eisenhardt & Zbaracki, 2019)

Method

In order to address the research questions, we used the framework of the evolution of *Design for Sustainable Development* derived from the literature (see Figure 1) as the starting point for a discussion with eight international academic experts working in six different European countries. In order to gain richer insights into the strategic role of designers for sustainable development, we selected experts with different research focuses. Furthermore, four of the experts that we selected have been working in the industry on related topics. The research focus, academic experience, and industry experience of the eight experts are summarized below in Table 1.

Table 1: Research focus, academic experience and industry experience of the experts selected for the interviews

	Research focus	*Academic experience*	*Industry experience*
Expert 1	Sustainable Design, Sustainable Business Strategy	3 years	5 years
Expert 2	Sustainable Design	27 years	-
Expert 3	Corporate Sustainability	12 years	-
Expert 4	Sustainable Business Strategy	8 years	5 years
Expert 5	Sustainable Design, Sustainability Policy	38 years	-
Expert 6	Sustainable Design	13 years	3 years
Expert 7	Corporate Sustainability	15 years	-
Expert 8	Sustainable Business Strategy	5 years	12 years

Data collection

Data has been collected using semi-structured qualitative interviews (Patton, 2002). Two researchers conducted the interviews. While one researcher showed the framework to the experts and probed them with the research question, the other researcher noted all the answers and comments on a printed copy of the framework. Some interviews were conducted face-to-face and some over Skype. All interviews were digitally recorded and consequently transcribed.

Data analysis

Data has been analyzed using a qualitative approach (Corbin & Strauss, 2008; Miles, Huberman, & Saldaña, 2013). The transcripts of the interviews and the experts' comments noted upon the printed models, have been scanned by the lead researcher and consequently condensed into written highlights and visual diagrams (Corbin & Strauss, 2008). After this first level of analysis, the written highlights and visual diagrams have been further analyzed through a set of face-to-face discussions involving the authors of this paper (who have relevant academic and industry experience on the *Strategic role of Designers for Development*). This second level of analysis allowed defining key topics (Miles et al., 2013). Written notes were taken during this process. Consequently, these notes have been used to map key developments onto the framework, to understand how the *Strategic role of Designers for Sustainable Development* has evolved around each key topic.

Results and discussion

The eight interviews, the follow up brainstorming and visual analysis allowed defining five topics related to the *Strategic role of Designers for Sustainable Development*. The topics are: strategic objective, perspective, language, key activities, and main challenge. They are presented and discussed in the following paragraphs. A visualization of how the *Strategic role of Designers for Sustainable Development* has evolved over time around these topics is presented in figure 2.

Strategic objective

Throughout the evolution of their role across the four levels of our framework (figure 1), the strategic objective of designers - namely what they need to focus on to steer the strategic decisions of organizations - has changed.

Designers traditionally focus on the "form and function" of products. Eco-designers are different because they do not only focus on how products look like but also on how they are produced, distributed and dismissed (Expert 2, Expert 5). Eco-design places a major focus on reducing the life cycle impact of products (Ramani et al., 2010). Consequently, at the Product level the strategic objective of designers is pushing an organization to think beyond the "form and function" of their product, and steer decisions towards changing its life cycle

(production, distribution, use, end of life), in order to reduce its environmental footprint while making profit. When the scope is broadened to services, suddenly the focus is placed on the exchanges with other stakeholders, and on how these affect the environmental and social impact of the supply chain (Expert 4, Expert 6). The design of sustainable services and business models places in fact a major focus on stakeholder interactions (Ceschin, 2012). Consequently, at the Product Service System level, the strategic objective of designers is pushing an organization to think beyond the life cycle of its product, and steer decisions towards changing tangible and intangible stakeholder exchanges (e.g. knowledge, materials, energy, money, etc.), in order to foster a positive social and environmental impact while making profit. Designers of sustainable business models place their focus on the entire organization (Expert 3, Expert 6). In fact, Sustainable Business Model Innovation entails redefining the core goals and underlying processes of organizations (Bocken et al., 2013). Consequently, at the Business Model, level the strategic objective of designers is pushing an organization to think beyond products and services, and steer decisions towards (re)defining its purpose, how it functions from an economic and operational standpoint, in order to pursue sustainability goals while making profit. When broadening the scope further, the focus of designers is fostering a sustainability transition (Gaziulusoy & Ryan, 2017). In other words, this can be described as a focus on the transformation of an entire market sector or industry through a collective conversation of all the parties involved (Expert 3, Expert 6). Consequently, at the Ecosystem level, the strategic objective of designers is pushing multiple organizations to think beyond their individual business, and steer decisions towards collectively (re)defining (un)sustainable market practices, in order to facilitate the transformation of existing sectors while making profit together.

Perspective

Throughout the evolution of their role across the four levels of our framework (figure 1), the perspective of designers - namely the point of view from which they approach a problem and develop a solution - has changed.

Most designers do not know what strategy is and how sustainability relates to it from an organizational perspective (Expert 7). Strategy is a core function of an organization that binds together all the other ones (e.g. R&D, Operations, HR, etc.) and as such, business sustainability can only be achieved if strategy demands it (van Tulder, van Tilburg, Francken, & Da Rosa, 2013). By training, designers have a technical background and are therefore able to change the way products are developed to reduce their impact (Expert 2). Consequently, at the Product level the perspective is department centric. The designer works from the perspective of the R&D department, aiming to change how products are made. However, when innovating with a broader focus, designers are forced to understand what is more relevant for business and how different people in their organization look at sustainability issues (Expert 6). Consequently, at the Product Service System level, the perspective is cross-functional. The designer works from the perspective of the R&D and the commercial departments, aiming to change how products are made and delivered to customers. Eventually, the business model framework can be used to take the perspective of the entire organization on a design change for sustainability (Expert 4). In fact, the business model can be used to define company strategy (Richardson, 2008; Teece, 2010). Consequently, at the Business Model level the perspective is firm-centric. The designer works from the perspective of the entire organization, aiming to change how it operates and makes money. When the focus becomes the sustainable transformation of an entire industry there are many perspectives because all the companies operating in that industry have different priorities and issues to deal with (Expert 1, Expert 5). In this case, the designer must be like a “spider-in-the-web” and be able to take all perspectives into account (Expert 5). Consequently, at the Ecosystem level, the perspective is cross organizational. The designer works from the perspective of multiple organizations, aiming to change together existing market sectors.

Language

Throughout the evolution of their role across the four levels of our framework (figure 1), the language of designers - namely the way in which they communicate with different stakeholders - has changed.

Designers working with complex problems must be able to speak different languages (Calabretta, Gemser, & Karpen, 2016). Over time, designers working with sustainability have learned to speak different languages in order to communicate more effectively with different audiences and foster the adoption of their ideas (Expert 5). When they design products, they must be able to explain to engineers how such products can be developed more sustainably (Expert 5). Consequently, at the Product level they use an engineering language, suitable to communicate with the R&D department of an organization. When they design services, they must be able to

explain to the commercial departments how sustainability requirements will change how the current offering is delivered (Expert 5). Consequently, at the Product Service System level they use an operational language, suitable to communicate with the R&D and commercial departments of an organization. When the focus is the transformation of a business model, it is important to understand and use the same language of the upper management (Expert 7). This is essential to make sure that sustainability efforts are driven from the top of the organization (van Tulder et al., 2013). Consequently, at the Business Model level they use a strategy language, suitable to communicate with the upper management and CEO of an organization. If designers want to focus on the sustainable transformation of an entire industry and take the perspective of multiple organizations, it is important that they understand policy dynamics and language (Expert 5). Consequently, at the Ecosystem level they use a policy language, suitable to communicate with decision makers in the public sector.

Key activities

Throughout the evolution of their role across the four levels of our framework (figure 1), the key activities of designers - namely the most important actions they have to get done - have changed.

Designers who want to develop sustainable products must be able to understand what a life cycle is and how it can be assessed (Expert 2, Expert 5). A life cycle approach to the design of a product is based on first analyzing the current life cycle and then setting clear design objectives and criteria to lower its environmental impact (Vezzoli & Sciama, 2006). Consequently, at the Product level the key activities of designers consist of life cycle analysis supporting product design. When designing services, the interactions of stakeholders and social aspects around the product life cycle come into play (Ceschin, 2012; Tukker, 2004). Thus, it is important to analyze who these stakeholders are, what they exchange with each other and what do they want to achieve (Expert 1, Expert 6). Consequently, at the Product Service System level the key activities are stakeholder analysis supporting product and service design. When the focus is broadened to designing business models, it is essential to try out different options by making very concrete experiments to see which model can work, not only from a sustainability standpoint but also from a business standpoint (Expert 4). Transforming the entire business model of an organization requires experimentation capabilities (Keskin et al., 2013). Consequently, at the Business Model level, the key activities are design of experiments supporting business modeling. When wanting to transform wider industries it is important to consider the role of businesses as well as that of the public sector (Walls & Paquin, 2015). Designers must be able to understand who are the players involved in a certain market, what are the power plays taking place and how they can be disrupted (Expert 3). Consequently, at the Ecosystem level the key activities are industry analysis supporting alignment of private and public sector.

Main challenge

Throughout the evolution of their role across the four levels of our framework (figure 1), the main challenge of designers - namely the most difficult issue that they face - has changed.

The more designers move away from designing products towards solving complex sustainability problems, the more their challenge will change from a technical to a business one (Expert 1, Expert 3, Expert 8). Reducing the energy and material flows associated with a single product is a technical challenge (Ramani et al., 2010). Consequently, at the Product level the main challenge relates to technical issues. Designing a “green” product requires reducing material and energy flows but this has a limited impact if the wider context is unsustainable. In fact, if the material is not sourced responsibly and if the energy comes from fossil fuels a product cannot be sustainable (Expert 2). Beyond the product level, design can foster more radical sustainability changes (Manzini & Vezzoli, 2003). However, when working in industry practice with an organization, the implementation of more radical solutions is difficult (Expert 6, Expert 8). Product - service combinations are complex solutions involving multiple stakeholders, which makes them difficult to implement (Morelli, 2002; Vezzoli, Ceschin, Diehl, & Kohtala, 2015). Consequently, at the Product Service System level the main challenge relates to implementation. Designing a product - service combination requires a change in how stakeholders behave and this may result in a design - implementation gap. Sustainable business models allow pushing forward even more radical changes but they are also affected by a design - implementation gap (Bocken et al., 2013; Geissdoerfer et al., 2018). In addition, the designer needs to make sure that the solution is financially viable in the first place and then that it can be scaled up (Expert 4). Consequently, at the Business Model level the main challenge relates to financial and operational aspects. Designing a sustainable organization (or venture) requires financial viability and followed by scaling. When multiple organizations are involved at the

same time it becomes even more difficult (Expert 1, Expert 8). Operating at this level requires bringing multiple parties together in the form of coalitions (Manzini, 2017). Such joint projects pose several political and legal challenges (Expert 1, Expert 5). Consequently, at the Ecosystem level the main challenge relates to political and legal aspects. Designing a coalition of organizations requires turning a joint project into a legal entity and this entails defining and negotiating roles.

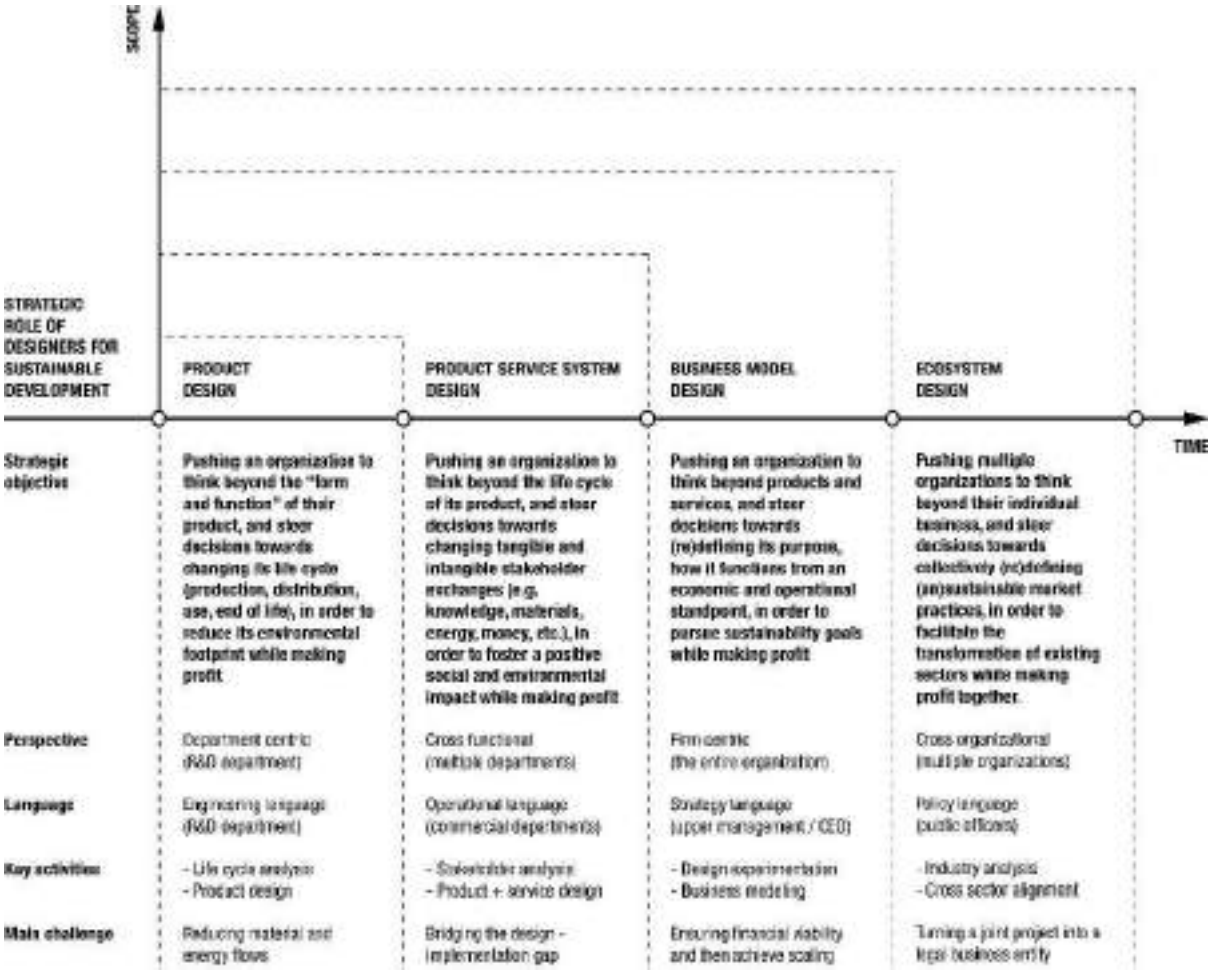

Figure 2: Evolution of the Strategic role of Designers for Sustainable Development. Based and adapted from (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018), and including the results of this research

Conclusions

In this paper, we explained that Design for Sustainable Development has been evolving over time, gradually broadening its scope from the design of Products to the design Product Service Systems, Business Models and Ecosystems. By combining sustainability literature from the fields of sustainable design and business, we visualized this idea into a framework, and further investigated this evolution from a business perspective, exploring how the strategic role of designers has evolved accordingly. To this end, we interviewed eight academic experts from six different countries, with mixed expertise in sustainable design and/or business, asking to provide their view on the framework and related subject. Their inputs have been analyzed qualitatively and condensed into five topics: strategic objective, perspective, language, key activities, and main challenge. Consequently, we connect interview data with literature to explain how the strategic role of designers for sustainable development has evolved through each one of these topics.

A final, overarching consideration relates to the fact that the four levels of design in our framework are nested. As explained by all the experts, and reinforced by literature, designers traditionally come from the inner level of Product Design and over time have been gradually involved into more strategic business decisions, which

are taken at higher levels (Micheli, Perks, & Beverland, 2018). In the light of this consideration, and of the findings of the research, we distill some implications for both designers and managers who aim to contribute to a transition towards sustainable development.

Implications for Designers

If designers want to become active agents of change for sustainability, they should go out of their comfort zone and continuously learn to do something new (Manzini, 2009). As explained, this implies not only having broader strategic objectives, but also being able to work from new perspectives, learning to speak new 'disciplinary languages' and crossing disciplines, to execute new key activities and to deal with new challenges. Working from new perspectives entails understanding how different departments and organizations see innovation related issues, and using design as a way of thinking to connect these multiple viewpoints (Calabretta & Gemser, 2015; Micheli et al., 2018). Learning 'disciplinary languages' and crossing these entails getting to know the terminologies that different professional profiles use when they talk about innovation related issues, and trying to translate those to facilitate communication across profiles (Calabretta et al., 2016; Calabretta, Gemser, & Wijnberg, 2017; Micheli et al., 2018). Executing new key activities and dealing with new challenges entails being comfortable to design in new situations of uncertainty, in a similar way that an entrepreneur would do, leading organizations through growth and transformation towards sustainability (Keskin, 2015; Romme & Reymen, 2018; Sarasvathy, 2008). These considerations underpin a crucial point: as designers acquire these new capabilities and their role becomes more strategic towards the right side of our framework, they should not become something else. They should remain designers and not forget all the capabilities that are described on the left side. Remembering that the path towards sustainable development is collaborative (Manzini, 2017; van Tulder, 2018), designers should use their skills of general specialists in order to bring together people on different levels by being able to move across all the four levels of the framework.

Implications for Managers

If managers want to truly use their influence to promote a sustainable transformation of their organization, they should in the first place acknowledge that designers are not just product makers (T. Brown & Martin, 2015; Liedtka & Ogilvie, 2012). As explained, they should embrace design as a mean of sustainable transformation and involve designers in the strategic decisions concerning corporate sustainability (Jay & Gerard, 2015; S Schaltegger, Lüdeke-Freund, & Hansen, 2012). Specifically, designers may be involved and play a role in balancing the desirability, feasibility and viability dimensions of innovation, with the dimension of sustainability, by performing a set of specific practices (Baldassarre et al., 2017; Bocken et al., 2019; Calabretta et al., 2016). These practices include, but are not limited to, conducting conversational interviews with key stakeholders of the innovation process, leading strategic brainstorming sessions, performing ethnographic observations with customers, conceiving and testing marketing campaigns through digital platforms and prototyping beyond focal products, entire value propositions, service exchanges and business models (Bocken et al., 2019; Schuit, Baldassarre, & Bocken, 2017). Going a step further, managers may consider learning to think more like designers themselves in order to breach corporate conventions and silos, an essential condition for operating sustainably (T. Brown & Martin, 2015; Porter & Kramer, 2011; Yunus et al., 2010).

Limitations and future research

This research has two main limitations. The first limitation relates to the small number of experts we interviewed. We only interviewed eight academic experts. The second limitation relates to our qualitative approach, which is not overly structured due to the exploratory nature of the investigation. We used semi-structured interviews to only start exploring the research question but did not have an interview protocol built on former research.

We encourage future research to address these limitations. A potential way to do that could be to build upon and improve the list of topics that we defined by interviewing more expert about the strategic role of designers for sustainable development by using a more structured data collection protocol. In addition, we see a fruitful avenue for future research in exploring more in-depth the connections between sustainable design and sustainable business. This might be done with a systematic literature review at the boundary of these two domains.

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Minding the gap: The road to circular business models

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Despite strategic design (SD) and product portfolio management (PPM) play a pivotal role in driving companies toward a more sustainable economy, it is still not clear how SD and PPM can contribute to the advances of circular business models (CBM). In this context, the aim of this research was to analyse the main literature about SD, PPM and CBM proposing an integrative framework, as well as to reduce the gap on drivers and barriers in the development of CBM through a case study in a biodiversity company. As conclusions of this work, SD helps companies to define the strategic vision for innovation, integrating sustainable stakeholder objectives, meanwhile, PPM activities support the decision-making process, being responsible for the alignment of projects with firms' strategy when generating circular business. In addition, regulatory requirements and cost of production have shown the main drivers, whereas technological restriction is the main barrier to overcome.

Keywords: Circular economy, environmental sustainability, new product development, sustainable design

Introduction

The global sustainability has been hampered by the imbalance between demand and supply in the consumption of natural resources. The scarcity of the resources, environmental concerns and stricter regulations have forced researchers from academia and industries to develop new strategies dealing with the need for sustainability (Singhal, Tripathy & Jena, 2019). This has led to strategic decision of sustainability for many organizations (Goyal, Esposito & Kapoor, 2016). Hence, sustainability considerations in new product development as strategic processes has been gaining greater acceptance in organizations (Ali, Stewart, Boks & Bey, 2019), also regarding on sustainability issues to be institutionalized, visionary leaders are required to foster sustainable business models (Bonviu, 2014).

As products have historically been designed for convenience but with little consideration of the waste left behind and given the fact that natural resources are finite and global populations are steadily growing, traditional models that involve wasteful products for consumers to buy and own require reinvention (Mesa, Esparragoza & Maury, 2018). Therefore, in adopting more sustainable development pathways, companies should be open to new experiences, increase consciousness and agreement to share knowledge (Ceglia, de Abreu & Da Silva Filho, 2017). In order to slow consumption and close the resource ties in today's market, a regenerative economic model is needed. In this way, the circular economy has become an important school of thought in sustainable economics, receiving more and more attention worldwide as a way to overcome the current model of production and consumption based on continuous growth (Skene, 2018; Ghisellini, Cialani & Ulgiati, 2016).

For companies to contribute to sustainable development, they will need to rethink their business models (Bocken, Farracho, Bosworth & Kemp, 2014) because in the current processes, value creation is based on a material flow, where virgin material enters the upstream value chain and the entire product value is added up through manufacturing processes (Andrews, 2015). Further, expanding the innovative niche of circular economy business model, that aims to drive the sustainability of a business network through circular strategies (Baldassarre et al., 2019). Circular business model innovation is about capturing the value from what is considered waste in a linear business approach (Ghisellini, Ripa & Ulgiati, 2018), in this case, Strategic Design (SD) plays a pivotal role in driving the companies toward a more sustainable economy (Jadhav, Kalita & Das, 2019).

Since SD has been disseminated in sustainable business model innovation research and practice in order to support the process of collaborative innovation among stakeholders (Geissdoerfer, Bocken & Hultink, 2016; Manzini & Vezzoli, 2003). It may integrate design principles with a business, in order to reach both long term and short term performance goals (Calabretta, Gemser & Karpen, 2016). In this context, the term strategic design for sustainability means the ability to create new stakeholder configurations and develop an integrated product, service and communication system consistent with a medium- to long-term sustainability perspective while being economically viable and socially appreciable (Manzini & Vezzoli, 2003).

New areas of design activities have been drawn and new methods and tools are being integrated into the appropriate guidelines for sustainability (Joyce & Paquin, 2016; Manzini & Vezzoli, 2003; Meroni, 2008). SD integrating products and service could improve the performance of sustainable projects (Jadhav et al., 2019), also designers are more and more often called to use their principles, tools, and methods to influence the innovative strategy of the companies they work with (Calabretta et al., 2016; Joyce & Paquin, 2016). Regarding on this, Pinheiro, Jugend, Dematt̂ Filho and Armellini (2018), proposed a product portfolio management (PPM) framework, pointing out the early phase in the new product development process as relevant for integrating sustainable development and concerns about environmental issues. Thus, the integration of PPM and SD may represent an opportunity, from strategic direction to contribute to the development of CBM.

Some literature have pointed out a lack of knowledge on why and how to develop environmentally sustainable projects (Alblas, Peters & Wortmann, 2014; Brones, Carvalho & Zancul, 2014). The early phase of projects development can be useful to improve the environmental impact of new business models, since it is at this moment that more possibilities of choice can occur on the projects (Bocken et al., 2014), especially when companies present difficulty in integrating environmental aspects into product design innovations (Driessen, Hillebrand, Lok & Verhallen, 2013; Pinkse & Kolk, 2010). Nonetheless, PPM could unfold new circular strategies, since it regards on merging dimensions such as strategic, organizational, methods and tools (Pinheiro et al., 2018).

Despite the literature has presented the possibility of the SD approach to developing sustainable environmentally friendly innovation in the industry (Manzini & Vezzoli, 2003), few studies analyse its relationships with a circular economy and the development of CBM (Baldassarre et al., 2019). Their relationship remains unclear and an integrated framework has not been found in the literature. Moreover, since PPM has been playing a strategic role, supporting managers to better handle this process of selecting projects (De Castro & De Carvalho, 2010; Pinheiro et al., 2018); this article proposes to answer the following question that needs further investigation: how can strategic design and product portfolio management develop circular business models?

Hence, this research aims to answer this research question by posing two sequential research objectives. The first objective is to contribute to the literature by making an initial attempt to combine SD, PPM and CBM perspectives presenting an integrative framework on these themes. The second objective is to reduce the gap on drivers and barriers in the development of CBM in a biodiversity company, owing to bioeconomy implies a more efficient resource management of bio-based renewable resources and since these ideas have been well received at the industry level, fostering cost reductions, innovation, and competitiveness (D'Amato, Veijonaho & Toppinen, 2018).

Considering the lack of research on the subject, this exploratory study was carried out through a qualitative approach. A case study was applied in a Brazilian leading company in the timber industry, which develops and manufacture new products made of wood. As SD is inherent to the company's' products in fauna and flora due to its operation, it is understood that this case study provides an adequate environment for reflections on the subject. The study can also be justified because Brazil is known by having one of the largest biodiversity in the world (Mongbay, 2016; Sustainability for All, 2017).

After this introduction, literature reviews on the topics SD, PPM, and CBM will be present and summarised with a proposal of an integrative framework. Afterward, the sequence of activities carried out in the case study, with a focus on meeting the drivers, and barriers to developing CBM are approached, followed by the findings reported in the case study. Next, the results obtained are faced up with the reviewed literature in a discussion based on the findings. Finally, the conclusion chapter outlines the key contributions of this research.

Theoretical background

Strategic Design

Strategic Design is a line of research and applied discipline based on the use of design principles and practices for the formulation and implementation of innovation strategies for organizations (Calabretta et al., 2016). SD is an approach that is responsible for connecting and articulating different types of knowledge from the point of view of strategy. Furthermore, it refers to the use of design principles and practices for the co-creation of business strategies and processes (Calabretta et al., 2016). Strategic Design is about defining the strategic vision for innovation, designing a concept and the business around it and finally assessing results before moving into a new iteration (Baldassarre et al., 2019). The success of the SD depends greatly on the interaction of individuals from different areas and their ideas, understanding the market and the consumers that will be affected (Franzato & Campelo, 2017).

The strategic dimension of design is revealed by questioning, interpreting, experimenting and generating learning in dynamic contexts. SD prioritizes the contextualized reading of the competitive environment, technological and sociocultural of the companies; possesses ability of questioning strategies; and is oriented to innovation, building knowledge through experimentation (Bergmann & Magalhães, 2019). More specifically, it is about applying the practices, methods, and tools to help organizations gaining competitive advantage by balancing desirability, feasibility and viability (Baldassarre et al., 2019).

For Meroni (2008), the SD is an approach on making sense in the complexity of contexts that are changing; learn and build skills; as well as, establish a platform of tools and methods to develop investigations. Further, SD is about conferring to social and market bodies a system of rules, beliefs, values, and tools to deal with the external environment, thus being able to evolve and so to survive successfully, as well as influencing and changing the environment too. This is because the transformations in the context of the companies' actions are inevitable and SD offers resources so that they face the challenges of the future, valuing the potential visionary of design to respond to the changing values of contemporaneity.

It is expected that the design may help to develop the most adequate solution to compete sustainably in the future from the learning generated by sincere attempts at innovation, which generate new concepts to be developed by the industries (Bergmann & Magalhães, 2019). Unlike other strategy formulation methodologies, SD focuses on collaboration and orientation to innovation and sustainability as a process, collecting real-time information from sources within organizations as well as external sources, consumers and the market (Meroni, 2008). In this vein, traditional kinds of SD have their place within sustainable design; sustainability transitions also surface the potential for new types of SD in which the interested are the common environmental and social good (Mok & Hyysalo, 2018).

Realff, Ammons and Newton (2000) already stated the need to the utilization of resources become radically more efficient and the SD of reverse production systems would be one strategy for achieving greater material efficiency in the recycling of products back into useful raw materials. Manzini and Vezzoli (2003) argued that the design competencies should move towards the concept of SD for sustainability, shifting the business focus from designing and selling physical products to a system of products and services which are jointly capable of fulfilling specific client demands, while re-orienting unsustainable trends in production and consumption practices.

Product Portfolio Management

In the strategic product planning stage, a company's product portfolio of new opportunities to be launched is generated. The set of these parallel projects is called portfolio or product portfolio (Rozenfeld et al., 2006). The product portfolio designs start with a large number of ideas that become fewer projects, and these a smaller number of products launched (Cooper, 2008). Product portfolio management (PPM) deals with the structured decision process on which projects should be developed within the organization through processes and criteria

(De Castro & De Carvalho, 2010). It involves evaluation activities, identification of new ideas and opportunities, prioritization and the definition of approving or cancelling projects.

During PPM, available resources and their allocations in the projects, the planning horizon and the stakeholders are also observed (Cooper, 2008). In order to avoid issues on selection and decision making, the process and tools to be used for the organization and selection of projects should be clearly defined (De Castro & De Carvalho, 2010). De Carvalho, Lopes & Marzagão (2013) observed that the most cited methods and tools applied to PPM are financial, mathematical programming and statistical models.

Otherwise, with a focus on the choice of projects that meet sustainability criteria, environmental analyses should guide the choices of new product designs (Brones & Carvalho, 2015; Sihvonen & Partanen, 2016). The use of more efficient materials in their transformation, the adjustment of product portfolios and the selection of products, services and products-services systems (PSS) more sustainable are in line with meeting sustainability goals (Marcelino-Sádaba, González-Jaen & Pérez-Ezcurdia, 2015; Vezzoli, Ceschin, Diehl & Kohtala, 2012).

Given the need of environmental sustainability, Brook and Pagnanelli (2014) have suggested the environmental decision considering aspects such as: (i) strategic alignment: projects should be aligned with the sustainability of the company; (ii) brand: projects should strengthen the firm's position in relation to sustainability; (iii) market potential: the projects will allow an increase in market share; (iv) consumer orientation: projects should focus on meeting the needs of customers and market segments; (v) CO2 emission/biomaterials: projects should contribute to zero emission levels, and be based on biomaterials; (vi) leveraging technological capabilities: improving the company's technological capabilities in relation to sustainability.

In addition, to approvals and decisions at a strategic level, portfolio reviews are relevant to verify if projects meet environmental requirements, which may represent an opportunity to improve their environmental impact (Bocken et al., 2014). Just as the top management support, the involvement of the teams in portfolio review contributes to decision-making (Petala, Wever, Dutilh & Brezet, 2010). Besides the technical and economic aspects recommended by Cooper (2008), considering the development of environmental issues during portfolio review gates can be useful as it may contribute, for example, to the alignment of projects with the development of new circular products (Gouvinhas, Naveiro, Perry & Romeiro Filho, 2016).

Circular Business Models

A well-designed business model searches to create value for the company and its customers, as well as stakeholders such as suppliers and business partners. A sustainable business model describes a company's sustainable value proposition to its customers and all other stakeholders, how it creates and delivers this value proposition, and how it captures economic value while maintaining or regenerating natural, social, and economic capital (Lüdeke-Freund, Massa, Bocken, Brent & Musango, 2016). In circular business models (CBM), the economic, social and environmental value of the materials are preserved as long as possible, keeping them in the economic system, lengthening the lifecycle of products they formed or returning them to the system for reuse (Bocken et al., 2014; Joyce & Paquin, 2016; Lewandowski, 2016).

In this new perception, products are no longer something obtained at a cost from the environment in a linear way, but a component of the production process that is designed in a circular way, meaning that resources are initially obtained from the environment, afterward waste becomes itself a resource and it is indefinitely re-cycled in the economic process (Bonviu, 2014). Therefore, CBM attempts to explain how resources, capabilities, and activities are geared to providing a customer value proposition, which represents the benefits offered to customers through products and services to maximize resource efficiency (Bocken, Schuit & Kraaijenhagen, 2018; Joyce & Paquin, 2016). CBM represent an alternative to current economic models of extraction, use, and disposal (EMF, 2015). In circular business, most products that would have been disposed of in the linear model, are re-used e.g. as a raw material. Hence, the value of raw materials is kept within the system for the longest possible time (Bodova, 2017).

Research has shown that CBM and circular economy (CE) are mainly rooted in the environmental ecological economy and industrial ecology (Mendoza, Sharmina, Gallego-Schmid, Heyes & Azapagic, 2017). The concept of the circular economy (CE) has emerged in recent years in response to the need to decouple economic growth from the consumption of environmental resources and impacts (Ellen MacArthur Foundation [EMF], 2015). In order to maximize the efficiency of resources, circular business represents an alternative to the

current economic model with a focus on extraction and use. It may be necessary to build sustainable business models that are consistent with the principles of the circular economy (Bocken, de Pauw, Bakker & van der Grinten, 2016).

In this vein, Geissdoerfer et al. (2016) define circular as a regenerative system in which the inflow of resources and their residues, emissions, and energy are minimized by the slowing, closing and narrowing material and energy circuits, achieved through design, maintenance, repair, reuse, remanufacturing, restoration and recycling. Therefore, post-use design strategies like reuse, remanufacturing, and recycling becomes highly relevant for the circular business as they enable loop closure and influence cost and emissions of operational value recovery (EMF, 2015; Lewandowski, 2016).

In addition, the interdisciplinary structure of circular business offers good prospects for the gradual improvement of current models of production and consumption (Ghisellini et al., 2016). The shift to CBM can require radical changes in production and consumption so that producers, consumers and other stakeholders have important roles to play (Baldassarre, Calabretta, Bocken & Jaskiewicz, 2017). It may be necessary to build sustainable business models that are consistent with the principles of the circular economy (Bocken et al., 2016). These circumstances bring manufacturing companies to an uncertain position when it comes to circular approaches since the potentials of their product design in combination with new CBM are still under investigation (Lieder, Asif, Rashid, Mihelič & Kotnik, 2017).

Theoretical integrative framework

To summarise the theoretical findings, and in order to meet the first aim of this article, it is proposed a framework integrating SD, PPM and CBM perspectives. As it was shown in the literature, the relations between SD and PPM are mainly supported by the concern to the integration of stakeholder objectives, including sustainability issues, while creating new innovative products and business. Regarding on this, SD is an activity that must consider the collective interest and values, define its actions systematically after establishing an orientation through a set of scenarios (Calabretta et al., 2016; Meroni, 2008; Manzini & Vezzoli, 2003). Meanwhile, considering market dynamics and the complexity of decision-making, PPM activities verify the alignment of projects with the strategy of the firms (Jugend & Silva, 2014).

The model proposes that PPM may guide the decision-making process in the set of firms' business model (Kester, Hultink & Griffin, 2014; Kock, Heising & Gemünden, 2015), directing which one should be approved, prioritized, updated or cancelled (Cooper, Edgett & Kleinschmidt, 1999; Kock et al., 2015). As circular design requires a new model or at least a set of principles, strategies, and methods adapted (Den Hollander, Bakker & Hultink, 2017), this proposal may represent an opportunity to integrate sustainability into the business modelling process and to develop new circular business. Figure 1 presents an overview of the framework.

Figure 1 Framework integrating the main perspectives of SD, PPM, and CBM

The framework outlines the main activities inherent to the SD, PPM and CBM scope. Despite this context, there are limitations to the development of CBM due to barriers by both instruments and users, competence and experience in companies, information available of the tools, and the time and resources to select and apply them (Joyce & Paquin, 2016; Van Hemel & Cramer, 2002). The literature presents drivers and barriers to the implementation of environmental tools in business and operations (Luiz, Jugend, Jabbour, Luiz & de Souza, 2016).

Dangelico (2016) Van Hemel and Cramer (2002) and list as main drivers the improvement of the company's image, opportunities for innovation, benefits effectively generated to the environment, improvement of product quality, etc. Among the barriers are technological restrictions, possible commercial disadvantage, greater complexity associated with these projects - which tends to consume more development time, the need for information and the uncertainty of results (Collado-Ruiz & Ostad-Ahmad-Ghorabi, 2013; Van Hemel & Cramer, 2002). To deepen understand the development of CBM and in order to highlight in practice this scenario, a case study was carried out in a biodiversity company, which is detailed in the next section.

Case Study

Aiming to reduce the gap on barriers and drivers in the development of CBM, this research comprised a case study in a leading company in the development of products based on biodiversity, based in Sao Paulo state, Brazil. The research method was considered because besides being a useful approach to deepen the knowledge about certain topics, the case study allows an analysis of the researched situations, since for the accomplishment of the study; interviews, observations and document analysis allow a better evaluation of the context (Myers, 2013; Yin, 2015).

Since this topic has been recently studied (Andrews, 2015; Baldassarre et al., 2019; EMF, 2015; Ghisellini et al., 2018; Jadhav et al., 2019), the qualitative procedure was the most appropriate. According to Eisenhardt (1989) and Yin (2015), the method is adequate when seeking a better understanding of the facts. It was considered important the use of qualitative research with the presence of the researcher in the field, in order to capture and understand the perceptions of the professionals involved in the strategic design, product portfolio and circular practices in the company, and, thus, obtain greater familiarization with the object of study (Yin, 2015).

The company's choice to the case study was made intentionally by the following criteria: (i) to develop and manage a broad portfolio of products based on biodiversity; (ii) to be concerned with the preservation of biodiversity; and, (iv) to provide full access to the researchers. In addition to the criteria that have been met, the company is one of the leaders in the development and manufacture of products made of reforested wood. In order to guarantee the internal validity of this study and to minimize the subjectivity tendency of the interviewee, at first, a formal interview questionnaire was developed.

The guide was based on the literature and, especially, on the research by Brones et al. (2014), which from the case study had the interest to identify how the environmental dimension can be integrated to the management practices of new product development, as well as to identify the challenges of this integration. Before taking its final form, this questionnaire was evaluated and received suggestions for improvements by academics and specialists. The questionnaire was sent by e-mail to the managing director and to the production specialist, a forest engineer, for analysis and knowledge of the agenda. Then a meeting was scheduled in the company's headquarter to conduct an on-site interview with both leaders in which the questionnaire based the conversation and was throughout answered.

During the field research, the director of the company and the production specialist were interviewed, following the recommended procedures for a case study (Eisenhardt, 1989; Gibbert & Ruigrok, 2010). In addition, to enable additional information and the data collection, informal conversations through visits to the different departments and to the factory floor were conducted, besides reading of documents (Yin, 2015). These actions enabled the acquirement of new information and different perceptions regarding on the researched topic.

Company description

The company has been operating for twenty-seven years and currently has about one hundred full-time employees. Headquarter is located in Sao Paulo state, the wealthiest part of the country, and attends exclusively to the national market. It has a product portfolio derived from reforestation wood, being recently responsible for producing a major project of gymnastics equipment, with all basic apparel included, for

governments within more than 400 cities. Besides that, their product portfolio is composed mostly of showers, sinks, tables and peculiar furniture.

Designing circular business models: drivers and barriers

The company's strategy is to operate with environmentally sustainable products and since it is possible to prioritize the development of products that aggregate CBM. For this, the top management drives throughout the activities from the innovative process to the evaluation and selection of product portfolio. As part of the process, revision gates were pointed out as strategic, since they allow to evaluate the synergy degree of projects with the firm's mission, vision, and values. Hence, all decisions about which project will be selected are taken aiming environmental concerning the preservation of native forest, adopting eucalyptus as the main raw material used throughout its portfolio.

By choosing wood for its products, the company strategy is to do not use native wood as a raw material input in any new product design. According to the interviewees, the extraction of native wood significantly impairs biodiversity and, therefore, the company does not develop products that use materials that may generate harmful waste and pollute the environment. Hence, the decision of the top management, on which products to develop, occurs mainly with the possibility of using reforestation wood. Moreover, wood is the main way to apply circularity in business, since the waste is reused in new business models. During or at the end of the production process, the waste is collected and immediately relocated for reuse in new products that have been designed for this purpose. Some examples of these new products identified as new opportunities for CBM are landscaping, stakes for fence support, gravel, besides the own decomposition of the wood for the generation of a natural organic substance, which is also sold as a product.

The dissemination of the goals within the company and positioning in the market was identified as relevant to the firms' business, in addition, the presence of specialists with environmental bias, leading or supporting decisions during the PPM and about the current business models. These factors mitigate environmental risks in projects and can influence the decision-making considering the stakeholders' integration. Also, marketing demand and regulatory pressure were identified as positive to environmental sustainability decisions. The market stimuli refer to the image of the firm, whose vision is to be recognized by the market as a firm friend of biodiversity.

Compliance with legislation occurs because the company must follow standards related to the development and manufacturing of products derived from wood, especially the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA). These factors were highlighted as responsible for generating new business models, since some of its customers seek products from logging companies that are recognized for not harming forest biodiversity. As good practices, it was identified the following steps as relevant: (i) Strategic design; (ii) Raw material definition; (iii) Decision-making processes; and (iv) Product planning. Furthermore, working with the internal and external disclosure of the has proved to be efficient in the process of achieving the company's business.

The company has faced challenges in generating new ideas for creating environmentally sustainable products. A substantial barrier highlighted refers to technological restrictions. Thus, according to the interviewees, since the timber sector is not very dynamic, there are few technological solutions available to aggregate on environmental products. In order to reduce some of these technological barriers, as well as to help in their creative process, the company has already established partnerships with local universities. For example, recently there was a joint effort between the company and professors of the Environmental Engineering at the University of Sao Paulo (USP). It was mentioned that the scenario is different in sectors considered more innovative, such as the electronics industry. However, as a successful case, recently the company approved the development of a new type of shower for swimming pools made of tree the stem, with an adaptation of the plumbing and replacing the common use of iron by wood in the structure of the product.

Discussion

Although the company demonstrates to be concerned about the products life cycle, strategic alignment and the strategic planning presented itself as the most commented items by the interviewees, what supports the literature either on SD (Baldassarre et al., 2019; Calabretta et al., 2016) or on PPM (Brook & Pagnanelli, 2014; Pinheiro et al., 2018) when integrating sustainability into innovation. Environmental aspects foreseen in the firm's strategic plan should promote the practice, being directly connected with the company's mission, vision,

and values (Bocken et al., 2018). That is, for the development of circular business the firm may have included environmental guidelines in its portfolio strategy.

Government pressure and legal issues are commonly recognized by the literature as one of the main barriers to the development of ecological products (Dalhammar, 2016; Van Hemel & Cramer, 2002). Otherwise, it was found that the adequacy of legislation and the adoption of systems could be a strength to the firms. As seen, the company takes advantage not only to enter in new markets but also to strength their image being in line with current legislation and best practices, in case IBAMA and certifications such as ISO 14001. That is, besides disseminating environmentally sustainable practices among companies, the legislation also represents, in this case, a stimulus for the adoption of environmental sustainability into the product portfolio.

On the one hand, confirming previous studies (Dangelico, 2016; Van Hemel and Cramer, 2002), it was observed the technological restriction as a barrier, since there are difficulties in the development and advancement of technologies for the timber sector. On the other hand, the company demonstrates initiatives for the development of these technologies through partnerships either with universities or by monitoring market demand as one of the sources for the process of generating ideas. It reinforces somewhat the literature (Franzato & Campelo, 2017; Marcelino-Sádab et al., 2015) suggesting a decision-making process based on more than one criteria, as well as that radical changes in production, requires the integration with stakeholders in order to develop CBM (Bocken et al., 2016).

In addition, there was a concern with the selection of suppliers due to the need for qualifications at various levels of the supply chain, is a relevant fact as pointed out in the literature (Marcelino-Sádab et al., 2015; Vezzoli et al., 2012). This process may help the company in their creative process and technological availability, since the integration with stakeholders is seen as a practice that contributes to the SD, also to the PPM, being one of the main perspective when developing CBM (Franzato & Campelo, 2017; Geissdoerfer et al., 2016; Lüdeke-Freund et al., 2016; Manzini & Vezzoli, 2003; Meroni, 2008). The reuse of waste as input to the development of new products, as well as the application of leftovers in the generation of natural organic substance presents a strong alignment with some characteristics of the circular economy (Bocken, et al., 2016; Bodova, 2017; EMF, 2015; Geissdoerfer et al., 2016).

In this case, there is no waste in its producton process, besides value being added through the lifecycle of products and even after the use when in decomposition state do not generate impacts to the environment (Bocken et al., 2018). This practice is also in line with the prevention of CO2 emission and use of biomaterials (Bonviu, 2014; Brook & Pagnanelli, 2014), as well as being a regenerative system in which the inflow of resources and their residues, emissions and energy are minimized, achieved through design (Bocken et al., 2014; Geissdoerfer et al., 2016). Table 1 presents the interviewees' comments about the scenario, highlighting some drivers and barriers when developing a circular business.

Table 1 Research variables and interviewees' comments

Variables	*Interviewees' comments*	*Literature*
Cost of production boosters the development of CBM	Mainly because of the total cost of production and the benefits of the entire lifecycle of our products, compared to market options for similar products, where part of them is composed of materials from non-renewable sources, such as polyethylene, concrete, etc. A finished treated eucalyptus product costs on average 50% less than a similar product, produced with wasteful raw materials.	Bonviu, (2014); De Carvalho et al. (2013); D'Amato et al. (2018); EMF (2015).
Stakeholders integration helps the development of CBM	Actions as dissemination of the goals within the company, brand positioning, presence of specialists with environmental bias, leading or supporting decisions, besides being attentive to marketing demand and to the regulatory requirements were identified as positive to environmental sustainability decisions.	Franzato & Campelo (2017); Geissdoerfer et al. (2016); Lüdeke-Freund et al. (2016); Manzini & Vezzoli (2003).

Reuse strategy prevent biodiversity when adopting CBM	When the strategy regards using reforested wood, the area of the forest has been already devastated for many years, so it is a way to preserve the native forest, avoid further deforestation. In addition, there is no waste in our process, besides value being added through the reuse techniques and even after use, the decomposition does not affect the environment.	Bocken et al. (2014); Bonviu (2014); Brook & Pagnanelli (2014); Geissdoerfer et al. (2016); Lewandowski (2016).
Lack of technology hinders the development of CBM	The technology available is stagnated when compared to other similar sectors of the economy. For example in agriculture: extraction, transportation, storage, and traceability equipment are most commonly applied and appear to be in more advanced stages than in the timber industry. Part of market thinks that the company's products have low quality due to the raw material.	Brook and Pagnanelli (2014); Collado-Ruiz & Ostad-Ahmad-Ghorabi (2013); Van Hemel and Cramer (2002).

As can be seen in table 1, another driver mentioned was the total cost of production, which facilitate the company operation. Besides the technological barrier, part of the consumer market sees the products as low quality when compared to traditional market products, due to the raw material used. Nevertheless, working only with eucalyptus from reforestation, is the greatest source of nature preservation, because the area of the forest has been already devastated. Company's' concern with the products lifecycle and the application of reuse techniques in the new products mapped in this study seems to be the main features of circular business model (Bocken et al., 2014; Brook & Pagnanelli, 2014; Geissdoerfer et al., 2016; Lewandowski, 2016).

Conclusions

This study has advanced the literature about SD, PPM, and CBM, contributing to academics by proposing an initial integrative framework on these themes. In addition, in order to reduce the gap on drivers and barriers in the development of CBM in a biodiversity company, a case study was applied in a Brazilian leading company in the timber industry, which develops and manufacture new products made of wood. Hence, this research also advances the practice of areas such as the development of environmental products and circular business since it outlines the results of a case study that shows how to manage more efficiently bio-based renewable resources at the industry level, fostering cost reductions, strengthen competitiveness and protecting the environment.

It is considered that the research problem was answered since it was presented that SD and PPM can develop CBM. At first, SD help managers and companies to define the strategic vision for innovation, designing a concept to transform their business model through a set of scenarios, applying practices, methods, and tools in order to gain a competitive advantage by balancing desirability, feasibility, and viability in its business. SD should integrate sustainable stakeholder objectives, considering the collective interest and values while creating new innovative products. PPM activities support the decision-making process, being responsible for verifying the alignment of projects with firms' strategy and generating new business models through it. In addition, by learning the practices of a leading company that operates with biodiversity, defining inputs that preserve or generate less impact biodiversity, and deciding to develop new products based on the waste of the production process itself, besides its main drivers and barriers when moving forward to CBM.

The case study has added to the literature that one of the relevant drivers for the development of CBM refers to the compliance with the legislation. By developing products derived from biodiversity, the firm adopts legal standards to choose the products that make up its portfolio, which guides decisions such as the selection of raw material to be incorporated in the production process and the concern with its lifecycle. This concern was evidenced by elements such as the possibility of keeping alive soils and forests and with the reuse of waste generated in new products, becoming a circular business model, typical characteristic of a circular economy. As the main barrier to the development of CBM, the technological restriction was mentioned as a characteristic of the timber sector, affecting mainly the front of innovation of the firm. However, partnerships with the professors of the USP has been shown as one of the strategies to deal with this lack.

This qualitative and exploratory research sought a familiarity with concepts of the research gap. However, it is recognized that the empirical results of this study should be viewed with methodological restriction, since, even considering that the case studied stands out in terms of product portfolio that respect biodiversity, due to the limitation of the research method employed the results presented here cannot be generalized. It is understood, therefore, that future research could be carried out in companies that operate in different sectors, environments, and present in developed countries with the purpose of identifying new strategies for the implementation of CBM. In addition, it would be interesting that future research, under quantitative approach verifies with larger lenses this relationship.

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Circular Archetypes: a feasibility study exploring how Makerspaces might support circular innovation, within the Scottish textile sector

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We live in a 'throwaway and replace' culture. Our growing population and demand for new products has placed huge pressures on our planet's resources. The research argues design can play a strategic role in supporting the adoption of new mindsets, methods and models to enhance awareness and understanding of the need to design for a circular economy. This paper provides a practical example. Drawing upon a feasibility study into Makerspaces, it will explore how they might be developed in the future to support circular innovation, within the context of textiles, to address complex issues around material waste. The insights drawn from this research act as a starting point for future work, reflecting on the implications of the methods applied, concluding the circular economy is the same imperative whether people are focusing on ecology, economy or just their own business. Furthermore, it will suggest that design-led approaches play a role in embedding collaborative ways of working to integrate sustainability into the business modelling process.

Keywords: Circular Economy, Design, Fashion, Textiles, Sustainability, Maker spaces

Introduction

This research is aligned to a design-led business support programme titled 'Design for Business' - positioned within the V&A Dundee – a Design Museum in Scotland. Design for Business aims to broaden the current remit and focus of design by using Design Thinking methods and approaches, to enable businesses, organisations and even citizens themselves to tackle complex problems, such as the Circular Economy (CE). "Design is key to circular economy" says Ken Webster (2017) through further quoting Cross (2001) and design thinking, "scientific problem solving is done by analysis, while designers problem solve through synthesis". This is connected to systems thinking and designers can play a role in helping to navigate through complex interactions, iterations and uncertainty (Webster, 2017).

This paper expands upon with insights drawn from a six-month feasibility study led by the author titled 'Re-Mantle and Make', funded by a larger project titled 'Future Makespaces in Redistributed Manufacturing', a two-year research project funded by the Engineering and Physical Sciences Research Council (EPSRC). The feasibility study explored how Makerspaces might be used to support circular innovation, within the context of fashion. To conceptualise a circular supply and demand model for the Scottish textile sector. This research was conducted in partnership with Kalopsia Collective, a micro-manufacturing unit based in Edinburgh, Scotland, with additional in-kind support from several Scottish based textile manufacturers; Johnstons of Elgin, Begg and

Company, MYB Textiles and the Scottish Leather Association, who participated within this research project and contributed further by gifting surplus textile waste from their factories.

Within the context of fashion, one of the most salient challenges facing the sector today is the global impact of the linear take, make, use and dispose model of production and consumption. An unsustainable model for a future that has disappearing material resources, energy scarcity and a society more aware of the human impact on our environments. Through this paper the author explores how the Circular Economy (CE) might offer a new outlook for textile design practice, building upon the work of Goldsworthy (2014) who claims designers need to learn how to adopt a more pro-active, systems-based approach that truly 'closes the loop'. Currently there are limited practical examples and it is unknown if it is truly possible to implement close loop innovation within the textile sector and if so, on what scale? This study aims to explore the barriers and opportunities to this closed loop scenario through piloting a circular model locally, in Scotland.

Through a design-led approach this paper intends to interrogate the concept of the CE and work in partnership across the supply chain to build new networks and connections between different stakeholders and to push the boundaries of linear practices. To explore opportunities for repurposing textile waste that attend to addressing gaps in knowledge and practice, by seeking to directly connect textile and fashion designers with other stakeholders across the supply chain. This will be explored through positing the research question 'How might Makerspaces be used as educational hubs to experiment with new tools, skills, techniques and technology to develop circular design strategies for micro-manufacturing within the Scottish textile sector?'

This paper presents an overview of the feasibility study to explore the concept of a circular supply and demand within the Scottish textile sector, drawing upon emerging insights drawn from key stakeholders across the supply chain. This study focused on the shifting role of the design practitioner by developing a conceptual framework for how Makerspaces might be used to share knowledge, practice and business support for circular innovation. This paper concludes by outlining next steps for this research, with recommendation for how the feasibility study might be replicated within other sectors or expanded upon through further research.

Context

Within the context of fashion, one of the most salient challenges facing the sector today is the global impact of the linear take, make, use and dispose model of production and consumption. Within the UK alone, we dispose of approximately 10,000 garments every ten minutes (Kerr & Foster, 2011), a level of waste that is unsustainable. Fletcher (2008) further estimates that up to 70% of our wardrobe content is inactive use. The linear economy results in an oversaturated and oversized fashion system with big environmental impact (Armstrong at al. 2016), it is imperative that we develop better use of resources and change the system. Garment life cycles have drastically shortened, for example in the UK WRAP (2012) has evidenced that the average time of lifetime of a owning a garment is 2.2 years (Gwilt, 2014). They also highlight that around 30% of clothing in wardrobes have not been worn for at least a year. The fashion industry is an engine for global growth and development. Generating £1.5 trillion in 2017, it employs around 60 million people along its value chain (Ellen MacArthur Foundation, 2017). At the same time the industry uses a large amount of resources and has a heavy environmental impact compounded by the industry's continuing growth.

Fashion consumption needs to transform, the commonly accepted role of design as a cheap resource of ideas, as a profession of beautification, and a powerful marketing 'tool' must therefore be questioned seriously and urgently (Mair, 2017). Today's linear 'take, make, dispose' economic model relies on large quantities of cheap, easily accessible materials and energy. With the world population expected to exceed 8.5 billion people and global garment production to increase by 63% by 2030, this model is reaching its physical limits (Webster, 2017). By acting now, the fashion industry can lead the transition to a circular system that reuses and recirculates products and materials, while offering new opportunities for innovative design, increased customer engagement and for capturing economic value.

Conventional methods of dealing with these issues have been cited as being symptoms based; they have not addressed continuous and rising consumption levels. However, there are garments that physically wear out and no longer function and those that are made obsolete by economics and it is here that it is cheaper to buy a new piece rather than mend an existing one (Fletcher, 2012). What actually happens in the lives of people who use garments should provide stimuli for fashion and textile design and production (Fletcher, 2015). These garments are currently designed in response to regularly changing trends that enable quick profit, rather than radically re-thinking new ways of designing (Niinimäki & Hassi, 2011). Value needs to be placed on consumer

use, attachment and stronger 'user-product', 'user-manufacturer' relationships (Chapman, 2006; Niinimäki & Hassi, 2011) and this research explores this further through 'user-designer' relationships.

Fast fashion only represents one very direct model of material interaction and it is clearly failing to fulfil consumer needs long term. How can we break the cycle of passive consumption to create a more sustainable, durable connection with our clothes? This project challenges the perpetual pursuit to obtain cheap, convenient, carefree clothing. Fashion helps shape our identities and what we wear signifies who we are and what we stand for. But there's something missing. There's a bigger story to be told about the conditions in which our clothes are made, the resources that have been used and the impact they've had on communities. Fashion is about change and about challenging the status quo, which, at present, is about 'more stuff.' In asking how much is enough and looking at elements of fashion that offer greatest delight, citizens and fashion professionals alike are questioning the quantitative approach to fashion and exploring ways in which its qualitative aspects can be brought to the fore (Chapman, 2003).

It is pertinent to challenge the existing paradigm by engaging with citizens themselves, as there is further disparity through disconnection between the designer, the process of manufacturing, and the consumer who is often left unsatisfied long term, which encourages the rapid replacement of products. In a genuinely circular fashion and textile system, design and use would comprise a single whole.

The Circular Economy (CE): Design-Led approaches for closing the loop on Textile waste

The Circular Economy (CE) concept envisions a reformed industrial system promoting resource efficiency by adding value through closed loop resource approaches (Ellen MacArthur Foundation, 2017). Some of these activities can already be observed in Makerspaces giving rise to a speculation on the potential role of makerspaces in a future distributed manufacturing system founded on CE principles. However, many authors argue that both sustainable strategies for product design and business model innovation are needed (Bakker, den Hollander et al. 2014; Brocken, Bakker and De Pauw 2016 and Prendeville et al 2017).

There is an increasing awareness of the requirement for new textile initiatives to be linked with the concept of the circular economy (Goldsworthy and Earley, 2016) However there is a requirement for more innovation tools, practical knowledge and accessible evidence available to provide support. Recently there has been a rise of projects that encourage and support textile and fashion designers in considering their responsibilities as creators of sustainable products and systems, but they have been struggling to comprehend the complexity of the challenges and to know how to go about tackling them in a scalable and economically viable way.

Within the UK, the RSA's Great Recovery programme has focused on the role of the design community in delivering a more circular economy. They highlight the importance of acknowledging that it is not the designer's responsibility alone to change whole supply chains and transition to a circular economy entails four fundamental building blocks – materials and product design, new business models, global reverse networks, and enabling conditions (Lewandowski, 2016). Businesses must also begin to develop design briefs around new business models that take account of provenance, longevity, impacts and end of life (RSA, 2012).

Existing business models for the circular economy have limited transferability and there is no comprehensive framework for supporting every kind of company in designing a circular business model (Lewandowski, 2016) There are very few studies covering how a circular business model framework should look. Most recently, the Ellen MacArthur Foundation has partnered with world leading design agency IDEO (2019) to explore how design might play a strategic role in supporting circular innovation to support systemic change focusing explicitly on the fashion industry. This research aims to learn from this ongoing work and expand upon it further to identify what sustainability strategies, innovation tools and business support is required to cultivate Circular Innovation and to re-think supply and demand on a local scale. This will require new knowledge to support and nurture new understanding of how fashion and textiles can be redesigned in the context of the circular economy (CE).

The Role of Makerspaces and Re-Distributed Manufacture (RDM) in Textiles

This feasibility study aimed to address the practicalities for repurposing textile waste within a redistributed manufacturing system (RDM) – supported by a Makerspace. This was achieved through partnerships with Kalopisa collective and MAKLab in Glasgow who provided access to their facilities, resources and staff. It was important to curate a space for previously disconnected stakeholders from across the textile supply chain to

come together, to interrogate the issue and to identify how they might work together in the future to explore a complex and systemic issues around textile waste.

Through working together these stakeholders engaged in a shared dialogue to consider a more holistic approach for designing and manufacturing on a local scale, and discuss the role Makerspaces might play in a future landscape of sustainable production. Redistributed manufacturing (RDM) involves rescaling global production by finding a multi-scalar (home, city, region, globe) and complementary fabrication ecosystem with a coherent distribution between domestic production, social fabrication, circular fabrication, supply-chains for batch production and global supply-chains (Diez, 2018). The potential of makerspaces in RDM and the Circular Economy was first identified by Prendeville *et al.* (2016). Based on Stewart and Tooze's definition (2018), we use '*makespace'* as *a catch-all term for an open access community fabrication workshop regrouping Fab Labs, Hackerspaces, (Re)Maker spaces and other facilities be described as spaces with a suite of fabrication tools and technologies openly accessible for use by a community.* Maker spaces are perceived as key spaces that actively interact with local (re)manufacturing businesses and public institutions, digital networks and more global institutions to develop a more sustainable redistributed manufacturing.

Makerspaces are commonplace design and fabrication laboratories, where people can access a range of equipment and machines for personal making (Smith et al. 2016). The Makerspace movement upholds the individual as a maker (Toombs, Bardzell, and Nasimento and Polvora, 2016) aligning itself with the values of localism, openness, sharing and collaboration, with the potential for citizen empowerment through making activities as a means to provoke the status quo.

An emergent network is feeding the discussion about the role and diversity of Makerspaces in the textile and clothing industry: the TCBL ecosystem (tcbl.eu) is gathering different stakeholders around seven principles (curiosity, viability, durability, multiplicity, openness, respect and responsibility) and create a network of interconnected labs that they defined as *"innovation spaces for exploration, creativity, entrepreneurship, small production, knowledge and innovation transfer to associate Enterprises and local citizens, where facilities, equipment, learning materials, case studies, business challenges, solutions, and exchange of know-how will be made available."* Analysing the landscape of craft makerspaces, Charny et al, (2017) claims that *"no makerspace has a single focus, rather they combine sympathetic activities to deliver their purpose"*. The activity can vary from activism for systemic or societal change, research and development, community and collaboration, learning for personal development, craft heritage, retail or tourist attraction, learning for professional skills or entrepreneurship, tools and technology.

Manufacturing and value creation are in the midst of a great transition, enabled by low-cost desktop digital technologies and the ability to share information easily and quickly over the Internet (Kostakis et al, 2015). Through new means to support product development costs and foster global communities around products, makerspaces are considered to play a prominent role in this transition. Distributed production is characterised by local production; cloud manufacturing services; flexible production environments capable of creating personalised and customised products; sustainable and resource efficient technologies; and flexibility and agility in production with shorter lead times (Srai et al 2016; EPRSC 2013; Moreno and Charnley 2016). This is because Makerspaces have the capacity to implement short and flexible production and consumption loops as well as reduce transportation (Birchness and Urry 2013) making it a potential enabler of a future CE. Sustainability may be benefitted by distributed production including product longevity e.g. product life extension through emotional attachment, intensification of use through product-service systems; local production with reduced transportation reduces environmental impacts; co-design by engaging users in the early stages of the design and innovation process for responsible decision making about what is produced; and technology affordances with the abilities and technologies to work towards sustainable practices (Kohtala, 2015).

So far, very little research has been undertaken that explores the relationship between makerspaces and circular practices. This is not unique to makerspaces – sustainable innovation requires intervening in what is designed, but also in the 'why': the values, beliefs, visions and objectives of organisations (Dewberry and Monteiro de Barros, 2009). Perhaps because designing with circular practices is challenging there is a lack of exemplars to draw inspiration from.

Understanding the Feasibility of CE for the Scottish Textile Sector

This research aimed to explore the feasibility of circular innovation within the Scottish textile sector by working with three of the largest global textile manufacturers who are based in Scotland; Begg and Company, Johnstones of Elgin, MYB Textiles and the Scottish Leather group. These manufactures played a pivotal role by providing on site access to their factories to conduct research to investigate emerging textile waste streams and to gain insights into how this was managed. They also provided their textile surplus as a resource for the feasibility study and an emerging RDM model evolved to re-think supply and demand within a circular framework.

The premise of the study was to identify new models to explore 'Future Makerspaces in Redistributed Manufacturing (RDM)'.

Developing a Design Brief

Through this research the author positions the Circular Fashion Archetype as a conduit to explore how designers might radically re-think how materials are sourced, designed, produced, supplied and distributed. To produce archetypes to share learning for others to replicate, expand and build upon.

This research endeavoured to learn more about the drivers for cultivating resourcefulness and cherish-ability within fashion and textiles – a term coined by Chapman (2006), but experimentation was required to identify creative methods through which these approaches could be implemented. A design brief was written (see Figure 1 below) to encourage those who participated within the workshops to challenge themselves as designers and citizens alike, to re-think new ways of designing. With a focus on developing concepts with 'designer-user' relationships to consider the cultivation of a new approach to consumption in which the user is provided with an opportunity to learn new skills, knowledge, and is motivated to extend the life or use of their clothing.

Through the design brief the workshop participants who engaged with this study were supported to conceptualise new ideas and the Makerspaces provided the facilities to prototype concepts are they emerged to support sampling and production using the textile waste gifted from the larger Manufacturers.

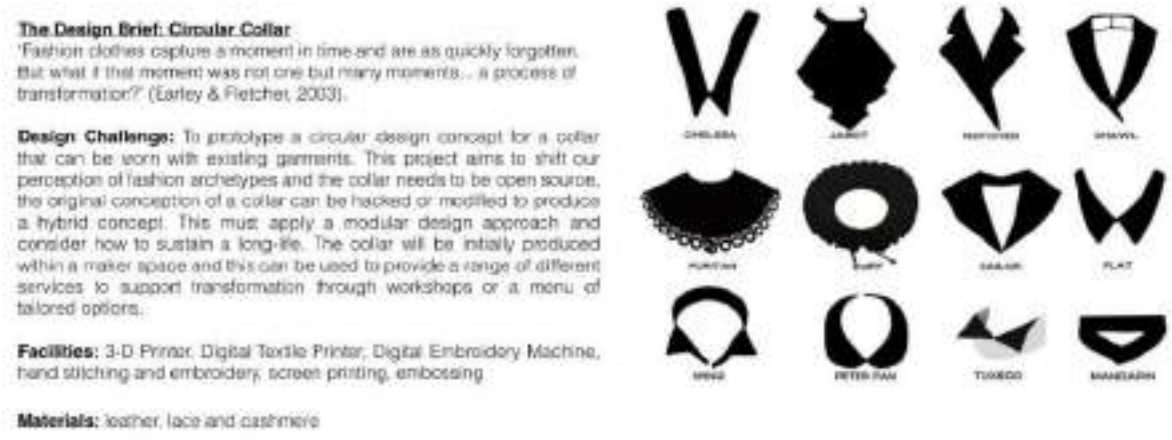

Figure 1 Circular Collar Brief

Methods and Approach

This research followed an Action Research methodology (Coghlan and Brannick, 2014) with methods integrated to support planning, action, observation and reflection. Figure 1 (below) depicts an on-going research process with three key stages: (1) scoping, (2) action (3) evaluation and analysis.

Figure 2 Project Phases

The research methodology is action-led, qualitative and exploratory. An action research approach was chosen as it is flexible and well suited to working within organisations and socio-technological concerns (Robson and McCartan 2015) and the emergent nature of action research (Koshy, Koshy, and Waterman 2010) is seen as well suited to the makerspace context. Bryman and Bell (2015) describe action research approaches as iterative, based on applied problems that require practical results and focus on changing thinking through collaboration. The research process was iterative insofar as the researchers carried out a series of activities in collaboration with a number of key stakeholders which were then reflected upon. In addition, through informal conversations, further insights were gleaned through on-site visits to makerspaces during the study.

Research Activities

The research activities comprised of; field research and factory visits to engage with large Manufacturers to deeper understand systemic issues around textile waste. This was followed by hosted two Make-a-thon workshops within Makerspaces in both rural and urban environments – this provided an opportunity to connect with different stakeholders from across the supply chain and to invite them to input to make recommendations for conceptualizing Circular Fashion and Textile Archetypes.

It was important to nurture lifecycle thinking and both workshops were facilitated to introduce the CE as a concept from the outset.

Stage 1: Assembling a Network of Key Stakeholders

The Scottish textile sector expressed a growing awareness and responsiveness to circular innovation. This could be credited to the work undertaken by Zero Waste Scotland, who had provided a range of training programs and master classes (Zero Waste Scotland, 2014-18) tailored to demonstrate a wealth of different strategies such as design for modularity, collaborative consumption, zero waste design and pattern cutting and material efficiency. The Scottish Textile and Leather Association (STLA) that provides national support for approximately ninety-five businesses of varying scale were also consulted. They made recommendations of manufacturers who might be responsive in donating textile waste and participating within the study.

Stage 2: Sourcing Textile Waste

This project aimed to identify RDM approaches for repurposing textile waste and this would not have been possible without the in kind support from several Scottish based textile manufacturers; Johnstons of Elgin who

donated wool products, Begg and Company who donated cashmere selvedge, MYB Textiles who donated lace and the Scottish Leather Association who donated leather offcuts.

Stage 3: Re-Make-a-Thons

Two Make-a-Thons were hosted within a Makerspaces in both rural and urban environments to explore how the facilities might be used to rework the textile surplus donated from the larger factories. The workshops were divided into three stages; conceptualisation, prototyping and presentation with a feedback loop between each stage to facilitate dialogue and capture insights.

While this paper focuses on the role of the designer, it is worth acknowledging that the workshop participants comprised of; textile and fashion designers, product designers, service and systems designers, consumer behaviors phycologists and Makerspace staff with technical expertise. Through interdisciplinary ways of working it was important to apply a holistic approach and consider the CE from multiple perspectives. Each participant contributed and collaborated to develop their own emerging ideas. This workshop structure supported collaboration and input from additional stakeholders across the supply chain from the manufacturers providing the textile waste, to other local businesses, design students, policy makers and citizens.

Figure 3 Prototyping Circular Archetypes

Figure 4 Discussing Circular Archetypes

The insights captured were clustered using thematic analysis and the following themes emerged:

- **Bringing Surplus Materials to Life:** the quality of the materials gathered were a real source of inspiration for designers but it took time for them to identify new processes to enhance reuse. E.g. This involved punching holes into leather to make it easier for sewing or laser cutting modular shapes with interlocking patterns.

- **Challenging Individual and Collective Mindsets:** due to unfamiliarity with the surplus materials, and the constraints of a designed brief for an open source collar archetype, they were forced to explore new ways of thinking and working. Practically, designers have the potential to unlock hidden potential within supply chains and materials.
- **Space to Make Together:** the Makerspace provided a place to experiment with new techniques and technologies, and to engage with people to focus on community building including public facing activity to broker relationships between different stakeholders.
- **Instilling Circularity**: throughout the project there was a clear concern to embed a circular ethos into the final designs, as well as ensuring quality. The shift towards a circular paradigm is inspired by motives such as new business opportunities, an urge of innovation, greater resilience against future risks and eliminating needless impacts.

Stage 4: Circular Archetypes

Concept Title	Circular Cape	Charm Collar
Brief Description	This cape can be layered together using different fabrics. It can be embellished, reprinted or modified over time. It can also be designed as an heirloom piece to gift across generations or to be shared within a family.	This collar aimed to engage the end user within the design process through co-design. It can be personalised digitally prior to production. With slots for adding bespoke embellishments that can be added, removed and reused overtime. The collar is also designed with fastenings to accompany any garment.
Materials: what materials or resources are required to produce this concept? How will they be sourced? Can the origin be traced? How can life cycles be optimised? What is the end of life strategy?	Open source pattern available via digital download or distribution.	Open source pattern available via digital download or distribution.
Methods: what sustainable design strategy/s have been applied? How is this concept made and what production methods are required?	▪ Design for Long life ▪ Design for modularity ▪ Design for Dissassembly	▪ Design for Customisation and Personalisation ▪ Co-Design ▪ Design for Dissassembly This cape is laser cut and assembled within a local maker space. There are slots for adding embellishments and they could be 3D printed using recycled plastic or other reclaimed materials.
Mindsets: how will you engage with the end user? What changes do you hope to see through the use of this concept? How will you mediate user-design relationships?	This concept explores cross generational skills – can it be used as a conduit to enable a grandmother, mother and child to share skills? The cape could be gifted and transformed aligned to family occasions and celebrations such as birthdays, weddings and anniversaries. A passport or guidebook could accompany the cape and be used to catalogue each lifecycle.	This concept explores personalisation and adaptability for the end user without the requirement of acquiring specialist skills and knowledge. The cape is produced within a Makerspace and accessories could be co-design and commissioned overtime. Therefore, a box of embellishments emerges through use and re-use. This might offer an approach for end users to connect to barter, swap or recreate the

		embellishments. Playing on the metaphor of a charm bracelet.
Model: how is this concept viable – what is the business case? Is micro-manufacture feasible? How is it designed, produced and distributed?	This cape is open source and can be produced using an heirloom fabric, a family tweed or tartan or a plain fabric with special lining. The business opportunity emerges through a bespoke production model. Expanding upon Savile Row and how a family archive is documents and revisited over time. The Makerspace could be used to explore a future tradition around craft and heritage within the context of the circular economy.	Design for Disassembly / Customisation. This cape requires a product service system with Makerspaces playing a pivotal role. The business opportunity emerges around the embellishments and there could be a subscription model.

Figure 5 Circular Archetypes

Stage 5: Showcasing Results and the Round Table

Through both Make-a-thons a broad range of ideas emerged to consider how Circular Archetypes might be produced locally using a CE model. The Makerspaces used to host each workshop also provided insights into what kinds of tools and equipment would be required to support RDM locally. Within this small study a lot was achieved by using a laser cutter, domestic sewing machine and heat press.

The larger Manufacturers did who provided the surplus were invited to preview the results and to offer their feedback on the feasibility of these concepts moving forward. With additional representation from Zero Waste Scotland – a government funded agency with a national remit of reducing waste and advocating circular practices within business, the public sector and to educate citizens.

The Circular Archetype Model (see figure X below) was presented to project partners to demonstrate how their surplus textile waste could be repurposed through RDM. This visual model expands upon the work of the Ellen Macarthur foundation (2017) and provided a visual framework to deconstruct the systemic issues concerning circular materials, products and services. While Makerspaces are situated within the third loop – they could be used to repurpose existing products within their second or third life, or simultaneously to produce new products using waste emerging from first life production. This session facilitated discussion and prompted debate and questions and provocations were used to invite stakeholders to position themselves in product ecologies, where they could have impact and what that impact might be.

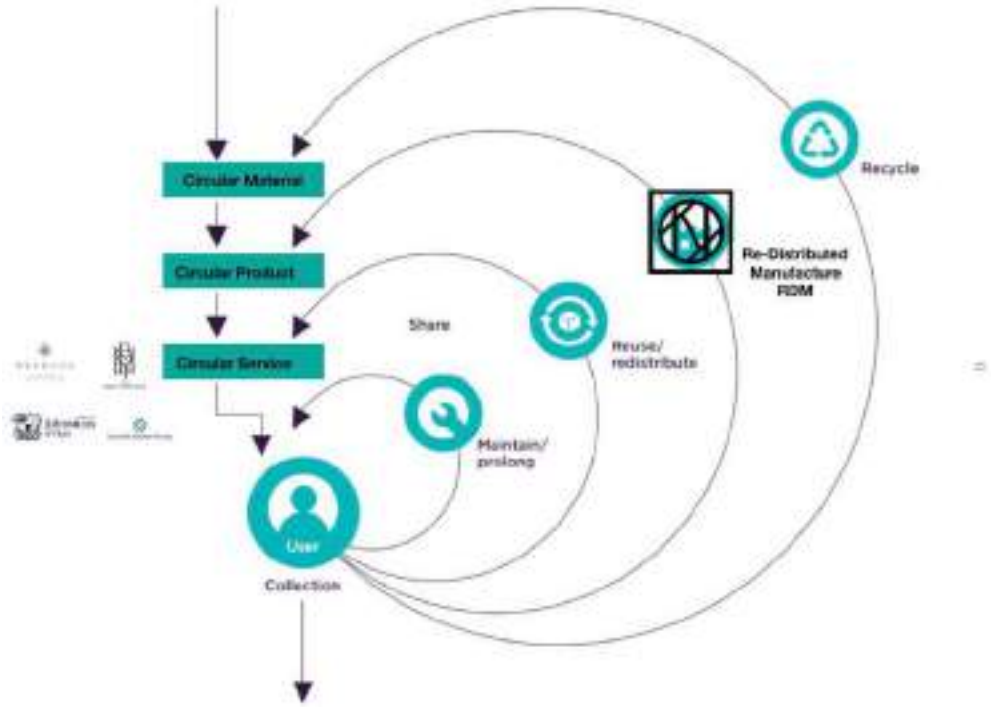

Figure 6 Circular Archetypes and Redistributed Manufacture RDM

Figure 7 Round Table

The insights captured were clustered using thematic analysis and the following themes emerged from the Round Table;

- **Tensions Between Volume and Niche:** The critical difference between opportunistic working with small amounts of surplus to make bespoke items versus operating at scale and the issues with supply, volume and quality of material.
- **Makerspaces Bringing Equality of Conversation:** As a neutral space for conversation, Makerspaces play a key role in democratic engagement with complex issues like the circular economy. They play a key technical role as places for experimenting and prototyping, they also play a key role as places were new ideas can take form and spread.
- **Material Making to Push the Conversation:** Tactile experiments and actually working through the process of designing and making with surplus material bring out systemic issues with implementing the circular economy in textiles.
- **The Questions of Scale:** Tensions between institutions, bringing that out in a democratic forum, evidence from our project, practice based, involved makers and policy and academia and Makerspaces and industry at different scales.
- **Peer Produced Knowledge:** The circular economy could be seen as a knowledge economy, education at all scales (human, industry, societal) is key to tackling the issue. Models and approaches are as important as technical innovation for implementing the circular economy. Will a more transparent distribution of knowledge contribute to a broader distribution of agency in the circular economy and develop new roles and responsibilities.
- **A Whole Ecology Approach:** For a circular economy to flourish and make meaningful change the whole system needs to be aligned to a particular way of working. The actions of individuals and small groups will face issues when colliding with the broader industrial landscape.
- **Roles and Responsibility:** Who is responsible for enacting the circular economy and how can agency be distributed through the system?

Results / Findings

This study provided a different lens through which to view RDM for the CE from a textile design perspective, with materials sourced from large scale industrial textile manufacturers who service a global fashion industry. While emergent, the Circular Fashion Archetypes provide stimuli to facilitate circular conversations to continue to discuss how we might expand upon the role, skills and capabilities of the designer in the future to equip them to operate within a circular economy.

Discussion

In this research, we see how connecting different stakeholders from across the supply chain is instrumental in supporting circular practices. However, the research unearths many contradictions in the current narrative about circularity in Makerspaces. For instance, the business focus of the CE, and the required Sustainable design strategies will require intensive resource management to implement a RDM system for local textile economies.

The feasibility study also raises further questions about the willingness of businesses to collaborate with both independent designers and makerspaces in the future. Many makerspaces are not financially self-sustainable. For this reason makerspace managers and founders themselves see a role for government intervention for issues related to sustainability and emphasise the important external factors that restrict their capacity to ‘act’ including consumer behaviour, market forces, policy and government legislation.

Sadly, since the initial study MAKlab a project partner and makerspace based in Glasgow has closed.This is illustrative of how circular makerspaces face many similar challenges (cultural, behavioral, organizational, technical, infrastructural) to sustainable innovation implemented in ‘mainstream’ design and manufacturing realms. The work of Zero Waste Scotland and similar public agencies will be essential in supporting joined-up approaches and the implementation of new practices.

Makerspaces are subject to rapid change and are not heterogeneous; therefore, the results may not be representative, but rather offer insights to a particular set of makerspaces at a given point in time. More research needs to be undertaken in this area and the following are recognised here:

- What processes, people and projects are synonymous with Circular Innovation – and how might new projects be identified to explore the decisions being made and the necessary guidance needed?
- What outputs are being produced, what facilities are required within the Makerspace and within its local and global ecosystem? This includes an audit of emerging waste streams.
- What tools and methods are required and how can they support designers, Manufacturers (Mirco and Macro) and SME's within the Circular Economy (induction manuals, signage packs, online resource, processes for mapping local resources)?
- What are the training needs of these individual and what is required to catalyse Circular Practices (guidance, know-how, leadership skills) to overcome challenges they face?
- Further clarification on what is meant by re-distributed production and how it can emerge from different types of Manufacturers needs to be better understood?
- Additional mechanisms and incentives to drive local re-distributed production need further exploration in terms of legislation, education and technology.

This paper highlights the importance of acknowledging that the circular economy goes beyond the capabilities of specific design disciplinesIt is a joint responsibility that cannot be undertaken in isolation (Goldsworthy, Earley, 2015). This will require the input of material scientists, business experts, waste managers and policy makers alongside other stakeholders and those undertaking roles that have not yet been identified. Practically, designers have the potential to unlock hidden potential within supply chains and materials (Whitty, 2018). Throughout this research, the author/s engaged with a large cohort of innovative Textile Designers based in Scotland who struggle to access new materials or RDM and business support due to the small scale of their business. However, while the research reveals immense opportunities to cultivate circular literacy from within Makerspaces, while emerging, this feasibility study provides a framework to facilitating circular conversations to continue to discuss how we might expand upon the role, skills and capabilities of the designer in the future to equip them to operate within a circular economy. Widespread unfamiliarity with the materials, and the constrained designed brief of an open source pattern collar, forced new ways of thinking and working for participants. With diverse stakeholders coming together in such circumstances enhanced skill sharing and a faster process of prototyping within a CE context. This also informed considered design outputs that weren't just designerly, but intended to inspire others tension in responsibilities from consumer to industry, makerspaces traversing audiences to change habits and mindsets around consumerism.

Conclusion

The CE is the same imperative whether people are focusing on ecology, economy or just their own business. Simply deciding that it must happen creates new spaces for ideas and action on a relevant scale of ambition. As policy and legislation influences businesses to re-evaluate how they manage, maintain and dispose of their waste streams, new business opportunities are beginning to emerge. But this will require knowledge exchange to support joined-up thinking to connect all stakeholders involved in the lifecycle of textile material journeys and new supply chain models. The RDM approach aimed to foster a joined-up approach to innovation to align emerging outputs to the principles of the CE and endeavoured to preserve and enhance natural capital, optimise the use of resources and foster system effectiveness by designing out wastefulness.

It is as important to know how to take things apart, as it is to design to design them. This is a new challenge for industry, business and designers, but also for consumers, who need to critically consider their own consumption practices. We have to create a new consciousness towards the use of clothing and introduce new practices for using our clothing longer, maintaining it well, but also investing in a smaller wardrobe with less content.

This study provides an opportunity for textile designers and students to experience the concept of the CE through participating within a practical intervention. Discussion was facilitated to challenge existing perceptions and prompt conversation around circular innovation to re-think design, production and use. The CE can provide a new lens to preview how we as designers would like to experience fashion. Research and development is beginning to help design and the textile industry to understand the value, viability, scalability and role of circular approaches in the future (DeCastro, 2014).

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Research Perspectives IN THE ERA OF Transformations

Service Blueprint for Sustainable Business Model Evaluation

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The adverse societal impacts caused by sharing mobility - a form of service-based sustainable business model innovations, showed that operation activities and managerial practices impact heavily on the sustainable value of a service offering. To identify how new service development (NSD) activities can better support the proposed service offering for sustainability, evaluating sustainability of service operations is needed. This study draws learnings from service design, product-service system and sustainable innovation research streams, to build sustainability evaluation framework into service blueprint. Six expert-interviews and two mobility case studies were developed, to illustrate service blueprint's capability in mapping sustainability input and benefits created during NSD and service operation activities. Results revealed a) the shift from using sustainable 'value' to 'benefits' concept in service operation evaluation, b) the public-private collaboration dilemma and c) the agile NSD and sustainable innovation incompatibility. This paper aims to offer a springboard for practitioners and researchers to uncover compelling insights, discuss latest service design developments, and envision future directions for integrating sustainability into service-based business model innovation.

Keywords: Service Innovation, Service Design, Sustainable Business Model Innovation, Sustainable Value Co-creation, Sustainability Evaluation Tool

Introduction

As environment and resource risk continue to challenge the world, a significant number of interests turn to how sustainable innovation (SI) drives economic growth while improving environmental and social performance (Boon et al., 2013; Charter and Clark, 2007). Recent years, rising service-based innovations have dominated the sustainable innovation in mobility activities, providing mobility services through collaborative consumption (Botsman and Roger, 2010; Morozov, 2013). Based on service-dominant logic, services are value networks (Vargo and Lusch, 2006) that presuppose social actors to be integral to the processes of service production as well as consumption. Thus, this brings to question how the implementation of collaborative organisational processes, activities and operations, impacts the proposed service offering and experience (den Hertog et al., 2010; Janssen et al., 2015). It is also unclear, how actors within a service operation co-create sustainable values in the delivery of service offering (Boon and Mendoza, 2010).

This gap is particularly visible in the mobility sector with the rise of sharing economy (e.g. peer-to-peer ridesharing and delivery). While the design of mobility service offering utilises assets through collaborative consumption, there is more and more attention drawn to rideshare services' unclear management policy of workers' rights and responsibilities, as well as the commoditization in aspect of life. With the blurry definition

of collaborator, the rise of rideshare became controversial and caused adverse societal impact in the service operation (Cohen and Kietzmann, 2014; Schofield, 2014; Morozov, 2013). Since sustainable innovation (SI) refers to product, processes or services that increase Triple Bottom Line (TBL) economic, social and environmental values in their production and consumption activities (Charter et al., 2008; Charter and Clark, 2007; Elkington, 1998), there is a need for evaluating the mobility service operation activities to identify how mobility service development process can be improved to better support its' proposed service offering for sustainability. This raises a question of how existing sustainability evaluation tools address and help service innovation and its' involved actors to integrate sustainability at every stage of the new service development (NSD) and service operation journey.

In the existing literature, sustainability, service and innovation have been the subject of much research and discussion (Calabrese et al., 2018; Chou, Chen and Conley, 2012; Vezzoli et al., 2015; Martin, 2016; Botsman and Roger, 2010; Cohen and Kietzmann, 2014; Yu and Sangiorgi., 2018), yet to the best of our knowledge no research has focused on how service design evaluates service actors' co-creation of sustainable values in NSD and service operation. Amongst the limited sustainability evaluation tools developed in the past literature, relevant literature scattered across three streams of research in service design, product-service system (PSS) and sustainable innovation (SI), focuses on different sustainability and innovation dimensions (Calabrese et al., 2018). The observed phenomenon within mobility sector points out an emerging field of service innovation for sustainability, which embraces multi-dimensional innovation across system, design, technology, organisation and customer in all three streams of research (den Hertog, 2000). Sustainability evaluation within service innovation in mobility needs to draw learnings from the three streams, develop practical tools that holistically address TBL sustainability and support the maturity of service innovation development for sustainability.

In this study, we investigate the potential of using service design's operational planning tool to evaluate service operation activities against proposed service offering for sustainability. We first review the service design and innovation literature, sustainable value creation and dynamic capabilities for sustainable business model innovation. Concept of uncaptured sustainable value within PSS stream (Yang et al., 2017) and the collaboration principles within SI stream (Curșeu and Schruijer, 2017) are reviewed, integrated into service operation planning tool - service blueprint and evaluated with industry experts for its' usability in practice. Then, the revised sustainability evaluation service blueprint is applied to two mobility case studies, to identify insights of what operation activities offer opportunities to innovate for sustainability. The results further conclude with implications in practice when using service design to facilitate sustainable values creation in service development process (Yu and Sangiorgi., 2018).

Service Design for Sustainable Innovation

In recent years, more and more sustainable business model innovations focus on providing services, in order to capture sustainable value through collaborative consumption (Cohen and Kietzmann, 2014). This view revealed that service is understood as a perspective on business, instead of simply a form of goods (Edvardsson, Gustafsson, and Roos 2005; Vargo and Lusch 2004).Therefore, a rising Service Design logic is being considered as SI's design and management strategy for its' suitability to deal with complex situation with multiple actors involved (Chou, Chen and Conley, 2012; Baldassarre et al., 2017; Prendeville and Bocken, 2017; Tukker, 2015). Service design is rooted in human-centred design, focus on problem solving with iterative design process (Stickdorn, Schneider and Andrews, 2011). Its' design process keeps customer journey at the heart and looks at end-to-end holistic service operation, as well as front and back service support at the same time (Sangiorgi et al., 2012). Through engaging actors with empathic design methods, service design discovers, identifies and addresses their concerns with service design and process reconfiguration (Segelström, 2013; Schmiedgen and Management, 2011)

Numbers of widely-used and effective tools have been developed to help service designers to sense make, discover and conceptualise new perspective on a particular service. In particular, service operation planning tool - service blueprint visualises a service user's experiences through different touchpoints, details their service interaction with front and back service support throughout the end-to-end journey (Stickdorn, Schneider and Andrews, 2011). It focuses on visualising user-interaction, relationship analysis and service experiences through multi-actors perspectives. Revealing the fundamental service design thinking to sense-make, organise and reimagine complicated relationships and interaction within a particular service, for an intended outcome (Dorst, 2015; Verganti, 2011, 2014). Through visualisation of service blueprint, it maps out how actors within a particular service interact. This means service blueprint key contribution is providing

visibility on complex service operations. Therefore, focusing service operation visualisation against sustainability evaluation requires a framework for evaluating service actors' sustainable value co-creation during operation. This draws the investigation of sustainability evaluation to product-service system and sustainable innovation literature, in order to discuss and integrate learnings into the development of sustainability evaluation for service operations.

Existing Sustainability Evaluation Tools

In the search of existing sustainability evaluation tools, we have found that many tools focus on evaluating the design of sustainable business model Innovation (BMI), its' value proposition and its' innovation process (Bocken et al., 2013; Evans, Rana, and Short 2014; Yang et al., 2017). Value mapping tool (Bocken et al., 2013; Evans, Rana, and Short 2014) evaluate BMI sustainability issues against internal and external stakeholders such as environment and society. Sustainable value analysis tool (Yang et al., 2017) focused on identifying the uncaptured sustainable values for stakeholders across the product life cycle, then translate them into opportunities for Innovation reconfiguration. These tools focus on analysing relationships and value exchange within a BMI, in order to improve value creation at the design and innovation process of BMI. Through the BMI perspective, these tools evaluate on the concept of how sustainable value can be delivered through a business, yet the perceived limitation of BMI perspective lies in its' capability to translate into practical business action (Prendeville and Bocken, 2017). This implies that these sustainability evaluation tools also have the limitation on evaluating the organisational and managerial sustainability impact in practice.

Amongst the two tools mentioned, sustainable value analysis tool (Yang et al., 2017) incorporates the perspective of product service systems (PSS) and establishes its' evaluation on product lifecycle, in order to bridge the evaluation gap between design concept of BMI and PSS development process. However, due to a number of factors, such as internal culture, organisational capabilities and the demand in multiple actors collaboration, PSS perspective still has its presupposed barrier to holistically evaluate the phenomenon of service innovation in the sharing economy (Tukker, 2015; Vezzoli et al., 2015). The comparison of these core concepts revealed the need to examine the practical organisational and managerial capabilities, in order to address the sustainability impact incurred in the service operation.

Organisational and Managerial Capabilities for Sustainable Value Creation

The importance of practical organisational and managerial capabilities is well defined in the literature of SI. According to Inigo et al. (2017), these are core-elements to co-creating social and environmental sustainable values in operations, as well as creating successful BMI (Mezger, 2014). In particular, the organisational capabilities needed for sustainable value creation involves understanding their own interaction with external set of activities in knowledge creation, stakeholder engagement and technological innovation, then utilising them with their own internal resources. This outlined two types of practical organisational and managerial capabilities, see table 1:

Table 1. Organisational and Managerial Capabilities for Sustainable Value Creation (Inigo et al., 2017)

Organisational and Managerial Capabilities for Sustainable Value Creation	
Capability in collaborating for sustainability	Close stakeholder dialogue and community participation leads to continuous learning and adaptation to the dynamics of TBL sustainable value creation
Capability in transforming operational activities for sustainability	Technological transformation of organisational structure and system activities creates TBL sustainability values for social actors involved

This draws the focus on investigating what's required for organisations to develop collaboration and transform operational activities for creating TBL sustainability values.

Capability in Collaborating for Sustainability

Achieving SI requires the collaboration between social actors involved in the particular innovation (Boons and Mendoza, 2010). Collaboration with multiparty enrich the knowledge pool and the comprehensiveness of sustainable value creation process. Through the collaborative process, actors explore their interdependencies, use their expertise and knowledge to integrate and influence the sustainability decision making outcome (Curșeu and Schruijer, 2017). It was discovered that the decision quality increases when social actors' diversity of interests is expressed through information sharing and exploration, while decision quality was compromised when social actors' diversity of interests was not acknowledged in the value creation process (Fadeeva, 2005, p173). Therefore, collaboration for sustainability considers the design of the internal structure with stakeholder interactions (Inogo el al., 2017). In which, scholars of stakeholder engagement in sustainability suggested three constructive collaboration principles that are crucial to capture actors' interest diversity and foster inclusive and sustainable value creation environment, see table 2 (Cox et al., 2010; Curșeu and Schruijer, 2017).

Table 2. Constructive Collaboration Principles for Sustainable Value Creation (Curșeu and Schruijer, 2017)

Constructive Collaboration Principles	*Example/Prompts*
Inclusive Stakeholder Selection	Are there tools in place to remove power disparity and assist peripheral stakeholders to voice their concern, in order to avoid biased selection of particular stakeholders and create sufficient representation of power dynamics between multi-stakeholders?
Normative System for Collaboration	Are there ground rules to build constructive task conflicts and engage in healthy debates, for enabling comprehensive problem formulation and cross-understanding of diverse viewpoints?
Process Consultation	Are there tasks consultation with multi-stakeholder during the process, to stimulate the emergence of trust, psychological safety and prevent collusive dynamics?

Capability of TBL Sustainable Value Creation in Operational Activities

On the other side, achieving technological sustainability transformation in organisational structure and system activities, consider how to harness the uncaptured TBL values within product lifecycle (Chou, Chen and Conley, 2012; Elkington,1994; Plepys et al., 2015). This implies that open and uncaptured perspective is crucial for sensemaking sustainability in product service lifecycle (Rauter, Vorbach and Baumgartner, 2017). Through focusing on the negative form of values, a reversal thinking was suggested, shaping focus for conducting complex sustainability research (van Veggel, 2005). It was suggested that the four forms of uncaptured values (Yang, 2016; Yang et al., 2017): value missed, value surplus, value destroyed and value absence can be utilised to discover, identify and articulate the comprehensive TBL values, which are not currently captured in the business model and its' product service lifecycle, see table 3:

Table 3. Adopted from Four Form of Value Uncaptured of Yang et al. (2016)

	Definition	Example/ Prompts
Value Missed	Something exists that is not exploited.	· Are there tangible or intangible resources that are underutilized? (e.g. capital assets or human resources?) · Is the business creating value in some form that it is failing to capture? (e.g. through the better use of data to enhance service?)
Value Surplus	Something exists that is not required.	· Are there excessive benefits? (e.g. overproduction, excessive service functionality?)
Value Destroyed	Something exists that undermines value.	· What are the negative outcomes of the business at each lifecycle stage?

		· Is there a potential or perceived risk of value being destroyed by continuing customary practices? (e.g. a risk of time to market?)
Value Absence	Something required that does not exist.	· What tangible and intangible needs of the company and its stakeholders have not been realized?

Through this identification process, organisation can transform the uncaptured TBL values and turn them into innovation opportunities. Yang et al. (2017) also used this uncaptured TBL values to develop Sustainability analysis tools (see figure 1), provided an effective step-by-step structure in analysing how captured and uncaptured TBL value incurred within the product life cycle. The step-by-step structure analyses value captured, then value uncaptured, for all stakeholders throughout the product life cycle. Through identifying the negative form of value, the analysis tool assists the discovery of new TBL value opportunities. It helps complex operations to take the initiative in understanding how their product life cycle can be optimised for sustainable value creation.

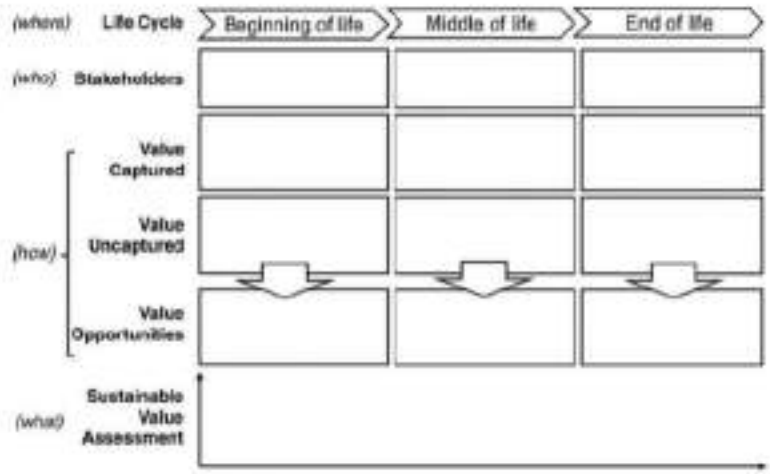

Figure 1. The Sustainable Value Analysis Tool (Yang et al., 2017)

Preliminary Sustainability Evaluation Service Blueprint

After the investigations above, we can see that achieving sustainable value creation in Service-Based Business Model Innovation requires not only the maturity in the operational and managerial capabilities. Most importantly, organisations need to understand the external environment of knowledge, stakeholder engagement, technologies and utilising them with internal resources for TBL sustainable value creation (Inigo et al., 2017). This points out the importance of sense making an organisation's design concept of BMI for sustainability, PSS development process and practical service operation. To do this, it is crucial to develop strategic and practical evaluative tool. A tool such as the service blueprint, which has capability in 1) providing visibility to the complex multi-actors service operations (Stickdorn, Schneider and Andrews, 2011); and the flexibility to sense make specific knowledge, such as 2) understanding the existing structure of stakeholder interaction during service operation, and 3) understanding the uncaptured and captured TBL values within existing product-service lifecycle (figure 2). Therefore, here we synthesise the literature findings and describe a preliminary sustainability evaluation service blueprint.

Identifying the New Service Development (NSD) and Service Operation process

Since the aim of the blueprint was to evaluate how the service was iterated and developed throughout the NSD and service operation process. Therefore, identifying the process to be blueprinted was the first priority (Shostack, 1984). The investigation would start from specifying physical evidence (service experience lifecycle), where the aim is to understand what iterations the service experience lifecycle has gone through (e.g. alpha, beta, launched version). Then, it goes deeper to look at what interactions are needed both digital and physical that support the customer interactions in each of these development phase. when are they aware of this

service? When do they join into test and feedback the product? And what are the relations between customers feedback and subsequent NSD activities?

Criteria 1: Evaluating Collaboration for Sustainability

As the blueprint develops, it revealed the different internal actors involved in the NSD activities. Therefore, it is also important to investigate who are the external actors that have been supporting the service development: How were they involved? What are the relations between external actors' feedback and subsequent NSD activities? The investigation of the above provided visibility to NSD activities, reveal silos and areas of opacity in existing service, as well as the complex and intricate relationships with different actors.

By evaluating how collaboration was conducted at each level and each step of the service operation, it allows us to analyse the comprehensiveness and the quality of the sustainable value creation process. It aims to identify whether there's a bias selection of stakeholders, there's a system for healthy debate and whether collaboration process was consulted with stakeholders to avoid collusive dynamics (Curșeu and Schruijer, 2017).

Criteria 2: Evaluating TBL Sustainable Value Creation in the Operational Activities

More importantly, this rich information enables the latter part of the blueprint to carry out sustainability evaluation against the exploited and unexploited TBL benefits. For example, one can specify how the service exploited TBL benefits in alpha version, which would be made comparable to the service's launched version. This then provide insights into whether NSD activities has been optimised for sustainable value creation.

By evaluating what uncaptured TBL values (value missed, value surplus, value destroyed and value absence) exist at each level and each step of the service operation, it allows us to determine whether there are activities underutilised in service operation; there are activities exist that do not align with TBL values; there are activities align with TBL values which was destroyed in the process of service operation; or there are activities that do not exist yet required, in order to align with TBL value creation in service operation (Yang et al., 2016).

With this thorough analysis, the blueprint then provide visibility towards what and how TBL values were created during NSD process and service operation. Enabling organisations to see the gap between design of service offering for sustainability and the delivery of sustainability during service operation, then reconfigure its' service operations' activities and managerial practice accordingly. This evaluation blueprint aims to function as the first step to sense making - internalising the environment of knowledge, stakeholder engagement, technologies of existing service for sustainable value creation (Inigo et al., 2017).

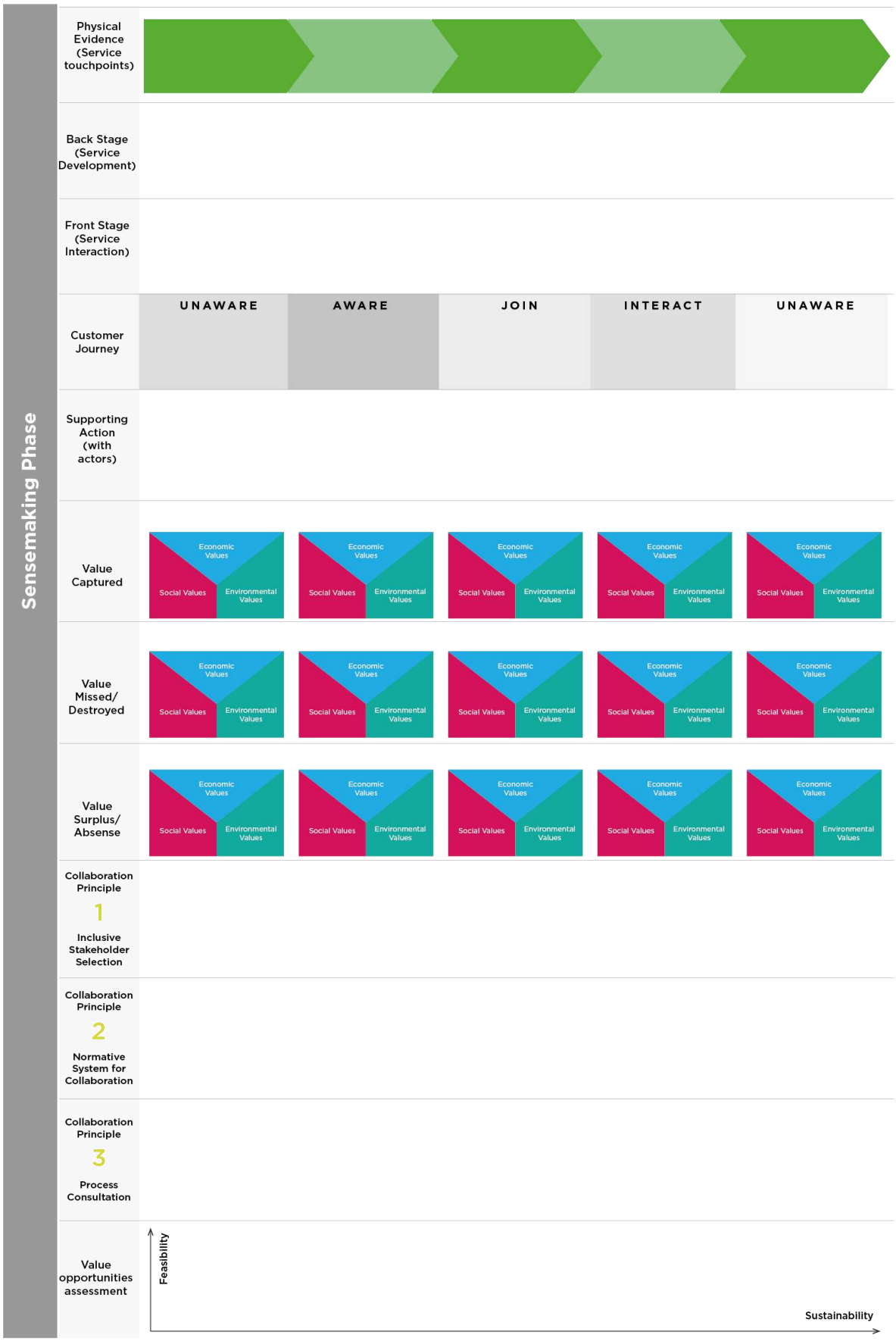

Figure 2. Preliminary Sustainability Evaluation Service Blueprint

Methods

This research is exploratory and uses the literature review to generate a preliminary blueprint. To provide insights into the service innovation as sustainable BMI phenomenon, our research design involved six expert-interviews for preliminary blueprint validation and desk research to generate two case studies in mobility sector (Bailey, 2010; Yin, 2003). Furthermore, it explores the actual practicalities in using the synthesised blueprint. See process diagram (figure 3.) below for methods used in each stage of research:

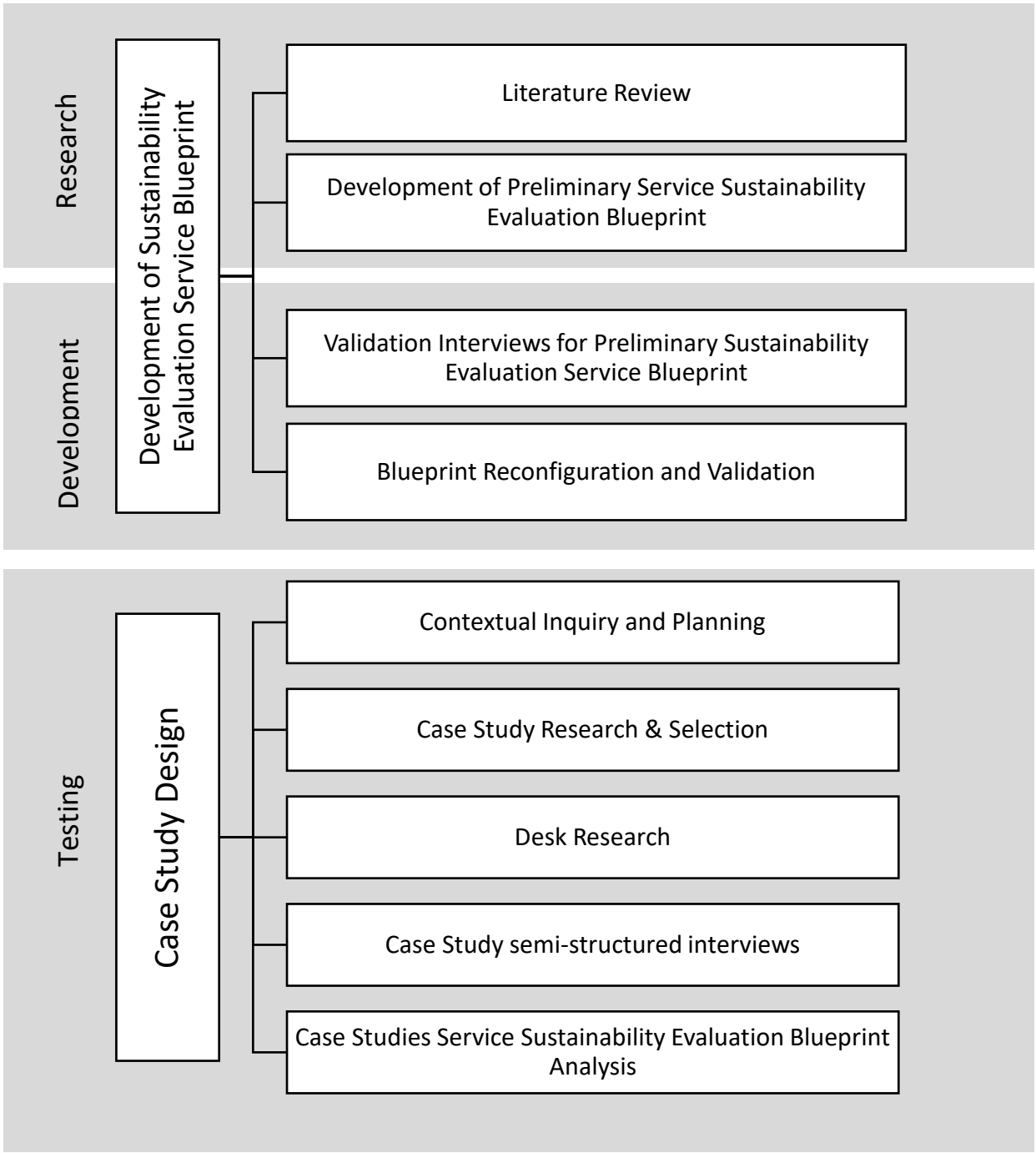

Figure 3. Research Methods Process Diagram

Development of Sustainability Evaluation Service Blueprint

A preliminary blueprint was synthesised from literature review of three research streams (service design, PSS and SI). As literature review and contextual inquiry pointed out that sharing mobility services is a newly emerged phenomenon, sustainability evaluation service blueprint can potentially be used by actors involved in all three streams of research. Therefore, semi-structured interviews were conducted with six actors involved in service design, PSS and SI. Upon completion of blueprint evaluation and validation, contextual research and interview insights were drawn. As information was vast, applicable information were sorted into clear categories using an Affinity Diagram, which allows key feedback to be addressed and summarized for revising the blueprint, see process diagram (figure 3). Iterated blueprint (see figure 5) was updated after discussion and feedback from expert interviewees. To test the iterated blueprint, case study method is determined to be an appropriate method for explorative research and observing phenomenon (Bailey, 2010; Yin, 2003).

Case Study Design

Figure 3 specified the process of using case study method to test and demonstrate the Sustainability Evaluation Service Blueprint. An initial desk research was conducted to highlight mobility services in sharing economy as sustainable innovation phenomenon (Botsman and Roger, 2010; Hyard, 2013; Cohen and Kietzmann, 2014). Citymapper Smart Ride and Ford Chariot were selected based on the criteria developed under desk research of Sustainable Mobility in the UK (See Table 4). Industry related documents and reports were reviewed and studied to establish an understanding of UK share mobility service industry practice, goals and strategies. To understand how multi-party actors contribute in sharing mobility service as sustainable innovation phenomenon, three experts interviews were conducted to provide insight for the investigation.

Table 4. Criteria for Case Studies Selection

Criteria	*Determined by:*
Clear intend to develop disruptive mobility innovation that meet TBL values:	Identifiable TBL values developed based on publications and recommendation by experts.
Social value	Satisfy the essential mobility needs of the people through promoting equality use of open data (Rose, 2017).
Economic value	Offers affordable, functional and efficient transport solutions that support economic development (Chariot, 2018; Citymapper, 2018a).
Environmental value	Limits carbon emissions and pollutants through utilising assets and resources (Chariot, 2018; Citymapper, 2018b).
Accessibility	Observable to researcher - operates in London, UK

Two selected mobility case studies were mapped using the Iterated Sustainability Evaluation Service Blueprint. Data about case studies was collected via desk research and expert interviews with share mobility service actors. While this analysis is not intended to be exhaustive, it aimed to illustrate how service operation's TBL values can be visualised using the conceptual Sustainability Evaluation Service Blueprint.

Limitations

The synthesised blueprint was evaluated by a small study sample of participants and experts, where it may be limited to its diversity and bias. Furthermore, the analysis examined the concept of the blueprint through exploratory case study approach, where wide range of public documents, research, articles and interviews were reviewed to address the phenomenon (Yin, 2003). Yet, the effectiveness and contribution of the synthesised blueprint has not been evaluated, which pointed out potential areas for future work in this topic.

Results

Blueprint Iteration and Validation

Thematic analysis was conducted using Affinity Diagram, where comments that are repeatedly mentioned by the experts during the interviews were written down on post-it notes, then sorted into different categories. Following this display of insights, key feedbacks could be identified:

1. **Varied collaboration principles comments depending on actor's commercial and non-commercial industry nature**
2. Time is a big concern for commercial actors to establish inclusive stakeholder selection and process consultation principles
3. **Confusing language of 'value' in sustainable values concept and uncaptured value concept**
4. **Facilitation is key to establish normative system for collaboration**
5. **The preliminary sustainability evaluation service blueprint lack facilitating guidance**
6. Contradictory comments in Inclusive stakeholder selection, where unexpected stakeholders delay timescale, but getting people involve is difficult
7. Tendency to select stakeholders based on running relationships and immediate network

The highlighted feedbacks above were particularly relevant in guiding the next stage of blueprint development. These feedbacks are categorised into the three themes below:

1. Facilitation is key to service blueprint swim lanes, yet there's a lack of facilitative question and prompts

The different terms of uncaptured values are difficult to understand and explain. As the 12 swim lanes investigations underlined the potential requirement of holding a series of stakeholder research workshops, to understand existing service, actors involved and how the collaboration was carried out. Therefore, interviewees suggested that plain English would be easier to understand. Also, facilitative questions linked to the swim lane would be preferable for facilitating workshops amongst actors (e.g. customers, front end staff, back end staff, external actors, etc). Interviewee commented:

> *'You only have that one opportunity in a workshop setting to get as much information as you need…you would want to plan for the entire facilitation, so you get what you want from them' (User Experience Designer, Commercial Design Consultancy).*

Therefore, prompted questions are created for the reconfigured blueprint based on Yang et al. (2017) facilitative question, see table 5.

2. From Values to Uncaptured Inputs and TBL benefits

Interviewees find the term value confusing between 'sustainable values' and 'uncaptured values'. Interviewee commented:

> *'I don't know whether this is personal aspiration values or organisational values?' (Consultancy Director, Commercial Sustainability Consultancy)*

Therefore, the usage of value concept is in need of further analysis in discussion session, which lead to the iteration of terminology used in the blueprint, where the term 'value' in 'sustainable value' was simplified as 'benefits', and the term 'uncaptured value' was simplified to 'unexploited input'. During the interviews, it was also identified that interviewees did not understand the different terms of values until an illustrative example was given. Consequently, the relevant value swim lanes on the blueprint were adjusted with the language suggested by the interviewees, along with the prompt questions based on Yang et al. (2017), see table 5:

Table 5. Iteration of Four Form of Value Uncaptured of Yang et al. (2017)

Terms	*Definition*	*Example/ Prompts*
Exploited input (Captured Value)	Something that has created and improved business economic benefits.	· How have they exploited benefits from the business operation process?
Insufficient Use of Input (Value Missed)	Something exists that is not exploited for sustainability benefits.	· Are there tangible or intangible resources that are underutilized? (e.g. capital assets or human resources?) · Is the business creating benefits in some form that it is failing to capture? (e.g. through the better use of data to enhance service?)
Excessive Input (Value Surplus)	Something exists that is not required for sustainability benefits.	· Are there excessive benefits? (e.g. overproduction, excessive service functionality?)
Undermined Input (Value Destroyed)	Something exists that undermines value for sustainability benefits.	· What are the negative outcomes of the business at each lifecycle stage? · Is there a potential or perceived risk of value being destroyed by continuing customary practices? (e.g. a risk of time to market?)
Required-but-Non-existent Input (Value Absence)	Something required that does not exist for sustainability benefits.	· What tangible and intangible needs of the company and its stakeholders have not been realized?
Identified Input opportunities (Value Opportunities)	Something that has been identified that can improve business sustainability benefits.	· How can insufficiently-use and needed input be introduced and exploited? · How can undermined and excessive input be eliminated? · What innovations could extend the exploited input in new and radical ways? · How can greater economic, societal and environmental benefits be captured from the existing business? · Where in the life cycle are there conflicts of interests between stakeholders? How can they be resolved?

3. Examination Needed for Collaboration Principles for Multi-Stakeholder

Interviewees generally agreed facilitating multi-stakeholder collaborations required two of the collaboration principles – Inclusive stakeholder selection and normative system for collaboration. Process consultation, however received the most diverse comments. Commercial actors pointing out that most of their commercial partners rely on them for process, interviewee also commented that:

> *'I don't quite agree on this one, if we consult them on process, it will take a very long time…I think it is more of an academic thing' (Consultancy Director, Commercial Sustainability Consultancy).*

However, public and independent actors are in favour of process consultation as a core principle and suggested that it is part of the best practice. Therefore, these diverse perspectives and viewpoints are in need for further examination, analysis and discussion through the case studies.

Iterated Sustainability Evaluation Service Blueprint

Based on the key feedback and desk research, the preliminary blueprint (see figure 2) was revised, to accurately present the information that was needed. The revised Sustainability Evaluation Service Blueprint (see figure 5) outlined facilitating questions to assist the investigation for the 12 swim-lanes: the existing process, physical evidence of artefacts, front-end service interaction, back-end service development, supporting actors involved, exploited input, insufficient use of input, excessive input, undermined input, required-but-non-existent input, identified input opportunities and input opportunities assessment.

By specifying the exploited TBL benefits in different NSD stage, the blueprint then goes deeper to evaluate (criteria 2) whether the NSD activities have evidence of insufficiently used input (or other types of inputs) at one specific stage that could enhance TBL benefits? Then, it goes deeper into evaluating whether (criteria 1) there is a quality sustainable value creation process. For example, do the NSD activities have evidence of embedding the 3 sustainable collaboration principles at each stage?

These evaluations then provide means to the next swim lane – identified input opportunities, where facilitative question, such as 'How can undermined input be eliminated?', is given to stimulate insight generation for service sustainability configuration. The blueprint ends on input opportunity assessment swim lane, where a sustainability-feasibility matrix is given to facilitate the evaluation of which input opportunities have higher sustainability impact and higher feasibility?

The sustainability evaluation service blueprint is designed to be modular and facilitative tool, for service designer and service developer to 1) understand an existing service, 2) understand the actors involved in the NSD and 3) to improve the service sustainability by identifying sustainable collaboration principles and eliminating unexploited TBL inputs in existing service.

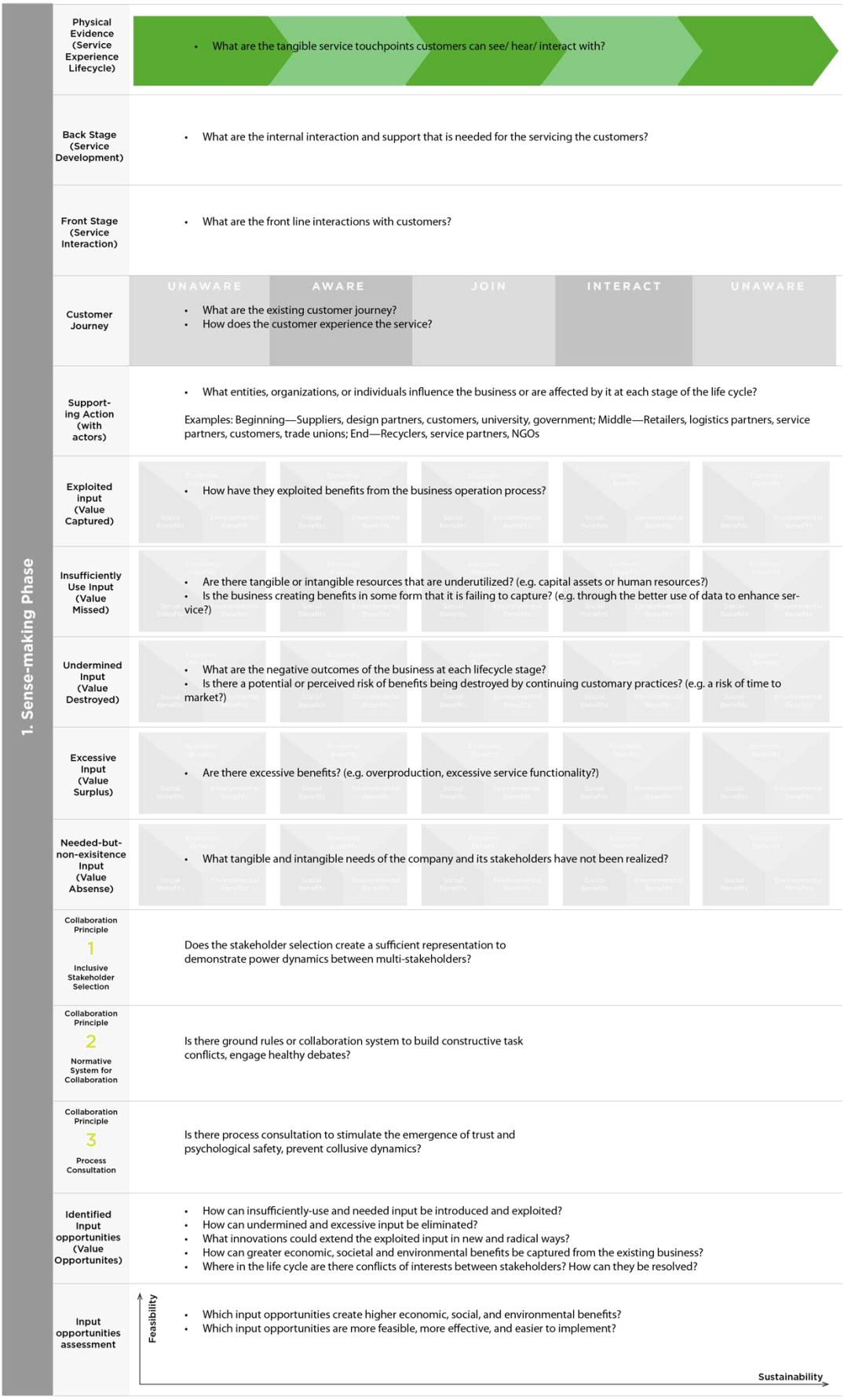

Figure 5. Iterated Sustainability Evaluation Service Blueprint

Testing Blueprint Through Case Studies

Combined the results from desk research and interviews, two case studies - Citymapper Smart Ride and Ford Chariot Commuter bus were mapped against the iterated blueprint, followed by a cross case study analysis.

Citymapper Smart Ride

Table 6. Citymapper Smart Ride Operation Profile

Background:	
Citymapper is an innovative transit and mapping service app that integrate open urban transport data and provide transit information to city users (Merlin and Eleni, 2018). This service provided Citymapper with insights on how public transport is supplied in an urban city like London. Therefore, Citymapper Smart Ride service was launched on the Citymapper app in 2017. It response to real-time transportation demand, utilised the open data capacity to identify underserved urban areas, then partnered with minibus/ taxi drivers to run commuter routes at those identified areas.	
Initial identification of service main sustainable benefits:	
Societal benefits	Operation prioritised underserved urban area to promote equality of commute options (Hern, 2018).
Economic benefits	Affordable fix rate £3 per journey that respond to real-time citizens' need of commute in underserved area (Hern, 2018).
Environmental benefits	Share transportation to ease congestion and pollution. (Ashtari, cited in Hern 2018)

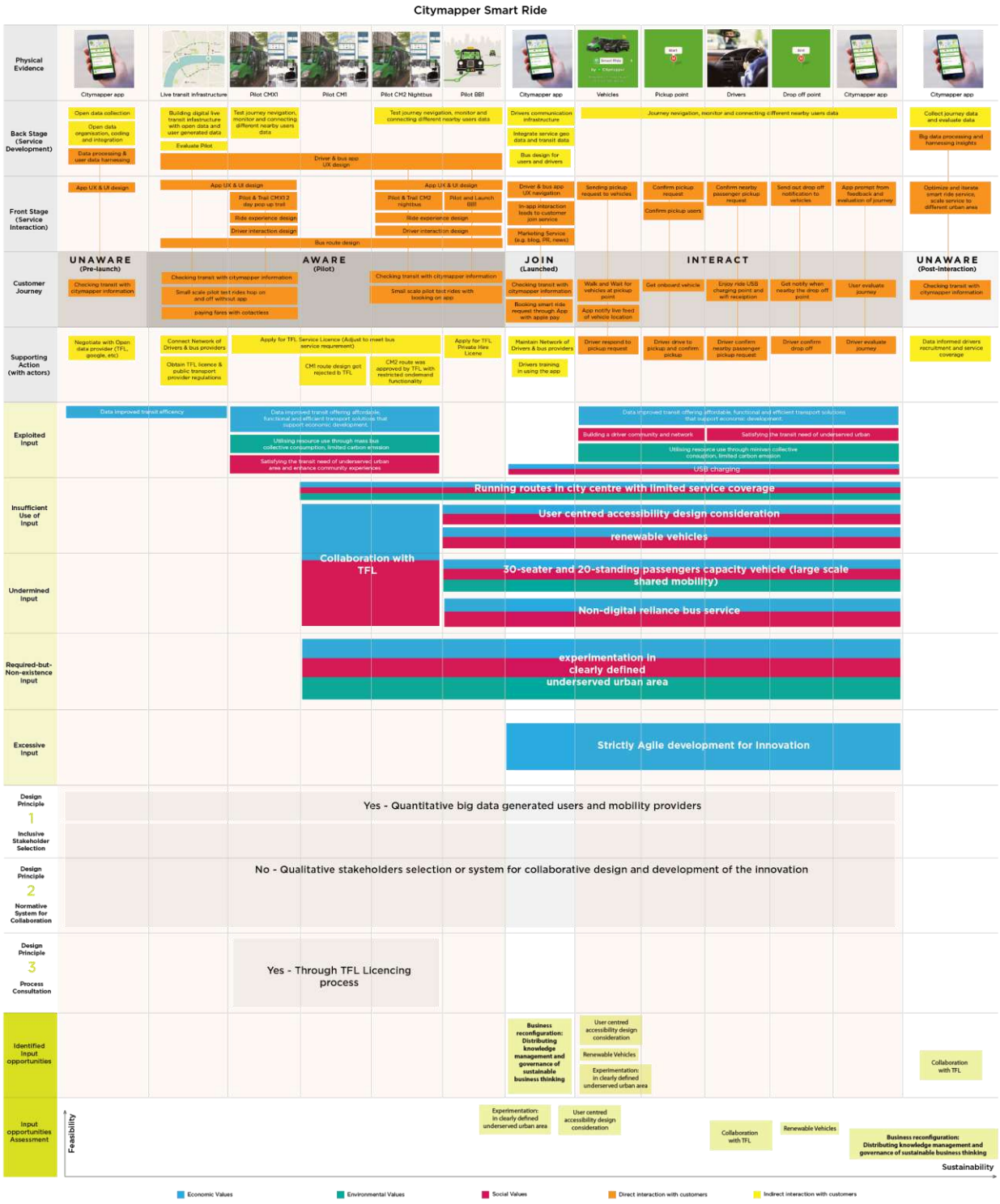

Figure 6. Citymapper Smart Ride Sustainability Evaluation Service Blueprint

Identified Collaborations Principles for Sustainability

The Sustainability Evaluation Service Blueprint (see figure 6) detailed that Citymapper Smart Ride has a unique business capacity of big data responsive network, generated from open transit database and Citymapper user-generated data (Kobie, 2018a). With the built digital infrastructure, Citymapper can respond flexibly to instant change in transit needs in different areas.

This concept was piloted with the testing 30-seater smartbus CMX1, designed with user-centred accessibility functions (Franklin-Wallis, 2017). The service applied for London Service Permission as CM1 and CM2 night

smart-bus (Price, 2017). Yet they were either rejected and restrained from its' flexibility advantage of responding to real-time transportation demands (Citymapper, 2018a), due to Transport for London (TFL) bus regulations 1981 for fleets carries 9+ passengers (e.g. fixed numbers of bus route per day, fixed distance between fleets). "*…It's not about a lack of desire, it's about changing the regulatory frameworks. At the moment it's a struggle to do this* (Bown of Citymapper, quote in ARUP 2018)." This quote and its supporting report drawn the attention to a main challenge of outdated policy overriding positive public feedback generated in the piloting phase. Regulatory difficulties with TFL and government body caused Citymapper to forfeit the pilot concept of London bus service and iterate their service design (Citymapper, 2018a). They scaled down their fleet size from minibus to minivan, carrying 6 passengers per fleet to obtain a private hire licence from TFL (Topham, 2018a), enter the share ride market of Uber (Barber, 2018).

In the end, Citymapper launched Smart Ride work with a network of 500 self-employed drivers (suppliers), provided them training in using the Citymapper driver app to connect with the users, similar to other ride hiring platforms (McMullan, 2018). This concept was born out from the agile approach of working, which forms an experimental closed innovation strategy that aims to solve immediate problem under a rapid timeframe (Citymapper, 2018c). These results show that the development of Smart Ride (see in Table 7) does not appear to have evidence of process consultation initiatives with multiple actors beyond TFL licencing requirements. Inclusive stakeholder selection and collaboration was also absent from documentation. As for normative system of collaboration, it can be argued that the open source transportation and user generated quantitative data were used for determining underserved area route creation, but no qualitative stakeholder collaboration was identified. Therefore, collaboration for sustainability remained largely unexplored in the design and development process.

Table 7. Identified Collaboration Principles in Citymapper Smart Ride

Design Principles	*Example*
1. Inclusive Stakeholder Selection	X
2. Normative System for Collaboration	Quantitative User generated underserved area route creation (Citymapper, 2018a)
3. Process Consultation	Process consultation done under TFL requirements (Price, 2017).

Identified Key Unexploited Input in Innovation

This section extracted some key results from the Citymapper Sustainability Service Blueprint exercise (see figure 6). The unexploited inputs (table 8) discussed below were identified in the reviewed documents, reports and news articles.

Table 8. Identified Key Unexploited Input in Innovation

Unexploited Input	
Undermined Input	*Downscaled Sustainable Impact through Bus to Minivan Iteration* The physical evidence of service operation journey (see figure 6) showed that the launch of smart-ride minivan has undermined the sustainability benefits of smart-ride minibus. The change in vehicle selection limited the user centred accessibility design of the ride experiences, including accessible exit for disabled users and large display for signposting bus stop arrivals (Tech Crunch, 2017). The down scale of the vehicles size also implies that more minivans are needed to satisfy a certain number of passengers, increasing the pollution and congestions on roads. This iteration also has turned the smart-ride into a digital exclusive service, which is only accessible to people with a smartphone that has installed Citymapper's app.

Insufficiently used Input	*i. TFL Collaboration* The iteration also lacks strategic input from collaboration with external stakeholders, which are the results of lacking collaboration principles (e.g. inclusive stakeholder selection and normative system of collaboration). As seen in figure 6, TFL is a major decision maker that impacted Citymapper's service iterations. Therefore, it can be determined that collaboration with TFL was one of the earliest undermined and insufficiently used input in Citymapper's Smart Ride service development. *ii. Run routes in City Centre with limited coverage (Citymapper, 2018a)*
Excessive Input	Short cycle, Speed focused User-Centred Agile App Development Process (caused by lack of business-government strategy)
Required-but-Non-Existent Input	*i. Lack of Business Government Strategy in User-Centred Agile App Development Process* On the other hand, the agile development approach is also suspected to block potential Smart Ride sustainable benefits. Agile development approach is commonly adopted in software development industry for its' speed of delivery and customer centric feedback method (Conboy et al., 2011). Although this iterative method has delivered speedy results for Citymapper in their public transit information service, creating smart ride service under agile development approach forced Citymapper to work in short cycles (Citymapper, 2018a, 2018b, 2018c). For example, the Smart Ride innovation team would then redevelop the service experience to problem solve the immediate regulatory feedback with technological solution, instead of strategically planning for business government shared objectives (Conboy et al.,2011). *ii. Experimentation in clearly defined underserved urban area* TFL denied the CM1 route based on the disturbing citizen in busy city centre (Price, 2017).

Ford Chariot Commuter Bus

Table 9. Ford Chariot Commuter Bus Operation Profile

Background:	
The Chariot Commuter Bus is a smart commute service app founded by Ali Vahabzadeh at San Francisco in 2014 (Brownstein, 2014), later on acquired by Ford in 2016 (Etherington, 2016). It is a first and last mile transport solution that supplement public transit trains and bus routes (Topham, 2018b). It connects users in the underserved urban area to their nearest public transport option (Smith, 2018a).	
Initial identification of service main sustainability benefits:	
Societal benefits	Operation prioritised underserved urban area to promote equality of commute options (Smith, 2018a).
Economic benefits	Affordable fix rate £2.4 per journey that has a guaranteed seat on the minibus (Topham, 2018b).
Environmental benefits	Share transportation to ease congestion and pollution. (Chariot, 2018b)

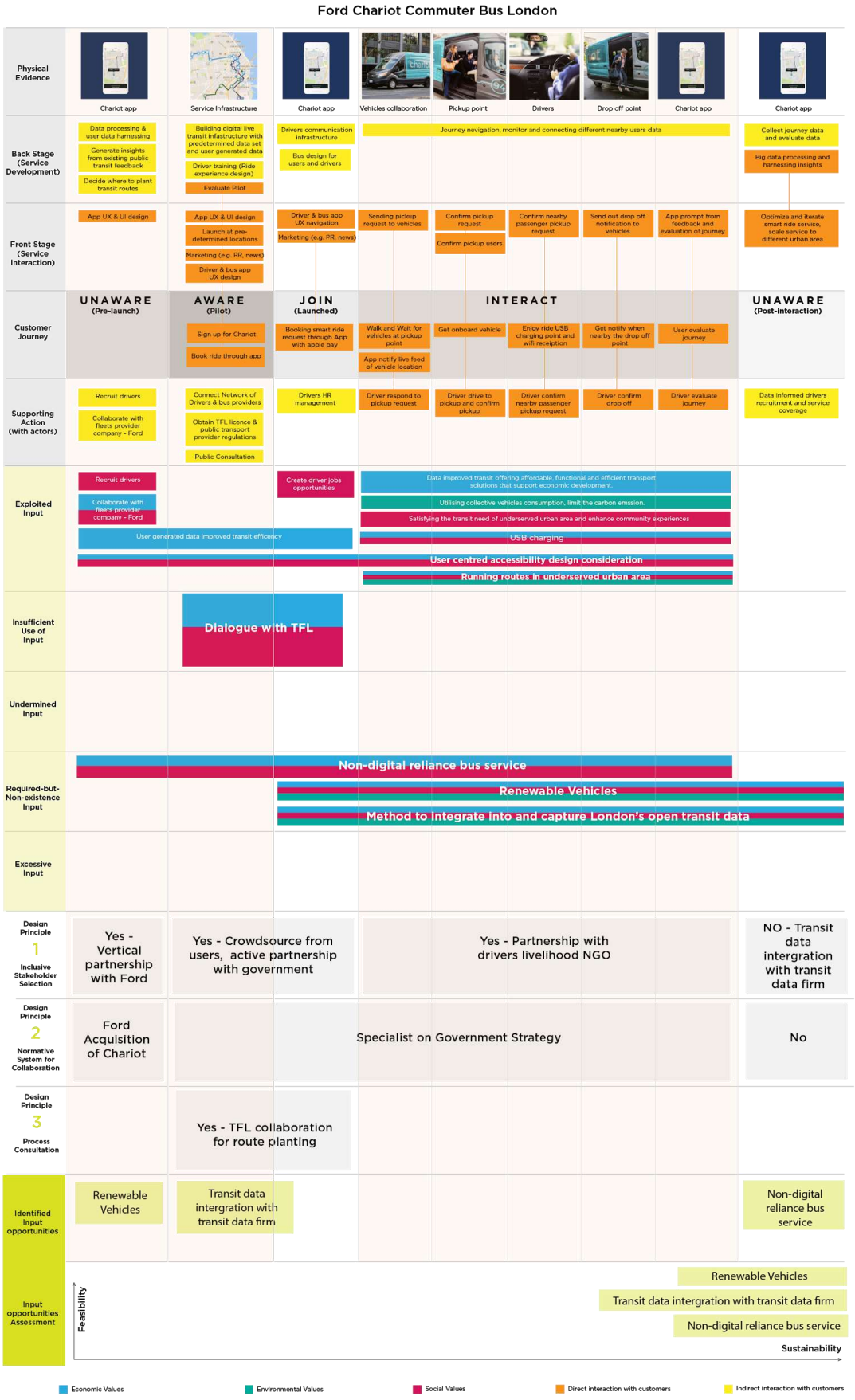

Figure 7. Ford Chariot Sustainability Evaluation Service Blueprint

Identified Collaborations Principles for Sustainability

The Service Sustainable Evaluation Blueprint (see figure 7) documented that Chariot, similar to Citymapper, also crowdsource for their route creation, desired-pickup and destination via the aggregated user interaction in Chariot's app (Etherington, 2018). However, without the advantages of having a public transit information app, like Google Maps or Citymapper, the process of aggregating user generated data was relatively difficult for Chariot.

Chariot was a proven successful in Bay area, San Francisco, which has led to the acquisition of Ford Smart Mobility. With Ford's help, the start-up expanded in different international cities (Etherington, 2018). Vahabzadeh, founder of Chariot stated in an interview that *"It became very clear very early on that Chariot would be able to leverage Ford's expertise in logistics and vehicle and operations to take Chariot and make this a global service, beyond just the Bay area"* (Etherington, 2018). This noticeable strategic corporate start-up collaboration taken early advantages of Ford's expertise. It also utilised its' business-governments relationships in multi-countries for operation expansion (Campbell, 2017), fast tracked Chariot's global development. While Ford's expertise secured the collaboration between TFL and Ford Chariot, collaboration difficulties with TFL continues to show. According to the Guardian, Chariot applied for six routes in underserved London areas, but only four were granted by TFL (Wilding, 2018). These events offer more insight into the cautious nature of public-private collaboration.

Researchers of mobility *(Lindsay, quoted in Wilding 2018)* explained that there are hidden concerns over investors increasingly investing in new and innovative digital transport solutions instead of public transport solutions, triggering possibility of '*ridesharing apps leading to a cycle of cataclysmic disinvestment '*. Greg Lindsay of the NeCities Foundation (cited in Wilding, 2018) also raised concern about private transport network: '*They will try to siphon off the most profitable customers and leave public transport a rump service*'. These quotes outlined the rivalry positions of public and private transit and the potential implication of social divide through transport options (Wilding, 2018; Topham, 2018c). Drawing the attention to an overall mobility challenge: How can private operators, like Chariot help to create a balance and synergistic system, instead of competitive relationship of private and public transit?

In this case study, Chariot has collaborated with its' vehicle supplier Ford, who's priorities are to develop partnerships with local government (see table 10). It utilised user generated data and strategic Ford partnerships in creating and expanding its' operation. However, similar to Citymapper, there was little evidence to show the process consultation beyond the TFL requirements. Therefore, collaboration principles were not fully revealed in the investigation.

Table 10. Identified Collaboration Principles in Ford Chariot

Design Principles	*Example*
1. Inclusive Stakeholder Selection	Ford strategic alliance lead to US local government partnership and UK expansion. (Etherington, 2018)
2. Normative System for Collaboration	User generated underserved area route creation (Etherington, 2018)
3. Process Consultation	Process consultation done under TFL requirements (Price, 2017).

Identified Unexploited Input in Innovation

This section extracted some key results from the Ford Chariot Sustainability Service Blueprint exercise (see figure 7). The key unexploited input (table 11) discussed below were identified in the reviewed documents, reports and news articles.

Table 11. Identified Key Unexploited Input in Innovation

Unexploited Input	
Undermined Input	X
Insufficiently used Input	*TFL Long-Term Collaboration* The Chariot service development journey (see figure 7) shown that the service has allocated resources for government strategy, keep on pursuing and developing relationship with local government, directly work with TFL to design routes that benefits both (Chariot, 2018b; Kobie, 2018b). Research also shows that Ford has contributed to a series of London mobility strategy, including TFL's 'Cleaner Air for London' initiatives, supplying TFL with hybrid vehicles that runs on zero emission electric power in city centre (Holley, 2018). Apart from government strategy, Chariot also voluntarily committed to The Living Wage Foundation's initiative, creating driver job opportunities that ensure minimum living wages of £10.20 per hour (West London Business, 2018). Although these contributions made Chariot business a desirable partner organisation for TFL, it is also worth to mention that the on-demand service idea was lately borrowed and operated by public authorities (Kobie, 2018b; Smith, 2018b), leaving Chariot service in a questionable operational future.
Excessive Input	X
Required-but-Non-Existent Input	*iii. Non-Digital Reliance Service* Although the operation principles of the service rely on digital and app to deliver its' service. It is suggested that digital only service may not be a sustainable solution for cities in the long run. Since app based on-demand service providers offer first and last mile solutions that targets commuters who are young professionals, it could create a symbol of social divide – segregating 'tech professionals and elites' from 'non-tech' ordinary public transport riders (Knowles, 2018). Consequently, distorting the intended societal benefits that the service supposed to deliver. *iv. Method to Capture and integrate into London Open Transit Data Information* Figure 7 also indicated an absence of public transit data integration. While rival Citymapper utilised its' own transit information app to integrate their service, Chariot has no means to integrate its' service with existing transit information provider, e.g. Google, TFL. Consequently, as information was not well received by London citizens, the service is less well known than its' rival. Besides, lacking capability to capture London's transit information has also put Chariot in a position that is dependent on TFL for routes creation and expansion.

Input Opportunity Assessments

The Citymapper Smart Ride and Ford Chariot case studies combined, offer learning points for sharing mobility services that aim to tackle sustainability challenges. While Citymapper Smart Ride uses agile experimentation approach to develop their service and highlighted the transport policy challenges in driving sustainable development with sharing mobility services, Ford Chariot revealed the macro challenge in private-public collaboration for developing holistic mobility ecosystem for sustainability. As the purpose was not to evaluate the effectiveness of both cases, the insights generated from the two case studies above are to provide means for discussing how innovation opportunities for sustainability can be explored under different service development and operation process. By doing so, the insights help to evaluate the implication of using service blueprint to sense-make sustainability related issues incurred in mobility service operation.

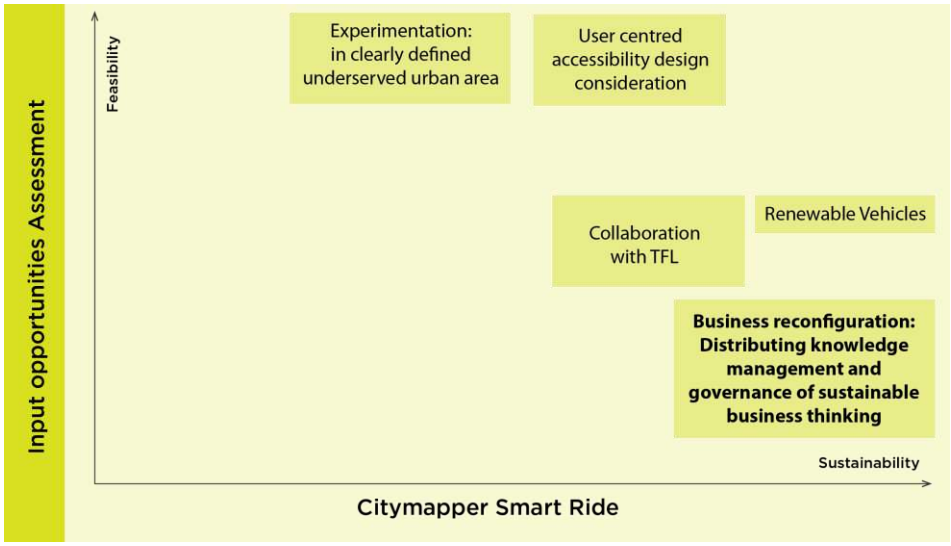

Figure 8. Citymapper Smart Ride Input Opportunities Assessment

According to the identified insights in the Citymapper smart ride case study (see table 7 & 8.), Citymapper has complex unexploited inputs related both on collaboration and TBL value. It showed that Smart Ride has made a lot of effort to meet the TFL licence criteria, including compromising their user-centred design, which led the business into an unsustainably demanding short-cycle development process. According to Inigo et al. (2017), radical innovation, like Smart Ride, would require reconfiguration (see figure 8) involving not only product service design, but business model reconfiguration, such as distribution of knowledge management (e.g. knowledge exchange and collaboration with TFL) and governance of sustainable business thinking (e.g. Smart Ride service operation managerial capability). These are all input opportunities worth considering for sharing mobility services models that aim to tackle sustainability challenges.

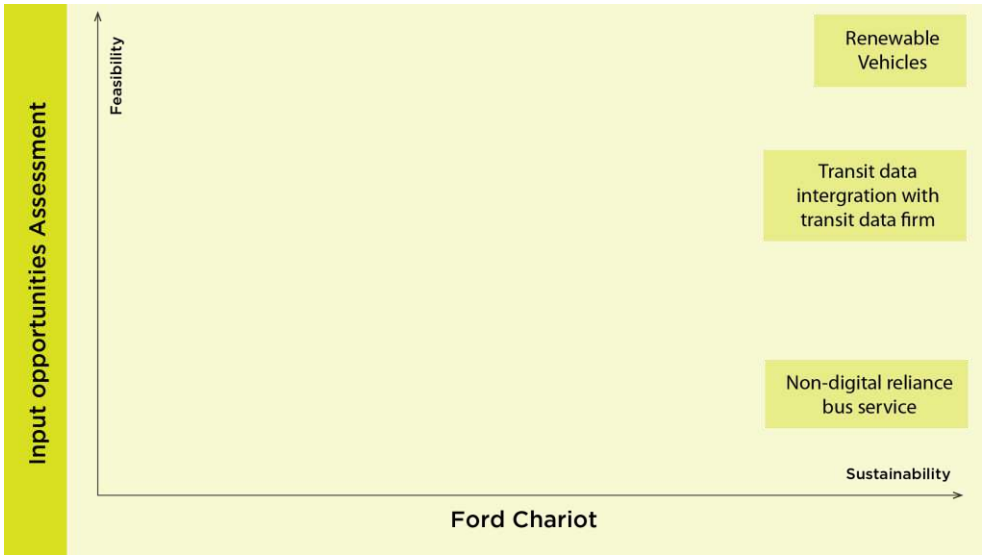

Figure 9. Citymapper Smart Ride Input Opportunities Assessment

According to the identified insights in the Ford Chariot case study (see table 10 & 11), Ford Chariot's unexploited inputs were all technical inputs that can be improved with Ford's capability to embrace new partnership. Therefore, the input opportunities assessment (see figure 9) determine that Ford's partnership capability increase the viability of transit data integration with transit data firm. While increased research and development capacity of Ford's renewable vehicles (Holley, 2018), could imply it is highly possible for Ford Chariot to operate their service on renewable fleets. Last but not least, non-digital reliance service may not be a feasible option for an app-based service company like Ford Chariot.

Discussion

This section analyses and discusses the findings according to the development of the blueprint and the two case studies, stating the contribution of the work to inform future research on sustainability evaluation, as well as the topic of sharing mobility service as sustainable innovation.

Sharing Mobility Service as Sustainable Innovation

Agile New Service Development (NSD) and Sustainable Innovation Incompatibility

The Smart Ride case study showcased a potential incompatibility in using Agile development process to iterate sustainable service, where regulatory feedback was answered with service technological solution, instead of strategically planning for business-government shared objectives (Conboy et al.,2011). While the agile development enabled the rapid progress of information technology (e.g. Citymapper's responsive transit data network), initiated the emergence of knowledge-based sustainable service concept - Citymapper Smart Ride. However, transforming mobility for sustainability builds on not only the result of the agile NSD and iteration with user feedback, but the sustainable value creation amongst the collaborative innovation networks (Elke den Ouden, 2012). This means the interdependent stakeholders ranging from TFL, Citymapper, drivers, users to local community members, needs to integrate their knowledge and expertise to create TBL values. This takes more than agile NSD and iteration on product and service feedback, but a shared working process, principles and tools to allow all the relevant stakeholders to work together constructively to test and build sustainable innovation that provide value at different levels - for the users, for the organisations and for society at large.

Private-Public Dilemma in Collaboration for Sustainability

Approaching sustainable innovation with service design and planning approach means considering how collaboration was conducted at each level and each stage of the service operation. From the first stage of validating service blueprint evaluation criteria to the examination of case studies, private and public actors hold diverse perspectives and viewpoints on collaboration process consultation in general. In the Mobility Innovation case study, the investigation reveals that while Chariot business is a desirable partner organisation for TFL, the on-demand service idea was lately borrowed and operated by public authorities (Kobie, 2018b; Smith, 2018b), leaving Chariot service in a questionable operational future. This event proven that while public process consultation allows public society and communities to feedback and improve the service innovation, it is unsustainable for business to do so without any protective measure on their rights to the service innovation. This further explained private actors' practice of setting process and ways of working as a self-protective measure, while public actors are in favour of process consultation as a core principle and suggested that it is part of the best practice.

Curșeu and Schruijer (2017) argued that these types of collaboration conflicts happened due to the distrust, unsafe and collusive dynamics of the collaboration. This further emphasis on building collaboration relationship on a normative system, where shared process and ways of working are established. These shared guidelines should aim to enable the emergence of trust and prevent collusive dynamics, building a constructive and safe multiparty collaborative system.

Sustainability Evaluation in Service-Based Sustainable Business Model Innovation

The Concept of Sustainability 'Value' in Evaluating Service Operations

Value is a term that was used throughout the literature and in the first iteration of the blueprint, yet feedback from actors indicated that the concept of value is difficult to use in practical operation evaluation. According to Yang et al. (2017), the concept of value was developed from Richardson (2008) and Amit & Zott (2012), which has established the academic theory building. Since this research aim to develop practical sustainability evaluation tools through service blueprint, requiring participatory research with non-academic actors who involved in the service operation. Therefore, using the term 'value' in a service blueprint would not be apprehensible for actors involved in the evaluation process.

Nonetheless, the concept of value defines things or activities exploited in the production process that have created and improved business economic benefits (e.g. profit margin), extended from Porter's concept of value chain (1985). However, this research focus on 'unexploited activities', which have not created, but have

potential to bring society and environment benefit - which is different from economic benefits as well. Through validation with industry experts, interviewees expressed that engaging stakeholders in sustainable value creations needs simple facilitative tools and language. Therefore, it was suggested to simplify sustainability 'values' to sustainability 'benefits', clarifies the purpose to create 'societal and environmental benefits', instead of simply 'economic benefits'. It was also suggested to simplify 'uncaptured values' to 'unexploited inputs', clarifies the consideration of 'unexploited activities', instead of 'exploited economic benefits - value'.

Role of Sustainability Evaluation Service Blueprint in Sustainable Innovation

Designing service blueprint with evaluation criteria of sustainable benefits and sustainable collaboration, allow us to identify insights for optimising the overall service offering for sustainability. It also informs the new service development (NSD) activities (Yu and Sangiorgi, 2017), especially relating to the organisational and managerial activities for sustainability. Together with service blueprint's capabilities to visualising user-interaction, relationship analysis and service experiences through multi-actors perspectives. The Service Sustainability Evaluation Tool stimulate comprehensive service operation evaluation against sustainability, to review the optic of sharing mobility as service-based sustainable innovation.

The two case studies above showcased how sustainability evaluation service blueprint can be used to contextualise the holistic service offer and operations development. For instance, the sustainability benefits criteria revealed that both services were driven by clear economic benefits, with either blurry and destroyed social and environmental benefits as the NSD activities progress into service operational and managerial activities. On the other hand, the sustainable collaboration criteria illustrated complex operational activities with multiple actors involved (Chou, Chen and Conley, 2012; Baldassarre et al., 2017; Prendeville and Bocken, 2017; Tukker, 2015), such as collaboration with TFL and community members, managing drivers, etc. Through mapping out stakeholders and their activities, service blueprint immediately exposed the unexploited input (e.g. electric fleet choice) and stakeholder impacts (e.g. social divide created through digital and non-digital commuters) in the rideshare service operation, opened up a clearer vision of the holistic service operation needs. The visibility enabled by this tool showcases its' value for practitioners to explore and employ service design thinking and practice for the advancement of sustainable innovation (Prendeville and Bockon, 2017).

Conclusion

This study contributes to the service design and innovation (including PSS research stream) and sustainability literatures. The synergies between sustainable values, collaborative principles for sustainability and service design tool construct a service operation sustainability evaluation blueprint. It draws on two explorative case studies and therefore there are some limitation to the conclusions drawn. By illustrating how service operation planning tool - service blueprint can facilitate the sustainability evaluation processes for sharing services, this research explored the potential of using service blueprint to improve the service sustainability by identifying sustainable collaboration principles and eliminating unexploited inputs in existing service. It repositions service design tool – service blueprint as a constructive facilitation tool for analysing sustainable service innovation. Most importantly, it enables service designers to map out all the interactions related with delivering a sustainable service and to determine feasibility of implementing those opportunities, leading to future possibilities for designing organisational interactions and policies for sustainable service innovations.

As the concepts of sustainable business model transform into concrete products and services, service designers and service developers need to learn how to evaluate and iterate for TBL benefits optimisation in the NSD activities, in order to build sustainable service operation journey. Further work is recommended to explore how to use the sustainability evaluation service blueprint to facilitate and improve TBL value creation in service operations of an organisation, which engage in a service-based innovation for sustainability. Learnings from an in-depth case study will further the use of service design practices, methods and tools, as strategy to build tangible Sustainable NSD process upon sustainability business model innovation theory.

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Track 4.j Introduction: Experience Design – Method and Evaluation

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In recent years, there has been a growing awareness of the human, social and economic benefits that experience design can bring to nations and organisations. Experience design is the process of enhancing users' trust, satisfaction and recognition of a product, service and system by improving the users' perception of the innovativeness, aesthetics and relevance of the experience provided in the interaction between the users and the product, service and system's design elements in a particular context. It takes the users' cognitive and emotional experience as its starting point and focuses on developing products, services and systems that could enable that experience. Experience design elements include information, navigation, engagement, entertainment and personalisation (adapted from Cheung 2016; Cheung 2020). Google Search, Google Maps and YouTube are illustrative of how intrinsic to our daily lives innovative experience designs have become. Tencent has its WeChat platform able to support location-based social plug-ins, allowing users to befriend and chat with nearby strangers through a simple shake of their smartphones. These types of experience systems did not exist in the pre-digital era and are now the focus of creative design. Alibaba's Tmall and Taobao implement technology-enabled forms of electronic payment security, product quality assurance and online dispute resolution to combat user distrust of online purchases. The success of these companies stems from the experience design strategies that they use, in which users are reached and connected through multiple touchpoints and interactions relevant to their sociocultural contexts. Experience design changes the nature and environments of physical artefacts by integrating digital systems and resources with the physical world. It can redefine the functionality, meaning and value of products, services and systems, strategically transforming them into highly integrated ecosystems capable of enhancing the sustainability and humaneness of our social and economic environments while offering industries a competitive edge. The sustainability of the experience ecosystems also relies on involving the users in exchanging value in ways that are mutually beneficial socially, economically and technologically over time. For example, Amazon, eBay and Taobao provide user-friendly interfaces that have enabled their users to create a new wave of small businesses and services on their platforms.

Yet as a relatively new area in the design field, experience design is in need for further research into developing a more sophisticated methodological framework for guiding its processes, and at the same time, creating evaluation criteria for measuring its outcomes in a more systematic and comprehensive manner. This track on "Experience Design – Method and Evaluation" aims to provide a platform for design researchers and practitioners interested in experience design to discuss its method and evaluation. The four papers accepted for this track propose a range of perspectives on the topic.

The first paper by Chen and Cheung, *Consumption experience on Tmall: a social semiotic multimodal analysis of interactive banner ads*, contributes to the methodology literature of experience design. It examines consumer-oriented advertising in e-commerce in China through analysing banner ads on Tmall with a synthesis of social semiotics, multimodal analysis, and interactivity. Departing from Tmall's annual Double 11 Carnival,

the analysis shows that the banner ads have been incorporated into a gamification design to encourage consumers to spend more and buy things they may not need even after the event has been completed. The authors' approach of analysing the ads on both the syntagmatic and paradigmatic dimensions is explicitly multimodal, taking the tri-fold convergence of linguistic, visual and interactive resources into consideration to study new phenomena in an e-selling environment. The approach could be helpful to scholars and practitioners in the field of experience design, where multimodality and textual analysis of visual information is of great importance.

The second paper by Alaali and Pitsaki, *Experience design at Starbucks: from global brand management to local spatial experiences*, explores how Starbucks achieves global consistency and meaningfully localised experiences within the context of global brands management and the need for integrating local identities. Through a review of literature and a series of interviews with store designers, design managers and brand concept experts at Starbucks, the authors compile the most commonly applied branding and design methods, with an emphasis on the locally relevant spatial experiences that the global brand would like to deliver. They also classify their findings in a way that could assist other brand and experience design teams in overcoming shared challenges. The findings focus on the management of the grounding brand concept, as well as operations and real estate teams. Through presenting some tools, manuals, guidelines and sample checklists, the authors suggest that store design teams in different locations can build strong, locally relevant spatial experiences that tie in successfully with the brand's global principles.

The third paper by Tellez and Gonzalez-Tobon, *Empathic design as a framework for creating meaningful experiences*, introduces empathic design as a framework and a strategy that can be adopted by the emerging field of experience design to create meaningful experiences connected with people's lives and needs. The paper presents the rationale behind the emergence of empathic design, the traits that characterize this approach to design, a collection of empathic design methods and practices, and a critical discussion of the limitations of empathy in design. The paper is developed based on a systematic literature review on empathic design, human-centred design, and empathy. The paper contributes to the broader discussion of how traditional design practices are adapting and evolving to respond to new realities, and how new design paradigms are needed to address the very complex challenges that we are facing in the 21st century.

The fourth paper by Capra, Berger, Szabluk and Oliveira, *Experience design applied to research: an exploratory method of user-centered research*, is presented based on the rationale that an accurate understanding of users' needs is essential for the development of innovative products. The paper presents an exploratory method of user-centered research in the context of the design process of technological products, conceived from the demands of a large information technology company. The method is oriented - but not restricted - to the initial stages of the product development process, and uses low-resolution prototypes and simulations of interactions, allowing users to imagine themselves in a future context through fictitious environments and scenarios in the ambit of ideation. The method is effective in identifying the requirements of the experience related to the product's usage and allows rapid iteration on existing assumptions and greater exploration of design concepts that emerge throughout the investigation.

In conclusion, the track facilitators are glad to see that the four papers are enriching the knowledge and skills regarding experience design and informing potential directions for further research.

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Consumption experience on Tmall: a social semiotic multimodal analysis of interactive banner ads

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This article contributes to the methodology literature of experience design by analysing banner ads on Tmall with a synthesis of social semiotics, multimodal analysis, and interactivity which guides our analysis of consumer-oriented advertising in e-commerce. Departing from Tmall's annual Double 11 Carnival, our analysis shows that the banner ads have been incorporated into a gamification design to encourage consumers to spend more and buy things they may not need even after the event has been completed. Our approach of analysing the ads on both the syntagmatic and paradigmatic dimensions is explicitly multimodal, taking the linguistic, visual and interactive resources (the tri-fold convergence) into consideration to study new phenomena in an e-selling environment. The approach of this study could be helpful to scholars and practitioners in the field of experience design, where multimodality and textual analysis of visual information is of great importance.

Keywords: Social semiotics, multimodal analysis, interactive banner ads, experience design, e-commerce

Introduction

In recent years, experience design has been advocated and practised in a variety of projects as it can bring significant human, social and economic benefits to nations and organisations worldwide. According to Cheung (2016), experience design is the process of enhancing users' trust, satisfaction and recognition of a product, service or system by improving users' perception of the innovativeness, aesthetics and relevance of the experience provided in the interaction between the users and the product, service or system's design elements in a particular context. It takes the users' cognitive and emotional needs as its starting point and focuses on developing products, services or systems that could enable an experience to address the needs. Experience design elements include information, navigation, engagement, entertainment, and personalisation (Cheung, 2016). This study focuses on the element of information in one of the most influential e-commerce platforms in China, namely Tmall owned by Alibaba. It investigates Tmall's information design strategy with a primary focus on its banner ads for advertising and promoting consumption experience.

Advertising plays a crucial role in pervasive marketing for organisations and businesses to build brand image, engage with their targeted audience, and promote their goals and activities (Sifaki & Papadopoulou, 2015). For e-commerce, advertising is particularly aimed at turning attention into transactions. Of the various types of ads, banner ads are an important genre. They are placed at a prominent position on a website or mobile app to attract consumers' attention during their visits, in accordance with web design and search engine optimisation practices. Unlike advertising through third-party intermediaries such as traditional mass media or

social media, banner ads on e-commerce websites function as a direct touchpoint to facilitate consumer navigation. They are an effective tool for targeting consumers to boost sales and spending. This is in line with the concept of "e-selling", which is different from e-commerce or e-retailing, in that it has a more nuanced focus. E-selling is a term intended to conceptualise human-computer dialogue "characterised by the digital spatio-temporal locus, the psychology of online persuasion, and complex perceptions of value" (Parvinen, Oinas-Kukkonen & Kaptein, 2015, p. 214). It is closely linked to concepts such as human interactivity, intentionality, persuasion, and value creation.

This article aims to contribute to the methodology literature of experience design by examining banner ads on Tmall with a social semiotic and multimodal analysis approach. We examine a selection of banner ads designed to attract consumers' attention and develop user trust for "e-selling" a brand, product and/or service. We also look at gamification design and how it drives consumer experience in the annual Double 11 Carnival on the e-commerce platform. Gamification design has been experimented by retailors, a practice of creating a game around the shopping experience, for example, to collect coupons and stamps (see more in Frith, 2013).

Tmall, literally Sky Cat, is China's largest third-party platform for brands and retailers. It was originally named Taobao Mall or *Taobao Shangcheng* (Alibaba, 2017a). It is a business-to-consumer (B2C) web domain launched in 2008, parallel to Alibaba's consumer-to-consumer (C2C) platform Taobao. Tmall has achieved a 136% year-on-year increase in cross-border retail revenues and remains the number one e-commerce platform in terms of market share (Alibaba, 2017b). CIW (2018) reports that the listing of more than 16,400 international brands from 68 countries on Tmall has attracted more than 529 million mobile Monthly Active Users (MAUs). Tmall now occupies almost 60% of the Chinese B2C market sales in fashion and apparel and maintains steady growth in consumer electronics and fast-moving consumer goods (FMCG). A particularly significant figure is connected to the 11th of November (*Shuang* 11, or Double 11), known as Singles' Day (Meng & Huang, 2017). The annual Double 11 Carnival is a spectacle celebrated by the platform, endorsed by the government, and participated by consumers. Every year Alibaba organises a grand live show and conducts a 24-hour countdown to see how much money it makes during the Carnival. In 2018 Tmall generated over USD 30.8 billion in just 24 hours (see Figure 1, Alizilia, 2018). Together with Alibaba's offline infrastructure (*Yintai* Mall and unmanned supermarkets), cloud computing (Ali Cloud), payment gateway (Alipay), and logistics (*Cainiao Yizhan* Delivery), Tmall has made a huge global impact in e-commerce consumption with its well-rounded industry ecosystem.

Figure 1: Live grand celebration of Double 11 Carnival. Source: Alizilia

Literature review

Our research focuses on Tmall banner ads, which are multimodal. Such ads make and convey meanings through a combination of textual, audio-visual and interactive modalities (augmented reality, virtual reality, clicks and hyperlinks, thus hypertextuality), all in one entity. We first follow the work of social semiotics and multimodality. It holds that semiotic resources such as signs and codes are socially constructed (Kress & Van Leeuwen, 2006; O'Halloran et al., 2011). The experience design element of information, in this case, is signified by various signs and codes. These conventions in the form of language and visual images are not static. They are subject to change and transformation and should be interpreted in specific social and cultural contexts.

The underlining theoretical rationale is that meaning-making and discursive processes with the help of semiotic resources are shaped by the motivations and interests of the sign-maker (He, 2016). However, we know little about the discursive constructions that aim to persuade consumers and change their minds (Van Dijk, 1993). This is particularly the case for the process of discursive construction in post-reform China after 1978, where consumerism is on the rise yet seldom investigated with a perspective of multimodal analysis. In the case of Tmall, the motivation and interests of the sign-maker can be investigated through a social semiotic and multimodal analysis of banner ads. In addition, because these banner ads are situated within an e-commerce website, we also examine the hypertextuality and affordances as part of interactive modalities for facilitating the discursive process through digital and multimedia texts. Here, we focus on the two-dimensional aspects of banner ads as interactive signs and sites, a departure from traditional multimodal analysis. In banner ads, hypertextuality is achieved through the affordances of digital text (search, scan, click, and tap). This interactivity allows and enables consumers to travel between texts and pages through hyperlinks and interactive functions. Informed by Adami's semiotic analysis of website interactivity, we aim to examine the interactivity in banner ads as both signs and sites (the two-fold nature in Adami's term, 2014). We investigate affordances available to activate interactivity, in addition to the communication of meanings achieved through traditional textual forms such as still and dynamic images, graphics, and words. To achieve this, we adopt and extend Halliday's (1978) three metafunctions (the ideational, interpersonal, and textual) to analyse both the (previously static) discursive process and the now interactive banner ads in e-commerce websites.

In advertising and marketing research, discourse analysis guided by metafunctions has been widely used to study information and persuasion conveyed via a diversified range of texts (Wagner, 2015). The first strand of work is centred on language and text. In recent years, a visual turn has occurred, as identified by several scholars in advertising (see a review in Holsanova, 2012). Following this turn, there has been a growing body of interdisciplinary literature that employs social semiotics and multimodal discourse analysis to analyse advertising and media formats (Thomas, 2014; Holsanova, 2012). These include food and product packages (Wagner, 2015), magazines (Lick, 2015; Chen & Machin, 2014), posters (Sifaki & Papadopoulou, 2015; White, 2010), picture books and animated movies (Unsworth, 2015), photography on social media (Zappavigna, 2016), automobile commercials (Chen, 2016), website and TV ads/reviews (He, 2016; Adami, 2014; Jessen & Graakjær, 2013), café design and architecture (Aiello & Dickinson, 2014), as well as political speech and presentation (Wong, 2016), to name just a few. Against this backdrop, we champion a tri-fold convergence of the multimodality of texts, visuals and affordances (interactivity) and use it as a framework to guide our analysis.

The social semiotic framework of interactive banner ads

The tri-fold nature of the text, visuals and interactivity of banner ads contributes to the meaning-making process in Tmall. This is in line with social semiotics which regards codes of language and communication are shaped by social and cultural processes. In this study, we are particularly interested in visual information, that is, how the producer, mediator/interpreter and audience/consumer are connected through banner ads. There are a few theoretical approaches to this, including the semiotic and cognitive approach – a seamless circle in line with experience design strategy and practice. The semiotic approach focuses on visual segmentation as a result of "intentional, socially typical choices that are made to achieve the optimally desired communicative effect on a hypothetical model reader/viewer", whereas the cognitive approach treats the dynamic and engagement process between the audience and the visuals as a point of departure from a reception perspective (Boeriis & Holsanova, 2012, p. 263). The distinction between the production and reception study shows that the semiotic approach focuses more on the factors that can shape perception and segmentation process as a shared knowledge, whereas the cognitive approach investigates the general and individual patterns that unfold in the actual reading of such constructed discourses. How consumers actually engage with various banner ads (subjectivity and agency) is out of the scope of our study. At the outset, the tri-fold approach we take in this study is semiotic in nature. In fact, such an approach is widely used in investigating the socially and culturally entangled semiotic system (see Kress & Van Leeuwen, 2001). This strand of work focuses more on the construction and communication processes (and their effect) than on individual preferences. However, both approaches value the principles of perception structure and organisation of textual and visual resources, in a predicted and interpretative manner. Therefore, in analysing banner ads, our study will particularly look at the structure and organisation of the multimodal resources of interactive banner ads. In doing so, it allows us to investigate these resources from three levels, namely the macro (ideological), the meso (organisational), and the micro (semiotic) level of shared social and cultural contexts in China. This is

in line with Foucault's theory that places interaction and communication under specific power-knowledge regimes (Pereira, 2015).

Contextualise the three metafunctions with interactive affordances

In this section, we look at existing literature about how multimodal discourse analysis is incorporated with such an approach to study both the textual and visual aspects of advertising and digital marketing. Multimodal analysis can be traced back to Halliday's (1978, 1994) Systemic Functional Linguistics (SFL). It is used to study the "functional and situational organisation of language in the social context" (He, 2016, p. 171). As a "functionalist", Halliday regards "language as a device designed for accomplishing communicative ends, and insofar as function the basis for his description of language" (Urban, 1981, p. 660). Halliday (1978) views linguistic signalling as an intersubjective phenomenon. He therefore contends that language study should begin with discourse analysis (linguistic signalling in action). As language users also encode individual and multiple layers of meaning within a given discourse, the distinct functional modes must be analysed. He suggests that the discourse is constructed by the intertwined meaning and function. He then develops three abstract metafunctions (the ideational, interpersonal, and textual), a framework that can be mapped onto a given discourse, textual, visual or both. First, the *ideational function* is to say something about the world, referring to particular "objects, people or even ideas" for a given socio-cultural group (Sifaki & Papadopoulou, 2015, p. 473). Second, the *interpersonal function* is to say something about the actors who participate in the communicative process. Finally, the *textual function* focuses on the text as a whole. Another important component of this framework is "contextualism", that is, to view language use in relation to both linguistic and non-linguistic contexts (Urban, 1981).

Drawing on Halliday's SFL, Kress and Van Leeuwen (2006) adapt the metafunctional theory to study multimodal information in the face of the visual turn (He, 2016, p. 171). They have developed a theoretical framework called Visual Grammar (VG), mirroring and naming Halliday's three functions as representational, interactive, and compositional meanings. They suggest that visual information is a semiotic mode of its own kind. Therefore, the three metafunctions can also be applied in visual analysis. In doing so, VG provides new terms as "grammatical realizations of metafunctional meaning in visual social semiotics" (Boeriis & Holsanova, 2012, p. 265). This is particularly useful in our case of analysing interactive banner ads. Representational meanings follow the ideational function, unfolding "actions and events, processes of change, transitory spatial arrangements" (Kress & Van Leeuwen, 2006, p. 56). Interactive meanings are coordinated via a number of interpersonal systems: gaze, social distance, perspectival angle, and modality. Compositional meanings at the textual level are achieved by leveraging resources such as information value, framing, and salience. Lemke (2002) further develops three equivalent terms, presentational, orientational, and organizational, to analyse hypermodality, whereas Zammit (2007, as cited in Adami, 2014) follows the terms in VG, adding an additional logical function. Here, to study the interactivity together with the multimodal VG of e-commerce banner ads, we stick to the terms of Halliday refined by Adami to avoid the possible confusion of an "interactive" function with different connotations and theoretical underpinnings (see more in Adami, 2014). As shown in Table 1, we present the refined framework for the examination of interactive banner ads on Tmall to facilitate both analysis and evaluation and to avoid turning our study into a mere description of the banner ads.

Table 1 Axis of metafunctions and the two dimensions of interactive sites/signs, adapted from Adami (2014, p. 142)

Dimensions	*Ideational function*	*Interpersonal function*	*Textual function*	*Interactive value*
Syntagmatic (within the page)	What it is: form/meaning (representation of the world)	What it says about: authors and users	How/where in the page: salience; information structure	Aesthetics of interactivity
Paradigmatic (optional realisation)	Which action; which effect; where	Directionality/power: who towards whom; authors/users/others	Before-After; Given-New	Functionalities of interactivity

In Table 1, we synthesise the framework adapted by Adami with SFL and VG to analyse the source text in two dimensions, namely, the syntagmatic dimension and paradigmatic dimension. The synthesis is useful for explaining the two dimensions (space and time) of interactive banner ads on top of SFL and VG: (1) the spatial

dimension of the ads, for example, where it sits on the page, and how a sign is made up of multimodal texts; (2) the intertextual dimension, which works as a gateway for realisation of potential meaning-making through specific functions such as clicking, hovering, searching, and sharing (Adami, 2014, p. 140). These two dimensions will guide our analysis given the two-fold nature of interactive banner ads as both signs (forms of meanings) and sites (for actions to produce certain effects).

Table 1 illustrates how the three metafunctions are mapped with the two dimensions (the totality of the sign and the site), creating an axis of meaning-creation. Syntagmatically, this contributes to the ideational function capable of presenting the world with various arrangements. Paradigmatically, it contributes to the effects endowed by the sites, activating potential meanings through various inflections and actions with these sites. In terms of the interpersonal function, syntagmatically, it communicates to the users with diversified expectations. Paradigmatically, it sets the directionality within a connection, a power-knowledge regime built between the authors and users (who acts upon whom). As for the textual function, syntagmatically, it concerns the structure of the information and its value created by the ideational and interpersonal function of the text as a whole. Paradigmatically, it relates to the time-space pair of interactive banner ads as both signs and sites, mapping the two dimensions in a before-after relationship within a certain change, that is, the text that is given as it is and the text it becomes if activated. These two dimensions (the syntagmatic and paradigmatic) mark two distinct yet relevant processes on a continuum: one is the arranging process of the texts, images, and affordances (for interactivity) of the banner ads (once activated); the other is the completed arrangement and layout, an equilibrium presented as the banner ads in a static state.

As we will demonstrate in our analysis section, the syntagmatic dimension (the ideational, interpersonal, and textual) guides our interpretation of interactive banner ads as signs in a relatively static way compared to "sites" to be activated. In turn, the paradigmatic dimension guides our analysis of the interactivity to be activated in a more dynamic manner. That is, the interactive affordances are designed to achieve interactivity with certain effects through consumers' actions to make the meaning-making process complete.

Methodology

Following the theoretical framework developed above, we use a combination of the visual, textual and interactive analysis of the banner ads on Tmall as our primary methodology. We select banner ads from its 2018 Double 11 Carnival, as well as other banner ads as an extension of the carnival metaphor. Because we do not aim to conduct a reception study, nor validate the effects of designated design campaigns, the eye-tracking method (Boeriis & Holsanova, 2012) or retrospective interviews (Gidlöf, Holmberg & Sandberg, 2012) are not used. The detailed working process of semiotic and multimodal analysis involves an "analytical zoom" in and out of the banners examined (Boeriis & Holsanova, 2012, p. 264). We then regard the zoom levels as a point of departure to closely investigate elements of the banner ads with the guidance of VG. These include images, texts, fonts, colours, and the banner as a whole. The relationships between the various elements will be explained in detail during analysis. We then put the banners in the wider social and cultural context with the message that it is designed to convey, zooming out from the separate and segmented clusters of elements to the comprehensive and interactive view of the banner ads as a whole again. As we merely aim to explore the production aspect of banner ads, these methods are deemed sufficient because they have proven to be fruitful in a number of social semiotic studies (Chik & Vásque, 2016; Grumbein & Goodman, 2015; Feng & Wignell, 2011; Tan, 2009).

Data analysis

As indicated in Table 1, the syntagmatic dimension utilises several modes of textual and visual semiotics to fulfil the ideational, interpersonal and textual functions, whereas the interactive value is achieved through the paradigmatic dimension with affordances of intertextuality and interactivity. These two dimensions will in turn be analysed in conjunction with multiple banner ads. At the outset, these two dimensions often work together in digital and multimedia environments. It is hard to separate them, even within one banner ad. Therefore, it makes sense to analyse these two dimensions together as a whole and as a complete process. However, to test our proposed framework, we have to separate and analyse them respectively at a later stage to achieve better clarity.

Figure 2: Banner ad on 2018 Double 11 Carnival's landing page. Source: Alibaba

We first take a holistic view in analysing both dimensions with the banner ad in Figure 2. For the ideational function, this ad shows the Double 11 Carnival is on. It also provides a video depicting the myth of the traits of 12 constellations and the responses of consumers when they receive their parcels delivered from the Carnival. It is extremely simple in terms of design as the concept and navigation of Double 11 Carnival are well known in China. As stated, the celebration of carnival and gamification has extended to everyday consumption on Tmall as an organisational marketing strategy. We will look at two banner ads of the 2017 Double 11 Carnival (Figure 3) and then other banner ads in everyday scenarios (Figures 4-6).

Figure 3: Banner ads of 2017 Double 11 Carnival. Source: Alibaba

In Figure 3, the key message is that Tmall is a creator of comfortable life. The cat-shaped icon is marked with 11.11 as the nose and eyes of the Sky Cat icon. The cat stretches its two arms, embracing a banner with multiple "red envelopes" indicating good fortune, money, and coupons on offer during the Carnival. In 2017 Tmall used the gamification design of spreadable red envelopes worth RMB 250 million to stimulate sharing through digital word-of-mouth. According to Chen (2017), Tmall also ran a series of pre-carnival campaigns to

attract consumers' attention and engagement (see Table 2). Such campaigns realise the important role played by gamification design in promoting Tmall's annual Double 11 Carnival. Such design has been widely deployed into after-carnival operation which we termed as "extended carnival" in everyday online consumption in China.

Table 2 Tmall pre-carnival campaigns 2017. Source: Chen (2017)

Campaigns	*Timeline*	*Events*	*Type*
Red envelopes torch relay	19.10-10.11	Ask friends to click and sign up through various social media to share the red envelopes	Red envelopes
Prepaid order	20.10-10.11	Prepayments, secure chosen goods, predelivery (with anticipated traffic jam based on past experience)	Prepayments
Coupons and discounts	20.10-11.11	Store/brand-specific coupons and discounts	Discounts
Huabei lucky draw	21.10-10.11	Deals of more than RMB 200 will gain a lucky draw of a free deal up to RMB 4999	Free lucky draw
Group red envelopes	25.10-11.11	Create social media groups, accumulate impact to get further discounts	Red envelopes
Cat hide-and-seek	26.10-11.11	Red envelopes worth RMB 50 million will be distributed on Double 11, and Golden Cats will randomly appear in 50 categories, with the smallest red envelopes worth RMB 100 each	Red envelopes

The three banner ads in Figures 4-6 present the goods on sale with instructions and invitations. The text "shop now" together with product images achieves the overarching function of informing consumers that they are ads, selling FMCG (Figure 4), mooncakes (Figure 5), and tailor-made outfits (Figure 6). The "informing" process is the interpersonal function in action, realised by designers and consumers within a communication and meaning-making process. For the textual function, these ads are placed at the top of the page to increase salience. The three metafunctions are achieved through a combination of multimodalities, with texts, images, and icons. In addition, the intertextual dimension is achieved through interactive affordances such as scrolling gadgets and links (clickable text together with text boxes) for interactivity, providing a gateway and site for the realisation of potential meaning-making and actions. Putting together, these banner ads not only work as signs, but also sites, realising the two-fold nature discussed in the literature review. In the following two sections, we will zoom-in and analyse the syntagmatic and paradigmatic dimensions, respectively.

Figure 4: Banner ad promoting FMCG and snacks. Source: Alibaba

Figure 5: Banner ad promoting mooncakes. Source: Alibaba

Figure 6: Banner ad promoting tailor-made outfits. Source: Alibaba

The syntagmatic dimension under the framework of VG

Colour. Colour is associated with effects and functions as a communicative carrier and vehicle. Van Leeuween (2011) points to two important functions of colour: identity and textual meaning. For identity, colour can be associated with a certain brand or product that the banner is advertising. For textual meaning, it has an ability to convey structure of an ad (its coherence and overall "feeling"). In Figure 4, Fulinmen (福临门, literally, blessing comes to your doorway) is a rice brand in China. By using light green, Fulinmen tries to create a brand image associated with nature to signify that it is healthy, organic and environmentally friendly. The Chinese character 福 (fu, blessing) in gold is to express prosperity and glory. The brown Snickers chocolate and the yellow AXE cleanser essence made of lemon extract are in their "natural" colours to deceive and persuade consumers, that is, to make consumers believe that "what you see is what you get". Tmall has various festival-related campaigns, such as Spring Festival, Mid-Autumn Festival, Mother's Day, and Christmas, beyond its self-created Double 11 Carnival for Singles' Day. Colours are tailored for different festivals to celebrate a certain festive mood. Despite red is deemed alarming and aggressive in certain cultures, it is widely used in China, particularly during Spring Festival and weddings. It is believed that red discourages bad luck and evil spirits, thus bringing blessings and happiness. Figure 5 uses pink, gold and red to create a festive mood for the Mid-Autumn Festival. In particular, red is used for the characters of 抢100元优惠券 (to snatch the RMB 100 coupons). It makes the "instruction" stand out from the already crowded space of an ad full of symbols and texts in large font. In comparison, the banner ad in Figure 6 uses black to represent premium products (the texts indicate premium and tailor-made female outfits) and therefore coupon and low-price strategies do not apply. Similarly, as presented in Figure 7 in the next sub-section, the banner ad advertising an automobile uses blue to signify trustworthiness.

Text. Text includes brand name (including the logo), basic information about a certain product, and most importantly, storytelling. Because text is one of the most conventional modes used in advertising and many

studies are dedicated to it, we will not conduct detailed textual analysis for banner ads. The general observation is that banner ads on Tmall seldom uses a storytelling approach as they predominately use text as instructional information. This is often price-related, for instance "to snatch red envelopes and coupons", "it is cheap now" and "if you love your mom, dress her up like this" (see Figure 8 in the next sub-section).

Typography. Typography is closely related to text. Some typography is meant to be decorative. Chinese calligraphy, for instance, is deemed a form of art in itself. Other types are mundane to indicate mandatory information. Typography is a useful device to achieve evocativeness and contains rich connotations and metaphors (Kress & Van Leeuwen, 2006). Figures 4-5 are examples each using a different typography for a distinct occasion. The ad in Figure 4 uses a computer-enabled art font that is both functional and decorative, while for a traditional Chinese festival the ad in Figure 5 uses Chinese calligraphy, which adds a cultural touch to create a positive association within the Chinese market.

Imagery, symbols, and icons. These include both informational or non-informational elements within a given banner ad. These elements are first of all ideational, to show consumers what the ads are promoting. These elements are also interpersonal. For example, for human figures (Figure 6 and Figure 8), two unknown models rather than celebrities are presented. The "mom" in Figure 8 directly connects herself to the consumers through her gaze. According to Kress and Van Leeuwen (2006, p. 117), this is a "demand" (compared with an "offer"), where represented participants look at the viewers/consumers. Through such an image, the producer of the ad (Tmall) also does something to the consumer. The gaze and the gesture of the represented mom "demand" the recipient/consumer to create an imaginary relationship. This relationship is intended to arouse certain reactions on the part of the consumer (Kress & Van Leeuwen, 2006, p. 117-118). In Figure 8, the "mom" looks directly at the consumer with an elegant smile on her face. Her gaze, smile, and gesture (presenting a bracelet) are aimed at establishing a relationship with consumers and thus garnering favourable attitudes towards her and, more importantly, the outfit and bracelet. If we zoom out to investigate the textual or compositional function of this ad, it uses golden colour to signify prosperity and festive mood of Mother's Day as a whole. Zooming in again, a cluster of the model, outfits, and the background imagery such as flowers are also worth exploring. The flower presented is a peony (mudan), the national flower of China, signifying prosperity and blessing. For Figure 6, the ad uses a low angle where the model looks down on consumers, creating a symbolic power over them. The power within such an interpersonal relationship derives from the fact that the model presents fashion outfits and premium tailor-made services to consumers.

Graphic devices such as abstract lines and shapes are also used. These devices are non-informational as symbols or icons per se. However, with certain appropriation or arrangement, they can convey certain meanings. For example, for the automobile ad in Figure 7, the variation that makes the background of the car blurred is intended to signify speed and dynamism.

The above analysis has demonstrated how multimodal analysis can be conducted across the various modes of Tmall banner ads including colour, texts, typography, and imagery. At the same time, the analysis has been conducted at different levels, zooming in and out to focus on specific elements and clusters following the ranking mechanism of the whole, group, unit, and component (Boeriis & Holsanova, 2012, p. 262-265).

The paradigmatic dimension on interactivity

The second part of the analysis is devoted to the investigation of interactivity and its associated interactive meanings in banner ads. Interactivity is defined as the affordance of a text with multimodality to be acted upon, realising the full capacity of hypertexuality, and thus meaning-making. As for banner ads, the meaning-making process is embedded in the affordance of interactivity to make the consumption experience easier and playful (gamification). A symbolic and discursive process as such is used to boost sales and also contributes to (not necessarily causes) the cultivation of a materialist and consumerist culture in contemporary China. Figures 7 and 8 show two Tmall banner ads, advertising automobile and Mother's Day outfits respectively. We will use these two ads to analyse the interactivity value achieved through the framework we proposed as an extension of the Double 11 Carnival.

Figure 7: Banner ad with interactive functions advertising automobile. Source: Alibaba

Figure 8: Banner ad with interactive functions advertising Mother's Day outfits. Source: Alibaba

Ideational function. At the top of the screenshots, above the banner ads, there are three interactive sites/signs from left to right. Syntagmatically, the top left ad places a QR code and AR (augmented reality) scanner with two Chinese characters 扫码 (to scan code); paradigmatically, touching or tapping the scanner activates the QR code scanner to direct consumers to anything that can be scanned. Scanned items can be a

product image online, or a physical product with coded information on its packaging. In the middle of the top bar, a lens symbol is presented. It is often used to represent a "search" function. It also uses text to advertise hero goods placed in front of many goods lined up for consumption, just as supermarkets do in their physical stores. The search bar in Figure 7 displays "**穿小白鞋 来一**场和青春的约会" (wear the little white shoes on a date). The "little white shoes" are hero goods that went viral online and have gained popularity among Chinese youth. The text displayed on the search bar in Figure 8 promotes a newly released model from the Chinese smartphone manufacturer Huawei, model Honour5c, and announces its exclusive release on Tmall. Following this text, the symbol of the lens syntagmatically presents an additional camera symbol. Paradigmatically, this function (called "miaopai") allows consumers to take a picture of any desirable good they see and search for. It can bring up search results with similar and even identical goods on Tmall. Alibaba has incorporated this function on various video platforms to form strategic partnerships (for the camera symbol and "search with picture" function, see Figure 9). Of course, the search area can be filled through conventional typing, which is a conventional interactive affordance. In Figure 9, a symbol of a text box on the top right corner is presented syntagmatically. Clicking or tapping it, paradigmatically, opens up a new page with the Tmall notification box, filled with various messages (currently four). The message box may include, retargeted promotions (based on consumers' search history and previous purchasing behaviour), direct marketing messages pushed by official shops that consumers follow, social media chats with friends on Tmall, and notifications of delivery tracking status.

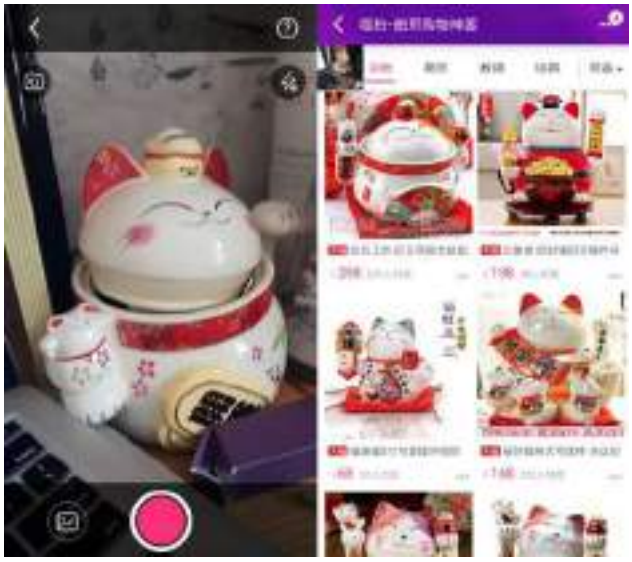

Figure 9: Built-in miaopai function located within the search bar of Tmall ads. Source: Alibaba

Within the banner ads, the ideational function is embodied in clickable/touchable links and icons, such as "**去**抢购 go" (to snap up and go), "**火速下**订>>" (order now) with an arrows symbol, and "**美**妈新衣满减包邮 **更有好礼相送**" (new outfits for pretty moms, in addition to free delivery if a purchase exceeds a certain amount, and other nice gifts). Syntagmatically, these texts and symbols all send similar information to encourage spending as in the Double 11 Carnival. Paradigmatically, clicking or tapping on the ads, the "go" sign, or the arrows ">>" directs consumers to the relevant Tmall product page. In addition, below the banner ads there are ten rectangles with rounded corners. They present ten other services in the Alibaba ecosystem, including e-payment, fans' party (social media function), free gift samples, as well as coupons and memberships, to name just a few.

Ideationally, the landing page of the Tmall app is dense with interactive signs and sites. Syntagmatically, it incorporates various formats such as dynamic elements (flash), symbols and icons, still images, and writing. Paradigmatically, it requires possible actions such as clicking, tapping, scanning, typing, and taking photos. These interactive actions have greater effects than mere reception of the text and enable access to new texts and sites. The interaction consumer has does not necessarily limit to banner ads themselves. These interactive affordances achieve hypertexuality by linking to and opening up new sites in a variety of ways, such as sliding for new images (dots placed at the bottom left of the banner ads), page changes, and pop-up windows.

Interpersonal function. The interpersonal function is orchestrated at an organisational (meso) level through technology-enabled affordances. These include search engine optimisation and algorithm-based re-targeted ads. However, due to limited space, our focus is on the front-end, including the graphic design and the intended affordances the interactive icons are embedded with. Syntagmatically, the icons and symbols on top of the banner ads signal to consumers that Tmall is all-purpose and ubiquitous: consumers can buy everything and socialise with friends on it. According to Adami (2014), such interactive functions are expected by consumers (perceived interactivity) and once provided, they create a complex dynamism to augment consumers' experience. As a B2C e-commerce platform, Tmall uses other features such as colour palette and modular layout to differentiate itself from the C2C Taobao platform, which is seen as filled with counterfeits. Tmall aims to build a different brand image. By collaborating with well-known brands home and aboard, Tmall aims to emphasise professionalism and its official status. This carefully constructed identity can be seen from the multimodal resources it uses. The richness, coolness (enabled with up-to-date technology), and exclusiveness are constructed from both the syntagmatic and paradigmatic dimensions, converging on various non-interactive and interactive modalities. Banner ads are created to show consumers what products and services are on offer with an "official tone", for example, through branded trademarks.

Paradigmatically, the interpersonal function can be achieved through a range of affordances and interactive functions to be activated. However, this interactivity is controlled and restrained to a certain degree. The modality configuration of the banner ads uses more images than text, exemplified by dynamic and still images, as well as icons. These images and icons are used to present both products and interactivity signifiers. Such configurations are intended to encourage consumer actions to achieve selective effects – not to allow consumers to create and manipulate ads or products (as they can to a certain degree on Taobao as shop owners) – but to provide mere access to further pages within Tmall, selling more products and services provided by certified brands (strategic partners). Even the social media function is limited to actions such as providing reviews, posting pictures after purchase, and befriending shop owners or other buyers within the Tmall platform. Therefore, the interactive affordances are enhanced, but only to a certain degree. There is a clear directionality (self-referencing) in the realisation of the interpersonal function, recursive within the larger Alibaba ecosystem. In addition, Tmall not only shapes its own professional, cool, official and exclusive image, but also projects a controlled "identity value" to consumers who visit the site, with a preference for visual modalities (signs and sites to be activated) over conventional texts (deemed non-interactive).

Textual function. Syntagmatically, the design and positioning of the interactive functions follow Tmall's conventions, cultivating a habit and particular aesthetic experience for its consumers. Once consumers open the Tmall app, they will expect the same layout that they experience in a physical store process. In addition, the banner ads are also placed in a very salient position (at eye level) and at the top of the landing page. There is also a sliding function so that consumers can switch between the ads (the dots sign). Overall, the banner ads allow for a level of manipulation, enhancing their interactive aesthetics as a whole. Paradigmatically, the transformation process marked by the before-after (interaction by clicking or hovering over) relationship between the signs and sites is quite cohesive and limited in scope, because Tmall does not allow third-party expansion. Whether it involves scanning, searching or redirecting, the interactive affordances are restrained within Tmall and are connected with purchasing. In this sense, the experience provided by Tmall has little to do with sociality or life uplifting, it is all about purchasing under the disguise of gamification and carnival. For example, the coupons and red envelopes with deadlines (the icon of countdown) creates an interactive stimulus for consumers to click and pay, timely. Otherwise, consumers may lose such an opportunity to get a bargain.

Conclusion

Combining a detailed multimodal analysis and social semiotic study of the meanings of the banner ads (micro), the Tmall platform design (meso) and wider Chinese society (macro), we have demonstrated that banner ads of Tmall have been constructed as a commodity. Tmall also has commodified the interactive and social sphere through social media functions to share pictures and reviews on purchased products and services. In doing so, we have shown that experience driven by a communicative consumerism is underway in contemporary China. Through an analysis of both the non-interactive and interactive functions of Tmall banner ads, we present a picture of the development of such visual information as both signs and sites. Equipped with the two-dimensional framework, the textual and visual modalities (texts, colour, typography, and imagery) are analysed as the initial state, followed by the interactivity as "what happens" if they are activated – a before-after relationship within a "becoming" process.

Based on the analysis of Tmall banner ads on both the syntagmatic and paradigmatic dimensions, we find that the ads have been incorporated into a gamification design to encourage consumers to spend more and buy things they may not need, even after the Double 11 Carnival. The banner ads of the Carnival are largely the same as those for the everyday consumption on Tmall, however, with intensified modalities to encourage consumers to spend. These include, festive colours and gamification design (red envelope campaigns) and more importantly, an emphasis on "low cost" such as special discounts, coupons, and free delivery services. Combined with words such as "buy now" and "go", terms such as 低价 (low price), 特价 (on sale), and 抢 (snap up), the intentionality of purchasing (panic and scare of losing a bargain) is intensified through such gamification design. The message of "there will be no chance to get the goods at such low price later (after the Carnival)!" is expressed explicitly through the aforementioned terms and icons. The reason why we see the Carnival has been extended to non-carnival, everyday consumption is because coupons and red envelopes (*hongbao*) are becoming a norm for most Tmall shops. These banner ads and coupons with clickable and touchable links are directly linked to a user's Tmall account, offering discounts, special deals, and "buy 1 get 1 free" services. In addition, if one's purchase exceeds a certain amount of money, a free gift will be sent with the delivery or the shipping fee will be waived. These discourses and visual constructions (afforded by interactivity) are primarily monetary stimuli. Such stimuli work particularly well on Tmall because users are attracted by cheap, quick and convenient shopping and delivery services, again, on a daily basis. The Double 11 Carnival is an important case in focus, extending its reach even after the event has been completed.

In sum, our approach is informed by existing studies but provides original insights in two ways. First, it departs from a social semiotic approach, combining both the textual and visual analysis and employing the VG framework at a more detailed level. Second, we have conducted much-needed testing of the tentative framework developed by Adami (2014, p. 150), a nuanced development focusing on the 'meaning-potential of interactive sites/signs'. In conclusion, the multimodality and interactivity examined in this study support Cheung's (2016) model in experience design. That is, experience design elements such as information, navigation, engagement, entertainment (in our case, gamification), and personalisation all work together to enhance users' trust, satisfaction and recognition of Tmall as a service provider. Our approach is explicitly multimodal, taking the linguistic, visual and interactive resources (the tri-fold convergence) into consideration to study new phenomena in an e-selling environment, contributing further to research on multimodality, textual analysis, and experience design. Due to the limit of space, we only focus our discussion on one single most influential e-commerce platform, that is Tmall, in China. In future, comparative studies of different platforms may yield additional insights to the field of experience design for generalisation purposes.

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Research Perspectives IN THE ERA OF Transformations

Experience design at Starbucks: from global brand management to local spatial experiences

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This study explores the question: Within the context of global brands management and the need for integrating local identities, how does Starbucks achieve global consistency and meaningfully localised experiences? Through a review of literature and a series of interviews with store designers, design managers and brand concept experts at Starbucks, we compiled the most commonly applied branding and design methods, with an emphasis on the locally relevant spatial experiences the global brand delivers. Moreover, we set out to classify our findings in a way that can assist other brand and experience design teams in overcoming shard challenges. Our findings focus on the management of the grounding brand concept, as well as operations and real estate teams. Through presenting some tools, manuals, guidelines and sample checklists, we suggest that store design teams in different locations can build strong, locally relevant spatial experiences that tie in successfully with the brand's global principles.

Keywords: Starbucks, spatial experience design, local identities integration

From Global Brand Management to Spatial Experience Design: an introduction to the research space and the impetus for our interest

Among the principal challenges that globalisation presents for global brands, including Starbucks, is the need to create experiences and to localise these experiences to various markets (Hands, 2008; Holt et al., 2004; Eldemenery, 2009; Boutros, 2009). There is increasing pressure from consumers to eliminate the unrelatable one-size-fits-all model. Therefore, successful global brands need to create a balance between sending a coherent message, while still tailoring it to different cultural local customs (Hands, 2008; Holt et al, 2004; Eldemenery, 2009; Boutros, 2009). He and Wang (2017) clarify that global brands will occasionally err on the side of inconsistency in order to better suit a particular locale.

Aligned organisations work across all functional boundaries as Kalback (2016) suggests, and they have to do whatever it takes to ensure their constituents have a great experience. This need propels the formation of multidisciplinary teams specialised in experience design.

Pine and Gilmore (1998) started a boom by introducing the experience economy, founded on the core distinction between tangible goods and memorable experiences. Kalback's (2016) multidisciplinary view and Pine and Gilmore's experience economy study lead to the use of the term 'spatial experience design' to refer to a holistic view of spaces. This usage moves away from seeing the visitors of such spaces as simply seeking out aesthetic rewards, and instead considers them as complex, emotional beings. In this view, places exist not

only physically in space, but also in people's minds, memories and imaginations. The identity of a specific space becomes interesting when it recalls a certain experience or evokes associated memories. In those instances, localisation becomes a major factor in fostering positive emotions within branded spaces.

Dealing with all touchpoints and teams with different disciplines in order to accomplish an effective localised spatial experience design has become an undeniably perplexing task. For designers to deliver, competitive organisations rely on multidisciplinary teams, including interior and graphic designers, marketers, and other professionals, so as to achieve the organisation's goals and aims. Designers may comprehend, shape and communicate new, innovative products and visualise brands, but design always needs to be harmonised and carefully associated with a firm's approach and core capabilities, as Hands (2008) has emphasised; this describes the manager's job to a tee. According to Steers et al. (2012), the better the toolkit, the better the chance of success.

On the basis of these core concepts, we look into a global leading brand – Starbucks – to uncover how it confronts the plethora of issues related to localised spatial experiences.

Why Starbucks?

The company selected for the study was Starbucks, a leading global brand with thousands of branches around the world. Its adaptations are successful and include a large number of employees, which made recruiting possibilities more abundant. Several factors supported the choice of Starbucks, including Grinyer's (2001) classifications, as well as Teufel and Zimmermann's (2015) overview of holistic retail experiences, as outlined below.

Starbucks has been identified as a dominant global brand that seeks a balance between consistency and local meaning; therefore, it has occasionally identified the need for its methodology to change, as our research indicates below. Starbucks is a noteworthy example of a brand that typically adapts its spaces in order to suit local environments. *Khaleeji Times*, a newspaper published in the United Arab Emirates, published an article in 2010 entitled 'Global brands, local tastes' (Khaleeji Times, 2010), which suggested that brands such as Starbucks are too standardised.

Our interest for the present research is based on the observation that Starbucks seemed to be picking up on consumers' preference for localised experiences, and dissatisfaction with its standardised shops. In 2012, two years after the article was published in *Khaleeji Times,* the company opened Starbucks 'The Bank' (designed by Liz Muller) in Amsterdam. The corporate website (Starbucks, 2012) suggested that this shop was 'a glimpse of Starbuck's vision for the future'. The design of the shop was highly individualised, revealing a radical aesthetic departure from the usual standardised Starbucks stores. The strategy seems to have been successful, as Starbucks has since designed localised shops for most of its locations.

Furthermore, Grinyer (2001) concludes that brands tend to be either 'value exporters' or 'value collectors', explaining that value exporters have a strong identity and change only minimally from one country to another, whereas value collectors put a tremendous amount of energy into adapting to the different countries in which they establish themselves. Of course, value exporters still have to adapt content to local cultures; however, value collectors have an outward style that is less identifiable from one country to the next, despite the considerable strength of their internal culture.

As we were interested in how global brands adapt to local environments in terms of experiential spatial design, a study of value collector brands would be more beneficial and provide better insights into how global brands have successfully adapted. As Grinyer mentions, even value exporters must adapt slightly; however, collectors such as those often do so drastically. Through the literature and review of images of different Starbucks stores around the world, we established that Starbucks does adapt its stores to their surrounding local environments.

Moreover, among the brands that Teufel and Zimmermann (2015) mention in the book *Holistic Retail Design*, Starbucks stands out as both a value exporter and successful in experiential design. Teufel and Zimmermann include Starbucks specifically because it provides both a holistic retail experience and adapts to local tastes. He references *The New York Times* (2010), stating: 'When Starbucks stock began dropping in 2007, the cookie-cutter approach to store design had fallen out of fashion. In 2008 Starbucks announced it would renovate company-owned stores to be more sustainable and to look less global and more local'.

The emphasis on adapting is also evident on the brand's website, which mentions the importance of local adaptation in store design strategies. This shows that companies put both experiential design and adaptation at the centre of their brand strategies. The Starbucks website (2018) states: 'Our new approach to store design means that our designers are looking at each store individually to ensure that it looks distinctively local. This represents a new level of coffeehouse comfort, meaning that no two Starbucks will ever be entirely the same'.

Starbucks is an interesting case because it was once a value exporter and has more recently changed its strategy. However, Starbucks still does have some standardised new stores, as some of its new designs are more adaptable than others. The method for this study was geared towards understanding Starbucks's strategy in terms of how it selects stores to be localised, as well as how it strikes the right balance between achieving consistency as a global brand and appropriately adapting to different markets.

Through this examination of Starbucks, we set out to understand the strategy used to strike the harmony between consistency and surprise that the branding teams use to convey corresponding experiences.

In order to capture the methods successfully used to tackle such issues, we reviewed secondary sources and developed an empirical study in order to describe the brand strategy. This essential information was gathered through semi-structured interviews with individuals who hold different positions within the Starbucks store design team, so as to comprehend its group structure and how it propels the progress from global to local when planning for spatial experiences.

Research Question and Methodology

In this study, we asked the following question: Within the context of globalisation and the need to reflect local brand identities, how does Starbucks manage the brand in order to achieve global consistency and meaningfully localised experiences?

The first objective was to understand how Starbucks is represented in local spaces. The second was to examine contemporary developments in brand management and experience design and to explore in detail their interrelations.

Therefore, to address the research question and objectives, we first conducted a literature review in order to understand Starbucks's operating context and study how the brand is seen through the lens of external observers. Specifically, we examined empirical data related to the company's spatial experience design methods. Through this approach, we were able to illustrate the successful methods employed by the organisation.

Yin (2014) defines case study research as a technique that explores an existing phenomenon in detail and within its real-world context. This paper used a single case, whereby the attention is focused on the multilayered nature of a single case, so as to comprehend the method used within these specific conditions (Stake, 1995). Flyvbjerg (2013) promotes the single case approach as a method for exploring a phenomenon, suggesting that it can deliver a precise comprehension of the phenomenon's causes and results, and a solid understanding of the qualities of the unique situation at hand, so as to encourage new theories and generate novel research questions.

Literature Review – Starbucks's Operating Context

The following section lays the foundation for the questions posed to the interviewees, including examples of Starbucks's spatial experiences that have been localised, the prior establishment of the importance of teams, as well as the origins of the development of the team responsible for the spatial experience design translating process.

It examines images of Starbucks spaces as well as the company's explanation of those spaces through their archive on 'Pinterest' patterns, showing how its adaptations emerged. Some approaches took their inspiration from surrounding history and heritage, while others included working with local artists or designers, incorporating surrounding landmarks and local customs, and sourcing local materials.

- Geographical inspiration: This approach takes its inspiration from the store's surroundings, be they natural wonders or manmade structures — anything around the area can serve as inspiration. A Starbucks store in Santa Cruz, Bolivia drew inspiration from one of the country's most spectacular

natural wonders, the world's largest salt flat. The geometrical patterns formed by the salt flat inspired many decorative elements found throughout the store (Pinterest, 2018) (Figure 1).

- Local heritage: Starbucks is committed to preserving the environment and showcasing local heritage. For example, its store in Hanoi, Vietnam, has several walls featuring work made by local artists, including a woven bamboo piece, which was made using the same technique as that used to produce Vietnam's iconic conical hats (Pinterest, 2018) (Figure 2). Also, the Starbucks in Fuzhou, China is all about "Wei Qi," the ancient Chinese board game. It houses the famous, world class, first "Wei Qi" master museum (Pinterest, 2019)(Figure 5). Moreover, the design of the remodelled Starbucks store near the bustling Kadikoy Carsi ferry terminal in Istanbul took its inspiration from the aesthetic boats and ferry buildings (Pinterest, 2019) (Figure 6).
- Sourcing local materials: Starbucks also locally sources materials in many of the stores around the world. An article published on its website explains that the decision to locally source is not driven solely by economic factors, but is instead motivated by a desire to be 'respectful' to the country (Starbucks, 2018). Examples include the store next to the flower market in Amsterdam, as mentioned above, which uses local materials including Belgian bluestone, classic white tiles, green marble, and a concrete floor (Figure 3). Also, Panama's store features tilework resembling a hand-painted style germane to the local culture. Starbucks also incorporated design elements from neighbouring regions, including furniture from Colombia and wood slatted light fixtures from Brazil (Starbucks, 2015 (Starbucks, 2015) (Figure 6). Finally, the Starbucks store at Taipei's Longmen building in Taiwan includes Taiwanese-designed wood tables and chairs to create indoor seating that reflects local styles (Starbucks, 2015) (Figure 7).

Figure 1: Starbucks Santa Cruz, Bolivia. Source: Pinterest (2018)

Figure 2: Starbucks Hanoi, Vietnam. Source: Pinterest (2018) & Figure 3: Starbucks Flower Market, Amsterdam. Source: Pinterest (2018)

Figure 4: Starbucks Istanbul, Turkey. Source: Pinterest (2018) & Figure 5: Starbucks Fuzhou, China. Source: Pinterest (2018)

Figure 6: Starbucks Panama. Source: Pinterest (2018)

Furthermore, the literature review established that teams were paramount within global organisations (Senn & Atanasova, 2011; Marks et al., 2001; Caldwell & Gladstein, 1992; Kirkman et al., 2004; Donnellon, 1993).

However, existing literature does not offer a precise explanation of what constitutes the process that grounds the transition from 'global' to 'local'.

By reviewing the literature, we were able to determine that Starbucks has an in-house design team split into two main categories: 'The Starbucks Global Design Team' and the 'The Store Design Team'. However, it should be noted that outsourcing is also used on some occasions. The Design Council (2007) identified that 'The Starbucks Global Design Team' is responsible for the delivery of all in-store collateral and packaging, for the design of much of advertising and marketing materials, and for a visual merchandising group that works on visual presentation in the stores and of the products. A separate store design team is responsible for the design of the furniture, fittings, and the layout of Starbucks' spaces. However, it did not specify how these different teams relate and the concrete roles they are assigned; therefore, the interviews were conducted in order to understand the teams' structure, the nature of communications within and across different teams, as well as the outsourcing model.

Moreover, secondary sources established that Starbucks still has some new stores opening that are standardised; therefore, identifying the strategy behind selecting which stores to localise was also a goal of the interviews.

Consequently, the interviews were designed to explore and capture the methods that the teams use regularly and also specifically when transposing the brand to local environments. They also included the need to understand the inspiration for localised designs and the challenges that the teams face in order to design tools to address those challenges.

The information explored in the literature review section was then used to formulate the questions for the purpose of data collection. The questions were designed to capture information including: (1) understanding the basics of its general practice, (2) understanding the process of localising in more detail, (3) understanding the teams, (4) discussing specific examples of projects and shops worldwide, and (5) seeking solutions to challenges faced.

Primary Data Collection – The Study of the Case of Starbucks

Interviews

We used primary data gathered through in-depth semi-structured interviews. Accordingly, the research method we chose in this study was mainly based on a qualitative approach. Semi-structured interviews are commonly applied in qualitative research (Kitchin & Tate, 2000) and also feature prominently within design research (Michlewski, 2008; Gary, 2014; Roise et al., 2014). Within this study, four semi-structured interviews were conducted.

Table 1: Participants' Information

Participant Code	*Job Title*	*Interview Duration*	*Medium*
Store Designer A	Senior Designer – International Store Design & Concepts at Starbucks EMEA	1:03:02	Video Conferencing
Store Designer B	Interior Project Designer at Starbucks EMEA	27:58	Video Conferencing
Designer Manager	Design Manager at Starbucks EMEA	51:30	Video Conferencing
Store Designer C	Store Designer at Starbucks, Miami, U.S.	37:28	Face to Face

Question included:

- What does your work involve on a more or less everyday basis?
- What is a typical project?
- Describe a typical project structure of a team.
- What are your roles and responsibilities in the context of a wider brand team?

- How do you facilitate the transition ‘from global to local’?
- Which store in your opinion is very successful and why?
- What does successfully representing global identities to local territories mean in relation to these particular examples?
- What are the main challenges that you are facing in terms of the things that we discussed, such as context vs. brand? What type of support do you need?
- What tools would be useful to you to address the issues of localising design in your practice?

Additional questions were available for lapses in conversation, or in cases wherein the participant failed to address the aspects needed to answer the research question. These supplementary prompts were used in order to encourage or guide participants towards the information required. These questions include the following:

- Which part of the work is systemised and which is manual?
- There are still some Starbucks shops that are standardised. Why is that?

Data Analysis

The analysis followed several steps according to the guidelines of case study and qualitative data analysis methodology (Eisenhardt, 1989; Miles & Huberman, 1994). Thematic analysis (TA) was used to analyse the qualitative data collected during the interviews. To ensure reliability, this method must be conducted systematically. Transcribing and coding can be very flexible and conducted on every sentence, word or paragraph, depending on the need, followed by an examination of the codes and their relationships with each other, and eventually revealing overarching themes. Then, an initial list of the main themes, construct and insights was completed. The list was further refined when compared with relationships found in the literature, in order to identify similarities and differences, increase the internal validity of results, and refine recurring themes and constructs. The iteration between data, literature and analysis was repeated several times. The results of this iterative process are presented and discussed in the following paragraphs.

Thematic analysis was adopted because of its flexibility — not simply in terms of theory, but also in terms of the research question, sample size and constitution, data collection method, and approaches to meaning generation (Clarke & Braun, 2017).

The main aim of the questions was to understand how Starbucks manages consistency and local relevancy. However, in order to extract the information sought, some general information about Starbucks was needed in order to understand the context in which local relevancy is achieved. Therefore, the findings begin by first outlining the general information such as ‘Team Structure’, ‘Available Tools’, ‘Spatial Restrictions‘ and ‘Strategy’. Later ‘Local Relevancy’ is explained, and various issues are addressed, including the challenge of local relevancy according to the store design team, where the team finds inspiration to tackle the issues, and the method they use to do so. Finally, the questions broach the topic of new tools that can help tackle these issues.

a. Team Structure and Method

This theme encapsulates the structure of the store design team at Starbucks and the way in which it communicates with the other teams. The interviewees were selected from two different Starbucks offices. Three of the participants were based in the Amsterdam office and responsible for the Europe, Middle East and Africa (EMEA) markets, while one of the participants was based in the Miami, Florida office and responsible for the South East America, Florida and Latin America markets.

The interviews established the fact that the EMEA market is split into two offices: one in Amsterdam and one in London. The London office is responsible for the U.K. stores and a small portion of Europe, while the Amsterdam offices are responsible for the rest of the stores in that market.

The store design teams are split based on the licensee, and vary from two to five members, depending on the size of that market. The teams are always composed of one designer manager and varying levels of designers with a 3D degree background. One participant mentioned:

“We in Amsterdam are covering what we call the GEO licensee market and that means that we have divided Europe in different areas related a licence store. For example, the Middle East, Turkey and Russia are covered by once licensee; they are quite a big company and they are operating the Starbucks stores in that area. Then we have a few teams, as they are really large; we have a few smaller teams that are developing new stores with that local licence, so the large design pool of people are divided in separate smaller teams. They vary from small teams are two persons and bigger teams are four to five persons and each team has a design manager and at least one project designer.” – Design Manager

Graphic designers were previously part of the store design team; however, they are now part of the concept team. Therefore, for artwork needs, the store designers use a program called the Starbucks art program. The design manager within the store design team is responsible for maintaining the relationship between the licensee and the internal team. The store design team takes care of not only creating the layouts, but also ensuring that the brand is expressed properly by the design and implemented in the right way. The design is rarely outsourced, but for very high-profile cases, this is sometimes used. For smaller design elements, outsourcing is also possible, but rare. The store design team in Amsterdam work with the operations, marketing, and real estate departments and with local construction teams. In the EMEA Starbucks office, the store designers speak to the operations and real estate teams on a weekly basis. Within the store design team, there are weekly meetings per market. Therein, the different teams meet to talk about the challenges faced, so it is important for the design team to present their project in order to receive feedback from the market. Meanwhile, the store design team itself holds a daily meeting at an assigned time.

The operations team are responsible for regularly evaluating the store’s efficiency and devising the templates and manuals.

In the U.S. office, the teams are usually composed of a project manager and a designer, and rarely comprise more than two members.

The design team begins by receiving the brief through a digital system. They view the brief and if there are any questions, they clarify those with the relevant department, usually operations or real estate. Then they start by understanding the customer and the needs of that specific store, followed by the creation of the preliminary layout, schematic layout, and packages — this is the stage wherein the drawings become increasingly more detailed. Then it goes to the market, operations team and market team. Once it has been approved, it either goes to a local firm to translate the drawings (if mandated by the laws of the country) or straight to construction. If the construction team has an issue, they contact the manager to resolve the problem.

b. Available Tools

It was paramount to understanding the tools that the store design team use in a leading global brand such as Starbucks. These tools include the following:

Briefs for new and renovation projects database: Project requests from the market are represented to the designers on a sheet which lists all stores that are yet to be completed, including new projects and renovations. The store designers receive a project request containing details such as a number, project rules along with tick boxes, and a survey package. If there is an issue, the store designer can flag the project to be discussed with the related department.

Fixed items template: A template for the focal point of the Starbucks stores (which is the bar) is available for designers. It includes information such as the amount of equipment and the spaces between items, with some variations depending on countries. The material finishes, artwork, and seating arrangements are subject to change from store to store. Furthermore, the back of house is fixed with a template and guidelines. The operations team are responsible for regularly evaluating the store’s efficiency and devising the templates and manuals.

Brief calculations: With each brief handed to designers, the real estate team has already calculated the number of people who can be accommodated by the store in order for the store to generate money. This covers how much space should be allocated to each function, depending on the chosen site.

Starbucks Art Program: The U.S. office develops pieces for the store designers to use. This is renovated constantly and varies from area to area.

Software: A furniture and materials library that includes 3D models of the catalogue items. The test results on a specific piece of furniture can be viewed, with the test having been carried out in the main office in the U.S.

Report: A report from the market addressing the local demographics and preferences of that specific area.

Database: This includes marketing guidelines, correct logo usage guidelines, brand wording, etc.

c. Spatial Restrictions

In terms of spatial challenges, budget constraints typically limit the type of furniture and finishes the designer can select, while attempting to satisfy the brief in terms of managing spatial restrictions, such as providing the amount of seating needed to make revenue, as well as ensuring that the emergency exits remain clearly marked, while also keeping the budget in mind. As a Starbucks store designer remarked:

"The challenges are not only bringing the identity of the brand into the café, it is also having the number of seating that the company requires to make that much money per year; sometimes it is impossible because you need to keep in mind fire exits, and some states have different rules: some states the require two exits, sometimes one exit. We receive many transfers from one Starbucks to XXX [another brand]. They left and we are taking over, so there is no plumbing. You start from zero from scratch and you have to minimise the cost. I cannot get my construction team to do plumbing wherever I want — that is cost — so sometimes I should keep the flooring; we are not changing it, so those small changes, the do's and don'ts, are what make things difficult." – Store Designer C

d. Strategy

Figure 7: Starbucks Store Hierarchy. Source: Forbes (2016)

The literature showed that Starbucks still has stores that are somewhat more standardised than others. The interviews explained the strategy visualised in Figure 4. At the top of the pyramid are the premium Starbucks stores; the core stores sit below, and become less and less premium towards the bottom. The most premium stores offer the maximum look, feel and experience of the brand. The budget decreases based on the store's position within the pyramid. Thus far, the Starbucks strategy is to localise all locations, but to pay closer attention to the highest-placed stores in terms of delivering the maximum experience of the brand.

d. Local relevancy:

1. Challenge

It is a challenge to create designs that people can claim more or less as their own, designed by a foreign designer. Moreover, creating works that are not cliché is a particular feat.

Staying relevant is also a challenge in a competitive market space, especially since online stores came to be; therefore, stores rely on experiences, but since many stores rely on that method to compete, there needs to be a differentiating factor to attract people to this specific experience. Participants mentioned:

"I mean, we do what we can, but it is a challenge working for the world and making stuff that people can claim more so their own. It is a big challenge honestly. Some people like it more than others." – Store Design A

“The difficulty there, you need to be sure that you are doing the right thing and you are not creating a cliché that everybody is living in this area already knows, so you can go wrong there as well.” – Design Manager

2. Inspiration

Currently, the company supplies the store designers with a report on the local demographics and market preferences. This is given to the store designers along with the brief, and serves as part of the inspiration which the designers work from in order to develop a localised shop. After the design has been developed, it is also presented to the market and feedback is offered in order to resolve any issue that arose. As designers mentioned:

“I would say the majority will arrive through the knowledge of the market itself. It kind of teaches us and guides us and, of course, the rest is common sense. It is what we know; it is the sensibility that we have, but the majority is the market itself.” –Store Designer B

Visiting the relevant country is often a good way of becoming acquainted with the culture, but this is not always possible. As a design manager at Starbucks mentioned:

“For example, if we travel and that is always a big budget issue we cannot endlessly travel; and especially the project designers, they cannot endlessly travel. Then that is something that even limited, but we always try to do, for example, is bring a few products that are locally relevant and they can be things to eat, coffee that is not from Starbucks but another brand, local tea, even some other products.” – Design Manager

To understand the people with whom they are working, store designers take the initiative to research real books, watch films and test local products that are brought by company personnel who could travel in order to understand the culture. As mentioned above in the previous example, a designer also commented:

“It is not asked for us but we take initiative on, let’s say, research and books. We watch films; we would do anything just to absorb and to actually understand who are the people we are working with, but there is no (to me), there is not a clear blueprint on how to do that, so this is (to me) something that you need to do on your own, and (to me) I take that really seriously, because if we are actually talking about being locally relevant the best would be is that we immerse ourselves in that culture.” – Store Designer A

Travelling to the country in which the store is being designed is a way of gaining inspiration and understanding the culture; however, for a number of reasons, including budget and timeline issues, the designers typically can’t spend a month or two in that country, and junior designers sometimes do not visit at all. The store designers try to work closely with the local team in the country, especially if they are not able to travel themselves, a situation which also presents its own challenges. These include inaccurate information or linguistic or cultural barriers. Miscommunication with local contractors can lead to difficulty in assessing whether the design has been executed in the way intended. As a participant mentioned:

“So we try to do as much as we can and also to work closely with our guys on the ground. Look, I have seen this, I have seen that. We see some feedback from people when we say this. We also discuss with operations. Normally they give us feedback on things and the problem with that is we would expect a bit of quality, or much more insight from our partners but we don’t always get that.” – Store Designer A

3. Method

There is no rulebook on how to be locally relevant — the inspiration and work are quite organic. However, there are certain core values against which every design is judged. Those values can easily be translated into different locations around the world. The first is human connection, followed by warmth and honesty. Connecting people over coffee can be translated into different seating arrangements, depending on the country. Meanwhile, warmth can be translated by the use of certain colours and materials. Honesty translates by paying farmers and artists in an honest way, and in terms of space, selecting real, honest materials.

e. The Need for New Tools

The interviews with the participants from the Starbucks store design teams verified the need for the tools being developed. It was key to determine the importance of developing such tools and to confirm that they are being targeted towards the right audience. The following statements by the participants confirmed the need for such materials.

When asked if the team would be interested in the tools developed, one of the designers replied:

“Oh, yeah, I think they would be interested to hear on the learning on that… absolutely! I think it would be useful, really useful, especially for Starbucks and other brands. I think a lot of brands would. This is also my perception from some of the things I have learned there. It is like a lot of the brands would like to hear about that because for them it is a major challenge staying relevant.” – Store Designer A

Another participant stated: “I think that it could be really interesting to have a platform that goes a bit deeper into a local culture and giving an image for an outsider of what is really important for a specific area.” – Design Manager

Conclusion

In conclusion, the strategy used to strike the harmony between consistency and local experience involves a combination of aspects, some of which are management’s responsibilities, while others fall into the domain of the designers.

Starbucks store images available in the literature allowed us to see the end results of localised spatial experience as produced by the Starbucks teams’ process. Subsequently, the interviews showed the method and tools the teams use to create localised Starbucks experiences. The interviews also confirmed the need for teamwork and communication, as previously discussed by Senn and Atanasova (2011), Marks et al. (2001), Caldwell and Gladstein (1992), Kirkman et al. (2004) and Donnellon (1993).

To conclude, the Starbucks case study shows that the method of imposing restrictions on functional elements is a necessity; however, having more flexible values when it comes to design is preferable. Instead of equalising the values reflected in colours and fixed materials, the use of more flexible words that can then be translated by designers into what they mean in different cultures helps to create a distinctive experience that people can claim as their own, while still remaining connected to the larger global brand.

The aim of this paper was address how a global leading brand such as Starbucks addresses the pressures of globalisation internally. Literature and observation easily establish that Starbucks localises spaces, but the process the design teams follow to arrive at such outcomes was previously unknown.

Semi-structured interviews revealed that the Starbucks team, even without visiting the relevant country, had to design a customised spatial experience that a local customer would enjoy, while still keeping some consistency. Where possible, travel facilitated this process; however, even a visit of a few days does is often not enough to deeply understand the local people’s perspectives. That is where tools come in handy, as these help the teams ensure that multi-disciplinary perspectives are taken into account to produce a holistic vision.

This suggests that tools are powerful enough to aid local knowledge, even when the designers have to design for local audiences remotely. Further research and improvement of these tools could save global brands travel budgets, as well as relieve the need to install a large local team in every part of the word.

The interviews also confirmed the need for assistance when it comes to this issue, as all interviewees agreed that locality is a frequent challenge of spatial design.

Further Research and Implications

This paper contributes to the wider research topic of investigating the connections between brand management and experience design under the pressures of globalisation. The aim of the research is (a) to explore how brand managers and experience designers on global teams relate to local identities that influence them, and (b) to develop a set of tools that those teams can use when creating local identities in specific sites, in the face of globalisation.

In order to achieve the objectives of the wider research topic, a number of methods could apply. This paper presents findings from part of the approach adopted in order to achieve the aims and objectives of the larger research topic.

The findings will be combined with additional methods so as to create tools that can aid practitioners in transposing global brands into local environments. Further research on other global brands is an important step in understanding the similarities and differences across organisations. That knowledge will help us develop tools with which to tackle the challenges that global brand teams face as a result of globalisation. Understanding the methods and tools employed by one of the most successful global brands ensures the future development of appropriate tools.

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Research Perspectives IN THE ERA OF Transformations

Empathic Design as a Framework for Creating Meaningful Experiences

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This paper introduces empathic design as a framework and a strategy that can be adopted by the emerging field of experience design (XD) to create meaningful experiences connected with people's lives and needs. The paper presents the rationale behind the emergence of empathic design, the traits that characterize this approach to design, a collection of empathic design methods and practices, and a critical discussion of the limitations of empathy in design. Methodologically, this paper is based on a systematic literature review on empathic design, human-centred design, and empathy, which is synthesized and focused its application in experience design. Ultimately, this paper intends to contribute to the broader discussion of how traditional design practices are adapting and evolving to respond to new realities, and how new design paradigms are needed to address the very complex challenges that we face in the 21st century.

Keywords: empathic design, experience design, human-centred design, empathy, soft skills

Introduction

In recent decades, as Western societies move towards a post-industrial era, the scope and focus of design have changed from creating functional and aesthetically pleasing artefacts to tailoring meaningful human-centred experiences. In this new scenario, design is expected to create value by improving, enriching, and helping people make sense of their experience within the built environment, which implies that designers are required to have a profound understanding of users so that they can create meaningful experiences mediated by products, environments, services, and systems (Krippendorff, 2006; Sanders & Stappers, 2008; Norman, 2014; Davis, 2016).

Whereas in most of the 20th century "hard skills" were appreciated and needed to design new products, messages, and environments, in the post-industrial scenario of the 21st century, the so-called "soft skills" are becoming increasingly important to create experiences that connect meaningfully with people's lives and dreams. Among the broad set of "soft skills," empathy has been gaining attention since the late-1990's when companies realized that they needed a closer and a more sensitive relationship with their customers, which led to the emergence of people-centred approaches to design (Sanders, 2006). This shift has favoured the appearance of design approaches, methods, and techniques that place people at the centre of the process such as user-centred design, human-centred design, participatory design, and empathic design (Liem & Sanders, 2013; Steen, 2012; IDEO, 2011).

This paper presents empathic design as a framework and a strategy that can be adopted by the emerging field of experience design (XD) to gain a deeper understanding of the human condition and, consequently, create experiences that meet people's needs, preferences, expectations, and aspirations.

The Seeds of Empathic Design

As technologies have matured and basic needs have been satisfied in most Western urban environments, the demand for more meaningful experiences has increased (Koskinen and Battarbee, 2003). This increasing demand in the last two decades has motivated a movement toward context-sensitive design (i.e., human-centred design approaches) as a response to the limited perspective that practitioners and organizations used to have about people's lives (Kouprie and Sleeswijk Visser, 2009). These changes marked a transition in how industries and designers conceived their relationships with the people they served, which in turn transformed how they approached, got involved with, and understood these same people (users and stakeholders).

As Sanders points out, "designers have been moving increasingly closer to the future users of what they design" (2008, p. 5), which has impacted design philosophies, values, methods, and practices. In this emerging scenario, roles have changed and evolved. Designers have become explorers of people's realities, and people have become partners and experts of their own experiences (Postma, 2012; Michlewski, 2008). Adopting these new roles has required from designers the development of new skill sets, in which empathy is fundamental as it allows for rationally understanding and emotionally connecting with other people's lives and circumstances (Segal & Fulton Suri, 1997).

Empathy and Design

Empathy, the ability to feel and understand other's emotions and circumstances, is considered a fundamental skill for designers to acquire an in-depth understanding of people (i.e., end-users and other stakeholders) so that products, services, environments, systems, and experiences meet human needs, expectations, and aspirations. Likewise, empathy is integral to the design process since it enables practitioners to approach other people's realities and perspectives, to uncover insights, and to develop solutions informed and inspired by people's experiences and behaviour. Additionally, empathy has been described as an ability that promotes "people-centred" innovation, and as a competency that is deemed crucial to dealing with the complex socio-technical issues that humanity faces in the 21st century (Brown, 2009; Brown & Katz, 2011; Howe, 2013; IDEO, 2011; d.school, 2010; Plattner et al., 2012; Norman, 2014; Kouprie & Sleeswijk Visser, 2009; Dandavate et al., 1996; Carroll et al., 2010; Sanders, 2006a).

According to Goldman and colleagues, empathy helps designers to move "beyond [their] egocentric views of the world and no longer design based on their own needs, desires, experiences or preferences" (2012, p. 18). By considering other people's perspectives while keeping their focus on the design problem, designers can uncover users' needs and requirements, identify and balance possible conflicting demands, and design satisfactory solutions that are functional, understandable, usable, and enjoyable (IDEO, 2011; Norman, 2013).

For Thomas and McDonagh, empathy is a critical component in current design approaches, as it allows for the generation of holistic design solutions that address the functional and emotional needs of people. This holistic approach is possible thanks to empathy, which "enables designers to gain intimate insights and understanding into human experiences" (2013, p. 3). Likewise, Altay (2014) argues that the practice of human-centred design requires empathy, as it increases designers' awareness of how diverse people interact and experience their social environments. According to the author, this awareness is achieved by interacting with users, sharing their everyday experiences, and inviting them to participate in the design process.

Likewise, some authors argue that empathy is especially crucial in human-centred design when designers have less in common with the populations for which they are designing and when they have little or no experience in the contexts and situations that frame the design problem. For instance, Carmel-Gilfilen and Portillo (2016) suggest that skills associated with empathy like listening, observation, and attention to the human experience are particularly essential in the context of health-care design. Additionally, Lee (2012) highlights the importance of empathy when designing for older adults, as it helps in dislodging designers' preconceptions and prejudices, and build an emotional commitment with them. As stated by Lee, these changes in the designers' mindset can lead to reframing the design problem and proposing more successful design concepts.

A key player in communicating the importance of empathy in design has been the international design consultancy IDEO. This firm pioneered the use of human-centred design methods and influenced the inception of an empathic approach to design (Battarbee et al., 2014, Mattelmäki, Vaajakallio & Koskinen, 2013). For instance, in one IDEO's toolkits, empathy is presented as a strategy and an ability that enables design teams to create products, services, and systems that reflect a deep understanding of people's problems and realities (IDEO, 2011). According to this publication, empathy for users emerges when designers use qualitative research methods to uncover insights, evaluate people's response to proposed solutions, and, especially, understand people's behaviour. Building this understanding enables designers to "identify physical, cognitive, social and/or cultural needs that we [designers] can meet through the products, services and experiences we create" (IDEO, 2011, p. 68).

In conclusion, authors agree in considering empathy a fundamental ability in current approaches to design, since it allows designers to transcend their assumptions and egocentrism, get immersed into the lives of users and stakeholders, and uncover their latent needs and expectations. Also, it is instrumental for designers in building an emotional connection and a deep understanding of people's reality, which is of particular importance to design for a diverse range of users in contexts that are new to the design team.

Empathic Design

Empathic design is a branch of human-centred design that aims at building a cognitive and affective understanding of people (potential users and stakeholders) for the development of concepts, products, services, strategies, and systems. This approach has its roots in design practices that focus on people's daily experiences, emotions, behaviours, and desires (Postma, Zwartkruis-Pelgrim, Daemen, & Du, 2012; Wright & McCarthy, 2008; Mattelmäki, Vaajakallio, & Koskinen, 2013; Battarbee, Fulton Suri, & Gibbs, 2014).

Empathic design comprises methods and techniques that help design teams to uncover people's latent needs, expectations, aspirations, and preferences. These methods aim at understanding people's emotions and life experiences to inform and inspire the design process. They involve collecting and analyzing data from people's everyday lives through the designer's immersion and direct interaction with potential users and stakeholders to provide a unique perspective based on people's experiences and emotions that enrich and complement the insights uncovered by other methods of inquiry such as market research (Battarbee et al., 2014; Leonard & Rayport, 1997; Mattelmäki et al., 2013; Fulton Suri, 2003; Postma et al., 2012).

Origins and Evolution of Empathic Design

The first mention of empathic design was in 1991 when Professor Dorothy Leonard-Barton, a researcher on innovation and creativity at Harvard Business School, published "Inanimate Integrators: A Block of Wood Speaks" in the Design Management Journal. This article discussed the use of models and prototypes to foster effective communication in the product development process. Leonard-Barton mentioned empathic design for the first time when discussing strategies to communicate with potential users of those new products and services in development. She presented empathic design as a process of gathering information about potential users to uncover their unrecognized needs and desires (Leonard-Barton, 1991). The author stated that empathic design was inspired by the work of renown industrial designer Henry Dreyfuss, who advocated for an approach to design based on "[direct] experience, observation, and research" (Dreyfuss, 1955, p. 65).

Another important influencer of empathic design was Bill Moggridge, co-founder of the international design consultancy IDEO and former director of the Cooper-Hewitt Design Museum in New York. According to Battarbee and colleagues (2014), in the 1970s Moggridge's studio introduced the observation of people and their context as a method for informing their design work. When Moggridge's studio merged with other firms to form IDEO in 1991, this human-centred approach was adopted by the newly created consultancy (Battarbee et al., 2014). Mattelmäki, Vaajakallio, and Koskinen (2013) also acknowledge the influence of IDEO in the inception of empathic design in the mid- and late-nineties and identify other influencers such as Liz Sanders at SonicRim, Patrick Jordan at Philips, and Dorothy Leonard-Barton at Harvard Business School. Additionally, the authors argue that empathic design originated from the human-centred design community as part of "a larger movement toward context-sensitive design" (Mattelmäki et al., 2013, p. 68).

According to Kouprie and Sleeswijk Visser (2009), this movement was a response to the limited information that current methods offered about the experience, situation, and emotions of users, which in turn limited the designer's capacity to innovate and develop new and successful products. The user-centred perspective

brought by this movement was embraced by the business community, which saw in these new approaches an opportunity to strengthen the connection with their customers at an emotional level (Postma et al., 2012). Since its emergence, empathic design has evolved and has influenced other approaches to design. Initially, empathic design intended to make sense of the human experience with the purpose to inform and inspire the design process. Later, it involved users more actively through co-design and participatory design methods and recently has been used to foster imagination and explore and build possible alternate futures.

Likewise, empathic design has spread and influenced the work of people working in places such as Aalto University in Finland; TU/Delft, TU/Eindhoven, and Philips in The Netherlands; Carnegie Mellon University, Ohio State University, University of Illinois, IDEO, and SonicRim in the United States; The Hong Kong Polytechnic and Tongji University in China; Politecnico di Milano in Italy; and Universidade Federal do Rio de Janeiro in Brazil (Mattelmäki et al., 2013; Sanders & Dandavate, 1999; Battarbee et al., 2014; Ho, Ma & Lee, 2011; Cipolla & Bartholo, 2014).

Characteristics of Empathic Design

Empathic design is characterized by proposing a balance between rationality and emotion (Postma et al., 2012). Several authors argue that designing under this framework requires finding equilibrium between the affective involvement of empathizing with another's experience and the cognitive process of analyzing it (Kouprie & Sleeswijk Visser, 2009; Battarbee et al., 2014). For Postma and colleagues, this balance implies combining "objective observation of people behaviour with more "subjective" interpretations of "what people think, feel and dream" (2012, p. 60). As Fulton Suri points out, "through observation, we become informed, and through empathy, the human connection, we are inspired to imagine new and better possibilities for people" (2003, p. 54).

Another important characteristic of empathic design is the involvement of users and stakeholders as partners in the design process. According to Mattelmäki (2006), such participation requires the designer to develop a sense of respect and commitment to their needs and to build a holistic understanding of their experiences. From an empathic design perspective, users and stakeholders are considered "experts of their experiences and crucial partners in building creative understanding of these experiences" (Postma et al., 2012, p. 60).

Additional to this balanced approach and respectful attitude, empathic design is guided by a set of underlying theoretical and methodological assumptions that Mattelmäki, Vaajakallio, and Koskinen have synthesized in the form of "four key beliefs" (2013, p. 68). These assumptions revolve around the creation of meaning by people, the discovery and interpretation of these meanings by designers, and the nature of the methods used in empathic design. These key beliefs are as follows:

1. People construct meanings that arise and change through interaction with the environment.
2. To explore these meanings, empathic design needs to be done in real life, where these meanings are created and transformed.
3. This meanings exploration should use design-specific methods such as visualization, mockups making, and storyboarding.
4. The research methods used in empathic design are "visual and tactile, inspiration-enhancing, deliberately cheap and low tech, playful, tested in reality, and targeted at the fuzzy front end of the design process" (Mattelmäki, Vaajakallio, & Koskinen, 2013, p. 69).

Role of the Designer in Empathic Design

In empathic design, practitioners are expected to have direct interaction with people (users and stakeholders), which means that the designer's role requires getting immersed in the user's world, their lives, and experiences to learn from them and inform and inspire their designs (van Rijn, Sleeswijk Visser, Stappers, & Özakar, 2011). This immersion also comprises user participation, since they are considered "experts on their experience" (Sleeswijk Visser, Stappers, van der Lugt, & Sanders, 2005). As a consequence, designers are expected to set the stage for users to participate and to facilitate activities for them to share their expertise with the team (Battarbee et al., 2014, p. 10). However, to maintain a balanced perspective, the user's viewpoint needs to be combined with the designer's personal insights, creativity, vision, and experience (Kouprie & Sleeswijk Visser, 2009; Postma et al., 2012).

These competencies are part of the skill set that empathic designers require according to several authors. The set is comprised of abilities such as being open-minded, aware of one's context, and self-aware about how one

thinks and feels. Also, this empathic skill set includes the capacity to observe meticulously, use visual information and tools of visual communication, and switch between empathizing and analyzing modes (Leonard-Barton & Rayport, 1997; Mattelmäki et al., 2013; Battarbee et al., 2014; Kouprie & Sleeswijk Visser, 2009).

Empathic Design Methods and Practices

Perhaps the most transferable aspects of empathic design to experience design (XD) are the methods and practices created or adapted within this approach to design. Most of these methods and techniques are intended to be used during the research phase of the design process, and their primary purpose is to prompt an empathic understanding of other people's experiences (Vaajakallio, 2012).

Empathic design methods are characterized by being user-centred (as they involve users and stakeholders at different extents); visual and tactile (as they provide inspiration and a means of communication to designers); cheap and low-tech (as they are easily and quickly deployed in any context); interpretive (as they are intended to make sense of other people's reality), playful and fun (as they offer opportunities to dream about alternate futures); tested in reality (as they are used to address real-world issues); and targeted at the fuzzy front end (as they are most effective in the early stages of product development) (Koskinen, Mattelmäki, & Battarbee, 2003).

Even though most methods are focused on the research and concept development stages of the process, Leonard and Rayport (1997) offer an overview of the empathic design process that goes beyond these initial phases. This process is comprised of five steps, namely, (1) observation, (2) capturing data; (3) reflection and analysis; (4) brainstorming for solutions; and (5) developing prototypes of possible solutions. In this model, observation is presented as the preferred method for learning about users on the basis that it allows for uncovering their unarticulated and latent needs.

Kouprie and Sleeswijk Visser (2009) propose a four-phase framework to practice empathy in the design process. This model is based on current literature in psychology and is intended to support designers in implementing empathy in their practice by offering them a guide to approach, interact, and understand users and stakeholders. The four phases proposed by the authors are (1) discovery, in which the designer makes a first contact with the user that raises his curiosity, interest, and motivation; (2) immersion, in which the designer explores the user's world to expand his knowledge and understanding of another's experience; (3) connection, in which the designer connects with the user on an emotional level by recalling his own feelings and experiences; and (4) detachment, in which the designer detaches from his emotional connection with the user to analyse and distil insights from his immersion.

The same authors also propose a system to classify a variety of empathic design methods depending on the purpose and phase of the process in which they can be applied. The categories offered by these authors are as follows: "(1) techniques for direct contact between designers and users (research); (2) techniques for communicating findings of user studies to design teams (communication); and (3) techniques for evoking the designer's own experiences in a domain relevant to the user (ideation)" (Kouprie & Sleeswijk Visser, 2009; p. 439).

The first category— "techniques for direct contact between designers and users"—includes methods based on user observation (e.g., observing users performing a task at their workplace); designer immersion (e.g., spending the night at the user's home); and generative sessions (e.g., facilitating a session in which users make a collage that captures their experience using public transit) (Kouprie & Sleeswijk Visser, 2009; IDEO, 2011; Stappers & Sanders, 2003).

The second category—"techniques for communicating findings of user studies to design teams"—involves methods used when direct contact with users is not possible. This category includes storytelling techniques such as personas (i.e., fictional characters based on user data); scenarios (i.e., fictional situations based on data from users and context); and storyboards (i.e., sequence of images that represent specific situations in the life of a user). Such methods are effective when they "convey the flavour of the user's world, as well as an understanding of it" (Kouprie & Sleeswijk Visser, 2009, p. 446; Sleeswijk Visser, 2009).

The third and final category— "techniques for evoking the designer's own experiences in a domain relevant to the user"—refers to methods that simulate the user's reality so designers can experience them and adopt their perspective. This category includes role-playing techniques such as product handling (i.e., use of sample products or prototypes by designers); experience prototyping (i.e., simulation of the experience mediated by a

product or service); bodystorming (i.e., brainstorming that uses body and space); and informance (i.e., informative performance of a situation or behaviour witnessed or researched) (Kouprie & Sleeswijk Visser, 2009; McDonagh-Philp, 2000; Buchenau & Fulton Suri, 2000; Moggridge, 2007).

Another classification of empathic design methods is offered by Jane Fulton Suri, Partner Emeritus and Executive Design Director at IDEO, who proposes the following three categories: (1) "looking at what people do," which includes techniques such as observing people in their natural environment, and exposing potential users to prototypes to observe their behaviour; (2) "asking people to participate," which includes techniques that help to reveal people's unarticulated attitudes and thoughts such as drawing, collage-making, storytelling, and diary-keeping; and (3) "trying things ourselves," which includes immersive techniques such as role-playing, experience prototyping, and simulations (Fulton Suri, 2003).

An example of the first category— "looking at what people do"—is the immersion of members of the design team into the users' context, as discussed by IDEO in their human-centred Design Toolkit (2011). This technique aims at providing designers with an experiential understanding of the users' everyday life through an immersive and prolonged exposure to their context and experiences. When using this method, designers spend two to four of days with members of the community of potential users, sharing their daily experiences in the context in which they live, work and socialize. According to IDEO "this kind of deep immersion gives us [designers] informed intuition that we take back with us to design solutions. We begin to take on the perspective of the interview participant which enables us to make design decisions with their perspective in mind" (2011, p. 59). Also, this strategy allows designers to contrast what the potential users say they do, with what they really do, which might not coincide.

An example of the second category— "asking people to participate"—is the use of empathy probes proposed by Mattelmäki and Battarbee (2002). This technique aims at uncovering what people say, do, and make (Sanders, 2002) through self-documentation. The package given to potential users includes a diary, a sheet of stickers (to use on the diary), disposable camera with a list of photos that users need to take (e.g., an object they user every day), and set of cards with questions to be answered depending on the nature of the project. The design team analyzes the information collected by potential users, and later conducts interviews with some of them to validate their preliminary findings. This method helps to promote empathy by providing the design team with a glimpse into the users' reality from their perspective.

An example of the third and last category, "trying things ourselves," is modelling everyday activities as a person with a disability as proposed by Thomas, McDonagh, and Strickfaden (2012). This strategy offers designers the opportunity to undergo the challenges and experiences that a person with a different level of ability encounters every day. An immersive technique is preferred when the presence of the design team into the user's world can be intrusive or when time and resources prevent the team from conducting extensive research with external participants. When using this method, designers execute everyday activities while reducing their specific abilities. For instance, designers can wear devices that limit their range of motion, obstruct their hearing, or restrict their peripheral vision. While they are wearing these devices and executing everyday activities, designers document their experiences in order to reflect on them and present findings to the team in a debriefing session. The purpose of this strategy is to promote empathy with potential users who represent physical disabilities.

Another remarkable example of this third category is offered by industrial designer and gerontologist Pat Moore. In her book Disguised!, Moore (1985) recounts her experience living and traveling for three years prosthetically disguised as an elder woman. This empathic experiment—initiated when Moore was at the age of 26—gave her an immersive experience of an older adult. In an interview conducted by author Roman Krznaric, Moore expressed her intention to gain true empathy with this population through total immersion: "I didn't just want to be an actress pretending to be an elderly person… I wanted a true immersion character, an empathic character, where I could really walk in someone else's shoes" (Krznaric, 2015, loc. 69-70). During this empathic experiment, Moore created different personas to explore the experience of elderly women of diverse health and economic conditions. She visited more than a hundred cities in disguise, and almost lost her life after being attacked by a gang on the streets of New York City (Moore, 1985).

Limitations of Empathic Design

Empathic design has limitations and is not well suited for addressing every experience design problem. According to Postma and colleagues (2012), this approach is most valuable in the early stages of the design process when opportunities are being identified and new concepts are being proposed. For Koskinen and

Battarbee (2003), the insights from the user's perspective obtained through empathic design have the most value in the "fuzzy front end" of the process; that is, in the search for new concepts for products, services, strategies, and systems. Sanders reiterates the importance of empathic approaches in these early phases of the development process and highlights that "the action in the fuzzy front end is all about new ways to understand and to empathize with the needs and dreams of people" (Sanders, 2006, p. 1).

Another limitation to empathic design is the risk of running into what has been called the "empathy trap;" that is, focusing only on another's needs while ignoring the designer's own concerns (Stern & Divecha, 2015). In the case of empathic design, this situation is seen when the design team focuses only on the user experience and loses its drive to find insights that inform and inspire new products and services (Mattelmäki et al., 2013). This situation is often accompanied by the loss of objectivity and a global frame of reference, which occurs when designers establish a strong connection with another person's feelings and perspectives (Fulton Suri, 2003). According to Segal and Fulton Suri (1997), the key to avoiding this trap is to maintain a balanced perspective by combining "loose" empathic strategies with "strict" observation techniques. However, keeping this balance between an empathic and an analytic mindset may be challenging for design teams and individuals. This requires of self-awareness and the capacity to make the switch between these two mindsets (Battarbee et al., 2014).

Another difficulty that empathic design poses to experience design is the uncertainty of the process in its early stages. As the initial phase of the process is devoted to getting immersed into the user's world and does not provide an immediate solution to the posed problem, designers and organizations may not perceive its value at first and may be reluctant to embrace this approach (Kouprie & Sleeswijk Visser, 2009). For this reason, Kouprie and Sleeswijk Visser highlight the importance of motivation and willingness to pursue an empathic design process. For them, "motivation is crucial for an effective process. When designers do not see the advantages of empathy in design, the results can be unsatisfying" (2009, p. 447).

For design anthropologist Dori Tunstall (2014), the use of empathy in design strategy has serious limitations. Empathy may offer the designer an understanding and/or an emotional connection with people, but it does not necessarily offer a path to take action for others. She proposes that more than having empathy for users and stakeholders, designers should have compassion and design from a position of caring. This approach means for design practitioners to have a "sustained emotional investment in an individual's well being, characterized by a desire to take actions that will benefit that person" (Tunstall, 2014, paragraph 4).

In an op-ed published in AIGA Eye on Design blog, Lilly Smith (2016) questions the use of empathy in the design and business communities. For her, empathy has become a "buzzword" that is being used by companies mostly as a sales pitch. She argues that even if designers use empathy to understand people's needs and create legitimately better products, the purpose is to sell those products. From her perspective, empathy in business and design is less about compassion and more about profit. This viewpoint is summarized by Roman Krznaric, who calls this strategy "empathy marketing" and argues that when businesses apply empathy, they are only "stepping into someone else's shoes to sell them another pair" (as cited in Smith, 2016).

Similarly, Kamil Michlewski, author of the book Design Attitude, differentiates real empathy from that with commercial purposes, which he calls "commercial empathy" (2008, p. 383). He argues that firms such as IDEO have incorporated a light version of practices and methods from anthropology, psychology, and sociology, which fail to offer the same in-depth understanding shown by their academic counterparts. For Michlewski, designers working in these environments "exhibit an attitude that might be described as commercial empathy. That is to say they are sympathetic towards commercially bound reference points of their work" (2008, p. 383).

Even designers who work within this commercial framework recognize that empathy poses its own challenges in the design process. For instance, Steve Selzer, design manager at Airbnb and former creative director at Frog Design, argues that the human-centred design process requires not only a deep understanding of others through empathy but also a deep understanding of oneself (2015). Selzer warns against the "empathy trap" mentioned before, in which designers and researchers centre their attention only on the user's needs while ignoring their own perspectives. He proposes that an alternative to avoid such situations is to acknowledge and understand one's values, perspectives, goals, and biases before trying to understand others through empathy.

Likewise, Dan Saffer, vice-president of product at Mayfield Robotics and former creative director at Smart Design, claims that empathy is not enough in human-centred design, but it needs to be combined with an objective understanding of the problem, and the informed perspective of the designer (2015). According to Saffer, empathy helps to designers see a problem from the user's perspective, but does not help them to see the solution. For him, empathy is only a stepping stone that helps designers moving from their egocentric perspectives to a real understanding of people and context

In sum, designers have acknowledged the value of empathy in the design process, but there are also voices that warn about the limitations and the pitfalls of using empathy as a design and business strategy. The strongest criticism of this kind of approaches is that they commodify empathy reducing its power to strengthen human relations, as they adopt it as a disposable buzzword to increase sales and profits.

Conclusions

Based on a systematic literature review, this paper presented and discussed empathic design as a framework and a strategy whose principles, methods, and practices can be adopted and applied by the emerging field of experience design (XD) to create meaningful experiences connected with people's lives and dreams. The paper presented the rationale behind the emergence of empathic design, the traits that characterize this approach to design, a collection of empathic design methods and practices, and a critical discussion of the limitations of empathy in design.

Even though empathic design emerged in a context where digital experiences were not as pervasive as they are today, its principles, practices, and methods can be very well applied to their design, since these are rooted in a profound understanding of people's daily experiences, emotions, behaviours, desires, expectations, and aspirations. It is important, however, to take into consideration the methodological and epistemological limitations of empathic design to avoid running into common pitfalls, such as falling into the "empathy trap," understanding empathy at a "buzzword level," or commodifying empathy to sell things to people instead of addressing their real needs and expectations.

Finally, this paper intends to contribute to the broader discussion of how traditional design practices are adapting and evolving to respond to new realities and scenarios, and how new design paradigms are needed to address the very complex challenges that we face in the 21st century.

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Research Perspectives IN THE ERA OF Transformations

Experience Design Applied to Research: An Exploratory Method of User-Centered Research

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An accurate understanding of users' needs is essential for the development of innovative products. This article presents an exploratory method of user centered research in the context of the design process of technological products, conceived from the demands of a large information technology company. The method is oriented - but not restricted - to the initial stages of the product development process, and uses low-resolution prototypes and simulations of interactions, allowing users to imagine themselves in a future context through fictitious environments and scenarios in the ambit of ideation. The method is effective in identifying the requirements of the experience related to the product's usage and allows rapid iteration on existing assumptions and greater exploration of design concepts that emerge throughout the investigation.

Keywords: design research, user experience, low-resolution prototypes

Introduction

In contemporary society, the old method of judging products - comparing only its practical benefits - does not work anymore. People began to attach greater importance to the search for meaning and to phenomena that bring greater significance to their daily experiences (Semprini, 2010). Design, as a transforming agent and a factor of competitive advantage, extended its performance to the experiences that consumers have with products, services, spaces or set of these (Freire, 2009). Regarding the relationship between people and the products and services they consume, experience involves the emotions, beliefs, and expectations that occur before, during and after consumption (Chammas, Quaresma, & Alvão, 2015), and its development depends on a deep understanding of the user.

To Freire (2009), the experience is the result of the interaction between people, products and the context in which this interaction occurs - and must be functional, determined, engaging, attractive and memorable. It involves the senses, motor, and mental abilities, intentions, expectations, desires, concerns, values and previous experiences - and therefore people become more and more sensitive to the dimensions of the product, which go beyond the traditional aspects of usability and imply the need to understand emotions, experiences and their implications for product design.

Differentiation in the market is driven by the meaning of the products, which means that the differentiation happens much more for the reasons that make people want a product than for the necessity that this product supplies (Verganti, 2009). Once the evolution of production systems and market dynamics has transformed design, technology itself is no longer a differential: it is necessary to create value for users (Zurlo & Cautela, 2014). As a result, approaching the potential users within the intended target market should be a basic

premise for the entire design process. Along the design process, the user should be considered as an individual who possesses individual skills and unique needs, with the potential to represent the knowledge and limitations of the intended ultimate target audience.

One of the purposes of design, in the experience dimension, is to create the conditions that allow the experience to be created in a planned way. The understanding of the environment in which an emotional experience occurs, and the way objects become emotional triggers for people opens space for the discoveries of new opportunities for designing meaningful products (Forlizzi, Disalvo, & Hanington, 2003). In order to happen, it is necessary to involve the users along in the design process, not only by questioning them about their needs and desires but also by providing an environment where they can interact with the product or service under development and imagine themselves in future scenarios within this context of use. Furthermore, considering that design is an eminently projectual activity in which specific methodological procedures must be used to accomplish investigations, planning, projections, and analysis(Meurer, 2014).

This article aims to document an exploratory method of user-centered research, applicable in design processes that aims to create or investigate user experiences related to products/services. This method follows an action-research approach. Action-research consists of a cyclical process in which improvement is sought through a systematic oscillation between acting in practice and investigating it (Tripp, 2005). This type of research comes from the social psychology applications by Kurt Lewin, in the 1940's USA, and have in its proposal and procedures an egalitarian need, considering participation and co-operation between the actors involved (Thiollent, 2011). Also, action-research uses less formal and prescriptive methods when conducted, because its goal is to address practical problems of a specific context, rather than produce independently validated and reproducible findings for others to use as guides for their future actions.

The method presented in this article arises in the context of projects under an agreement between HP Inc. Brazil R&D Center and Tecnopuc Crialab, the creativity laboratory of the Pontifical Catholic University of Rio Grande do Sul - Brazil. In this partnership, Tecnopuc Crialab is configured as an external design team, which co-creates with the company's development teams in projects of products, services, and experiences. The method was applied 8 times in three different projects, and involved a total of 180 participants. The projects addressed research problems from 3 different contexts: home spaces, corporate meeting spaces, and home business working spaces, and were applied to investigate scenarios of interaction between users, ambient, and devices. All applications of the method were done in the initial stages of investigations to design technological products for these different contexts.

In this article, the first section explores the concept of experience design, followed by the conceptualization of user-centered design as a process by which experiences are conceived. In the second section, the method is presented, followed by a later discussion. Finally, we present conclusions that discuss the potential impact of the method in user centered experience design.

User centered design

The importance of design in innovation processes is a consensus in many different studies (Borja de Mozota, 2007). For Mitchell (1993) focusing on the needs and desires of users is central to the design, and therefore it is necessary to redirect design thinking to go beyond the product. Designers can design more than just products - and among the key qualities of these professionals are the skills to explore new tools and to create tangible versions of abstract ideas, representing different dimensions of the user experience (Suri, 2003)

Experience is a broad concept and it is related to how people interact with a product and what they learn in this process (Freire, 2009). An experience involves the relationship between the user and the product - therefore, the design is not limited to designing objects, but is also related to designing the contexts in which they are used, the systems in which they are organized, and the environment in which they operate. In addition to other factors, the potential commercial success of artifacts depends on the experiences they provide - and hence understanding consumer motivation is essential for designing significant experiences (Pine & Gilmore, 1998).

The term "user experience" is consolidated and widely diffused by the acronym "UX" (user experience), and especially in the business world has been used as an approach to understand how to give the consumers better experiences with their products in order to develop better products. According to ISO 9241-210, the term UX can be defined as the perception and response of people as to the use (or anticipation of use) of a

product, system or service. Therefore, it refers to the description of the totality of an individual's experience with the products and businesses with which he interacts.

When designing experiences for users, user-centered design approaches, methods, and tools should take place. To Krippendorff (2006) center design on human beings implicates in developing technology in human terms, guided by meaning. When designing by user-centered design recommendations, we should know that users are the ones who determinate products meanings, and it is the designer's role to take care of users and make sure that their concerns are being taken care of (Krippendorff, 2006).

For Keates and Clarkson (2003) user-centered design involves an approach that aims to create interfaces, artifacts, products, and services that are applicable, appropriate, and accessible to as many users as possible. In the creation process, which also includes research, users must be constructively oriented so that they can provide the information needed for product development (Lowdermilk, 2013). For that, the use of methods, techniques, tools, and approaches that actually help in understanding the project context and promote user participation in the design process is essential.

User-centered research methods

Observing the expansion of the concept of design and of the possible outcomes of the design process, we can clearly see changes in the designer's procedures in projects. The designer comes to be understood as a specialist in the relationship between people and things. Understanding interactions in the perspective of experiences, designers seek solutions to problems through processes that aim to develop products, services, and experiences. Considering the various roles that the designer can have and the types of projects that he can execute, choosing the most appropriate method for each project is of a contextual and subjective nature. High complexity projects require a high degree of structuring to be developed, and innovative projects face some level of uncertainty, being difficult to structure (van der Linden & Lacerda, 2009). The designer, which has multidisciplinary competencies, should be able to apply more than one approach to the same project (Chammas et al., 2015).

In traditional design methods, the designer is focused on the product/service being designed and looks for ways to ensure that it meets the user’s needs. These methods include research phases, where the researcher collects primary data or uses secondary sources to learn about the user’s needs, so the designer can interpret it through concept sketches or scenarios. However, in these cases the focus continues on the design development of the product/service, and the roles of the researcher, the designer, and the user are distinct, even they depend on each other. The user is not really a part of the team (Sanders, 2002), and a gap might exist in the communication between these actors.

In ideal participatory experiences, the roles of the designer, the researcher and the user are mixed, what enriches the results (Sanders, 2002). This new understanding calls for new studies. In this way, developing new methods to optimize processes focused on understanding and creating user experiences must become part of the designer's work. People want to express themselves and to participate directly and proactively in the design development process (Sanders, 2002). Users participation and co-creation in the product development process, demonstrating their behaviors and thoughts can lead to a more assertive result, since learning from users is very strategic (Schrage, 2015) so it must be strongly considered in new user-centered research methods.

In addition, it is relevant to establish an alignment between designers, engineers, and developers’ perspectives from the beginning of the project, bringing dimensions of the user experience to the technological interactions that will be developed. This meets the need of applying flexible processes, with iterative phases, in order to be able to review previous decisions whenever needed. The lack of integration between design and other actors (or factors) in the product development process is a serious problem to be overcome in companies and in societies that wish to be successful in innovation processes (van der Linden & Lacerda, 2009). These subjects were considered throughout the projects under the agreement between HP Inc. Brazil R&D Center and Tecnopuc Crialab, and are addressed in the method presented in the following pages.

User centered design

As the user experience becomes central to the design process, the need to establish means by which designers and users can act as equal partners emerge, impacting not only the results but also the design goals and procedures. In the process of designing new products and services, the users’ participation is essential to

contribute with their vision about what is being developed or planned. In this context, and based on the perspectives previously presented, we will present a research method directed - but not restricted - to the initial stages of a technological product and/or service development process, from a user-centered design perspective. The method brings in its structure, processes, and concepts from several design thinkers and other adjacent areas, which makes it ideal for projects of medium or high complexity.

The method presented in this article proposes not treating the users as objects of research, but rather as co-researchers. As previously mentioned, in classical research settings, the relationship between researchers and researched seems to be very clearly defined as a "non-relationship", in which the researcher is, as far as possible, neutral or invisible. In this classical perspective, anything else is considered to lead to the distortion of the results or to threaten the internal validity (Bergold, J. & Thomas, S., 2012). This is different in participatory methods, as the perspectives of various stakeholders and their opinions are important for the process of discovery, so objectivity and neutrality are replaced by reflective subjectivity. In this sense, research with stakeholders to whom the proceedings of academic research are unfamiliar, calls for new methods of data collection that should, therefore, be developed appropriate to the concrete research situation and partners defined.

Because it can be difficult for people who have never had anything to do with research to understand methodological procedures, the knowledge created by the research is built on the participants' everyday experiences by immersing the user in a fictitious environments that are similar to their real ones, where they can imagine new scenarios of interactions while they simulate known daily activities. This transforms research by providing a structure for new roles of researchers and researched ones. The researcher acquires new and unfamiliar roles, being an enabler to the users undertaking research, while the users involved bring their perspectives into the knowledge-production process.

The presented method uses the concepts of low-resolution prototyping and storytelling to construct a visibly fictitious and immersive environment with the intention to involve the user in a simulation of usage of a product and/or service in order to reveal the behavior of a population through participatory practices. Considering that technological innovation is one of the major sources of competitive advantage in the long term, but often requires costs and structure that few companies have the capacity to supply (Verganti, 2009) the method relies on the idea that it is possible to raise the maximum input of users in stages prior to technological development. Moreover, considering that people use emotional, psychological and sociocultural reasons when choosing a product, in addition to the practical and functional reasons, this method creates possibility for a greater interaction with the users, so that ones can think beyond functional characteristics, extending to the real value they attach to things (Krippendorff, 2006; Verganti, 2009) resulting in a big opportunity for designers to qualify their design process. Next, the four phases of the method are presented: context, plan, action and analysis.

Phase 1 - CONTEXT

The first phase of the method is related to the understanding of the project context (Figure 1). It defines the **research goal** and the directions to be followed in the experience application, in a joint decision between designers, managers, and development team. The circumstances of the research - which can be driven by the idea of a product to be developed, by the need to validate a product that is already under development, or to review a product already launched, for example - are also clarified.

In this phase, we also try to **understand the user**, and for that, we can use several techniques that help understand their profile, such as personas (Kalbach, 2009) and empathy map (Osterwalder & Pigneur, 2010), for example. It is important to emphasize that the user's understanding at this moment is important to guide the definition of the hypotheses and the application of the experience - however, there are projects in which the experience is planned to explore behaviors and situations of use to later define the target audience of the product.

In order to better understand the delimited public and the context of the project, desk research - that is exploratory research in academic bases and websites on the Internet to investigate cultural, behavioral and market aspects related to the project - is done. This research aims to bring a theoretical foundation that will help in the definition of the protocols of the next phase, and that will base the elaboration of the hypotheses.

Next, we identify the **behavior settings** related to the experience, which configure patterns of behavior that occur in a given time and space. The behavior settings theory (Barker, 1968; Wicker, 1987) provides the

classification of behavioral patterns linked to a physical environment where they occur in a coordinated way. Based on these behavior settings, it is defined what **technological interactions** should occur in the experiment, and that are pertinent to the project scope - such as voice interactions, use of graphical interfaces, use of touch interfaces, passive user recognition, among others. Finally, we define the research hypotheses that will be validated with the application of the experiment.

It is important to emphasize that the method has an iterative character, and each phase or step can be revisited, whenever necessary. The CONTEXT phase creates the fundamental basis for the later phases of the method since it gathers all the information necessary for the effective design of the experiment, which follows.

Figure 1: Context Phase. Source: the authors.

Phase 2 - PLAN

There are many possible strategies to be applied for user participation in the design process. In this method, the application of an experience in which the user will immerse and interact with the product is prioritized. The PLAN phase consists of the design of the experience to be applied and simulated. This phase begins with the elaboration of the narrative (storytelling), which is written based on the hypotheses, behavioral patterns, and technologies defined in the previous phase, and that is consolidated as a text or storyboard. The narrative aims to tell stories that will be experienced by users in a relevant way to assist them in their immersion on the simulated experience, involving the interaction with the product being tested and sharing ideas and knowledge in a persuasive way in a script (Denning, 2005). For that, researchers can use specific methodologies for the construction of narratives, such as Smith and Wintrob's narrative framework (2013), Denning's template (2005) or Smith's storytelling model (2012).

The next step is to elaborate on the research protocols. The scripts for simulation are elaborated, which cover from the user's arrival to the research site until their exit. Also, the interview scripts are defined - which, in this method, will be semi-structured scripts with questions pertinent to the project context, and that will be done before, during and/or after the experiment.

The physical construction of the ambient for the experience simulation then begins, through the use of prototyping techniques, which aims at the conceptual or analogical representation of a product, service and its environment of use, in order to turn tangible an imaginary future for idea validation. Prototyping is a common step of any product innovation process and is an activity and tool that has received considerable attention in the product development process (Zomerdijk & Voss, 2010). By broadening the understanding of the design process in business and development domains, early-stage prototypes in the design process have become an important practice. Unlike the traditional role of the prototypes in the engineering process, in which they are more used for product testing, prototypes in the design process - especially in product design - has an exploratory role (Elverum, Welo, & Tronvoll, 2016). At this stage of the method, low-resolution prototypes of the artifacts that compose the experience to be simulated are constructed, considering the products involved and the scenario where the interaction takes place (Figure 2).

The **low-resolution prototyping of the scenario** is done considering the narratives that were previously created - the space to be constructed will be the scenario in which the experience will occur, and will assist the user to immerse himself, imagining in fact in the situation in which he would perform the requested actions. It may be risky to make decisions based solely on the users' interaction with the product prototype without an understanding of the context of use of the product - hence the prototyping of the scenario is essential for the completeness of the experience and the identification of the contextual factors that drive the use of the product. Finally, the **low-resolution prototyping of the product** with which the user will interact in the experiment inserts the product into its context of use and serves not only to test functionalities, ergonomic issues, and other aspects of the product itself, but also to investigate the meaning that this product has for the user. All prototypes must be constructed in order to stimulate imagination, explore ideas and validate hypotheses, as a tool to build to think (Seidel & Fixson, 2013). It is interesting to emphasize that low-resolution prototyping also has the advantage of bringing a playful aspect to the experience so that the user feels more comfortable doing simulations.

Figure 2: Example of low-resolution prototyping of scenario and product, as part of a project between Tecnopuc Crialab and HP Inc. Brazil R&D Center. Source: the authors.

Still, in the planning phase (Figure 3) it is defined the recording media - which can be video, audio, and photography, for example - and tools of support - that will be used in specific parts of the interaction. These support tools are used jointly by the user and the researcher, and help the user to imagine hypothetical scenarios and to more fully demonstrate their thoughts, opinions, and feelings. Some examples of support tools are cards to help scenario creation, image sorting (Kumar, 2013) the emotional response test (Memória, 2006; Meurer, 2014), among others.

Finally, we recruit the participants to take part in the experiment and schedule them with enough intervals to reorganize the experience space, if this is the case. Recruited users must be within the profile traced in the context step, in the first phase. Recruitment does not necessarily need to be started at this stage but must be finished before the beginning of the next phase - again, it is emphasized that the phases have an iterative character, for better application of the method.

Figure 3: Plan Phase. Source: the authors.

Phase 3 - ACTION

The third phase of the method (Figure 4) is focused on the effective simulation of the experience that is being designed. In this phase, a pilot application of the experience with a few users is done to verify the operation of the scenario and the research protocols. Once this verification is done, the experiment will be applied according to the scheduled participants. This research procedure provides the testing, evaluation, and analysis of hypotheses, exploration of ideas, generation of insights or confirmation of facts already known (Hevner, March, Park, & Ram, 2004), so it is advantageous to perform this application in short rounds, interspersed with pauses for a reassessment of the protocols. Possible adjustments may occur in these reevaluation intervals, and these adjustments should be recorded for consideration in the final analysis. Throughout the application rounds, it is also essential to make sure all recording media are working so that the experiences simulated by each participant are registered so that they can be analyzed at the end of the research.

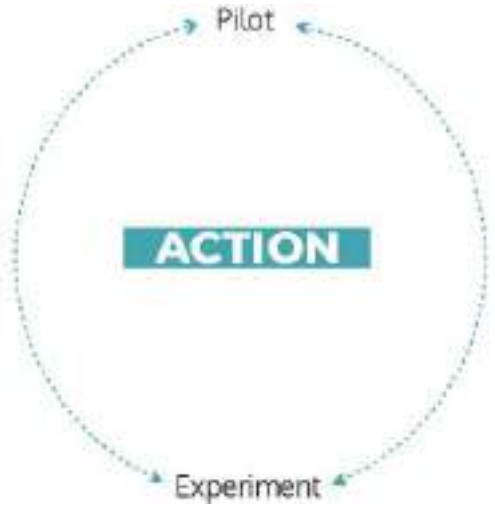

Figure 4: Action Phase. Source: the authors.

Phase 4 - ANALYSIS

The last step of the method refers to the analysis of the evidence generated with the application of the simulation of the experience (Figure 5). The analysis of the data obtained is done qualitatively since this approach allows to describe the complexity of the phenomena related to the objects of the study. For that, it is important to first make **transcriptions** of all the audios and select important parts and images from the videos

recorded - this is important to help to cross images and texts of the transcription later. Ideally, more than one video camera is used for recording the user in different angles. After that, evidence from each recording media (data from interviews and observation) are **crossed** and **categorized** and, finally, **analyzed.** The analyzed results are compiled, and **design principles** are generated. Design principles propose to transform the insights collected and generated into project recommendations and indicators for the development of a future solution related to the desired experience (Kumar, 2013).

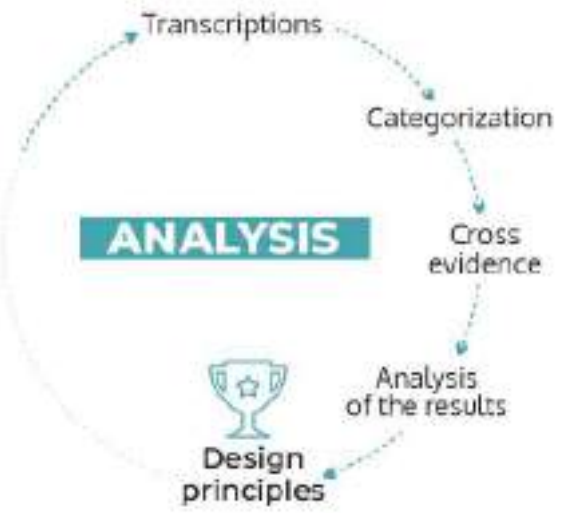

Figure 5: Analysis Phase. Source: the authors.

This method allows constant iterations throughout its application and predicts and suggests them especially in its central phases - plan and action. This means that the experience plan can be reviewed at any time, which will impact the application of the simulation with the users, resulting in a new version of the experience. This new version can take place whenever a change in the research process is defined, whether it is a new premise to be explored or the reformulation of an old one (Figure 6).

Figure 6: The four phases of the method. Source: the authors.

Discussion

After applying this method in several projects within the partnership between Tecnopuc Crialab and HP Inc. Brazil R&D Center, there are two relevant points that can be discussed. One refers to the participatory characteristic of this method, that is entirely based on the involvement of the users as co-creators of the product/service that is being tested or validated. Other refers to the contribution of its exploratory aspect to the design process.

According to Sanders (2002), there are many ways we can learn from people using research methods: we can listen to what people say, we can watch what people do, we can observe what people use, and we can interpret what people express and make inferences about what they think. Each method can reveal different

stories and peculiar aspects of the user's perceptions. But, seeing the whole picture is only possible putting these perspectives all together. As an example, listening to what people say in an interview can tell us just what they are able to express in words, as well as observing them while using a product can provide us just observable information. So special tools are needed to access the deeper levels of user expression, such as non-verbal ways of communicating. For that, bringing the user to create together is essential to understand what is truly meaningful to them (Sanders, 2002; Preece, Rogers, & Sharp, 2002).

This method was built and repeatedly tested to enable a scenario in which the users can simulate specific situations, interacting with product and environment prototypes, interacting with the researcher to freely talk about their perceptions, physically interfering in the prototypes in order to demonstrate new ideas, and, from that, using their imagination to immerse themselves in hypothetical situations. In this way, the designers and researchers not only interview and/or observe the users, but create with them, having as results a deep understanding of what people say (their thoughts), what people do (their actions), and what people make (their feelings and dreams), to create innovative and significant products/services (Sanders, 2002).

Another valuable point of this method is its exploratory aspect. The purpose of this method is not only to validate certain hypotheses related to the design problem but also to make new discoveries that will influence the design experience - and therefore it is considered to be explorative. As the simulations are applied with flexible scripts and protocols, the results obtained with this method can bring ideas to new projects, and start new research cycles.

Some advantages are perceived specifically in each method's phase. In the first phase, called "context", the stages of "behavior settings" and "technological interactions" stand out. It is suggested that these steps be carried out in sequence, as presented in the text, so that existing contracts between people and products already available in their contexts are not disrespected. That is, interaction with a known product has a clear purpose for the user, and this purpose must be considered when casting the eye of the technological interactions on the product or context in which it is inserted. The contract that a person has with a mirror, for example, is the reflection of his image, so it is not possible to conceive an experience in which the primary use of the mirror is no longer a place where the person sees his reflection for beauty and / or health purposes.

In the "plan" phase, the formulation of scripts and protocols associated with prototyping of products and scenarios gives a systemic perspective for the research under development. This clarifies and relates "what you want to know" with "how it will be asked to the user" and "what kind of experience it will simulate" in order to get the most out of this participatory interaction.

The presented method allows constant iterations throughout its application between all phases, and predicts and suggests them especially in its central stages ("plan" and "action"). This means that the planning can be reviewed at any time, which will impact the application of the experience with the users, resulting in a new version of the research experience. This iterative structure corroborates its characteristic of being open to the influence from the users' imaginative participation in its results. This influence might result in a new version of the under development experience and can take place whenever a change in the research process is defined, whether it is a new premise to be explored, the reformulation of an old, a new identified behavior setting, or new technological interaction that is considered.

The "action" phase, in which simulations of interactions with artifacts occur in visibly fictitious built environments, has shown to be efficient to verify user behaviors in interaction scenarios unknown by them. Still, this phase transcends verification, as it also encourages and supports imagination so that participants in the experiment can in fact project the future and imagine themselves in the simulated situation. As opposed to answers collected from interviews (or another traditional method of inquiry), for example, the comments of the participants become more spontaneous, without much prior elaboration before their speech, and therefore more reliable to their feelings and real opinions.

In the "analysis" phase, audio and video recordings make possible to observe behaviors that are not verbalized, from speeches, gestures, body and facial expressions that neither the user perceives himself to be doing or speaking. Interestingly, sometimes these gestures and expressions even contradict speech, which reaffirms the importance of a method that considers data triangulation. This triangulation give space for the manifestation of the paradoxes and idiosyncrasies of users, so the researcher can truly understand their needs and intentions. Thus, the phase called 'analysis' is qualified by the crossing of what the user consciously speaks, automatically does and unconsciously expresses while simulating the research experience.

It can be stated that the presented method is directed to research steps inserted in design processes, but it is not restricted to them. As a flexible method, it can be used for designing products and services, and also for validating existing products and services. When used for validation purposes, the 'context' phase may not be entirely applied, since hypothesis, behavior settings and technological interactions might have already been defined by the product in case. The method, when applied for conceptual purposes, adds value by its "build to think" characteristic, in which prototyping is used in moments of ideation for generating ideas and exploring unforeseen possibilities. When applied for validation purposes, its focus may be directed to the confirmation of product or service requirements.

Stands out the importance of the involvement and alignment of designers, engineers and developers in the conception of the design research focused on the user, strongly acting together in the phases "context" and "plan" so that the defined hypotheses at the beginning of the process are of common interest and cover questions related to the various areas involved in the design of the technological product or service. Structuring work in teams, joining skills, knowledge, attitudes and other personal characteristics is paramount for achieving the company's goals (Peeters-Baars, 2006). With this in mind, aspects of the experience simulation have a direct impact on its development (technological or not), leading to a review of priorities and adjustments in the requirements. The simplicity of the method allows the dimensions of the experiment to be rebuilt whenever necessary throughout the research process and works with the bias towards failing early and iterating fast. This way the process can be repeated several times, with low costs in terms of material and technological resources, which helps to deepen the design of the experience.

Final considerations

This article aimed to present a method that brings the approach of experience design applied to user centered design research, focusing on using low-resolution prototyping to create interactive meaningful experiences. With the repeated applications of this method in different project contexts, it is verified that the carefully planned simulations provide a deep immersion of the participants in the context of the project, which allows more significant contributions from the respondents, far from those resulting from traditional methods of inquiry such as interviews or focus groups.

Simulations help users visualize and understand the new technologies represented in the experience, and also to relate them to their daily lives, so they can assess their relevance and meaning in the midst of their routines. In addition, the application and registration of simulations with low- resolution prototypes are advantageous for the observation of small subtleties of user behavior, such as facial and body expressions that support or contradict speech, and which enrich the analysis of the research evidences.

Just as personas and scenarios help the imaginative process of designers, prototypes and simulations have the potential to do the same for users who are immersed in the co-creation process. The use of low-resolution prototypes proved to be efficient in stimulating the imagination of users, since it allows a higher level of abstraction, surpassing their previous experiences with related product or services and opening room for ideating new scenarios of usage. Also, low-resolution prototypes represent low costs in terms of material and technological resources, which enables new applications of the experience whenever necessary.

The method also transcends the idea of the designer as the only definer of the subject-object relationship within a system, since it has as fundamental the participation of the user. It is believed that the researcher is able to identify and report the tangible and intangible aspects assessed by the participant user from the simulations and interactions that he / she performs.

Finally, the usefulness of the method in several stages of technological product design processes is emphasized, since its iterative structure considers inputs of the users. We highlight the impact of the use of the method for the subsequent technological development, which then has as a starting point an experience (its artifacts and contexts of use) that is significant for the user of the solution under development.

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Track 5.a Introduction: Transforming Complexities through Design in Collaborative Community-based Processes

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Introduction

Complexity is a key characteristic of many participatory and community-oriented design activities. Designers' varied roles are being transformed as they have to manage the complexities and entanglements associated with global societal, technological and environmental change. As design turns towards a social mode of operation and application, this session 'Transforming Complexities through Design in Collaborative Community-based Processes' seeks to open a discourse on the role of design in managing the complexities that affect communities and individuals, alongside their attendant processes and practices. A range of approaches, skills and competencies currently demonstrated across instances and experiences of complexity, and across a range of contexts for collaborative and community-oriented design, are mapped through the contributions in this track.

Alongside design's traditional role of creating solutions, there is evidence of a shift towards a role for design in diagnosing, facilitating and aiding deeper understandings of the challenging contexts through which complexities emerge and are experienced by individuals and among communities across a variety of situations. The role of design in creating solutions that result from understanding, interpreting and analysing multi-disciplinary processes, whilst seeking to adapt to sensitive societal and political situations, is considered. The practical solutions and outcomes that can be produced when (sensitive) social complexities are managed through design are also explored. Practitioners and academics contributed discussions through case studies, methods, theories and initiatives that deal with complexities through design research and practice. The papers in this session introduction are presented according to the order of their presentation during the conference.

Topics that are explored in this session include the roles, skills and competencies of designers in mitigating complexities, in particular, those that emerge during collaborative processes and projects of community-oriented and practice-based design. Another topic explored is the complexities associated with design interventions that are aimed at social transformation and the opportunities they deliver for designers to envision new possibilities for better futures. The papers share insights into ways in which complexities affect upon both design researchers, the communities they collaborate with, and their impact on methods used in these collaborations. Additionally, some contributions consider the methods and methodological approaches for managing complexity or supporting community-oriented initiatives and in particular, with communities at the edge or margin, in transition or in a state of precarity. The discussions attempt to frame or suggest a potential way out or around the challenges that have been identified so that concrete guidance for others becomes a key outcome.

Complexity is often experienced locally, but common challenges exist across countries and within continents. DESIGNSCAPES is a European Commission funded project whose aim is to select a variety of promising ideas and projects across a number of European cities and provide them with the funding, support tools and mentoring to embed and implement design approaches to support their activities. Taking an approach of *emerging intervention,* the project aimed for an agility and flexibility that, given the complex scenarios, embraced change and would actively evolve in its own implementation. It was also grounded in local action between independent stakeholders thus providing its ascribed system behaviour, whilst the realities of dealing with and interacting with local contexts and agents in urban settings were carefully negotiated. These complexities unfolded by continuously documenting and analysing the stakeholders' 'change journeys' over a two-year period. This paper by Simeone, Drabble, Iacopini, van Dam, Morelli, de Götzen and Cullen presents a rigorous literature review on the significant role of Theory of Change and design in mitigating complexities and while a relatively formal strategy is presented, an argument is made for strategic flexibility and adaptability. Theory of Change was practically implemented and enabled in DESIGNSCAPES by a strategic kernel that allowed for the development of a diagnosis, thus guiding policy and actions that served as an effective logical tool for analysis. The approach stimulated agile adaptations to the intended actions when needed as it enabled the presentation of strategy in a simplified version that is easily understandable by stakeholders and external individuals. Additionally, as the strategy was not fully specified it allowed flexibility for the project partners to interpret and apply it according to their interests and needs. A critical view the paper presents towards a Theory of Change is that the approach was not necessarily reliable as a predictor for a project pathway. As the project is still ongoing, analyses of the project outcomes will enable a deeper examination of the potential of Theory of Change and the practical implications of its application in relation to a broad array of design-driven projects. This contribution is one regarding a complexity of opportunity in determining and framing, as well as of application as the contexts shift or change in response to conditions of implementation. The paper opens up discussions on human messiness and a necessary degree of flexibility and agility that are evident on the part of projects themselves, thus complexity can be perceived as something not always considerate of the more formal theoretical methods that might be used to attempt to understand and respond to it.

The complexities of local contexts, as we have seen, are often particularly challenging and such contexts are often relatively under-researched, in particular when they challenge researchers' own knowledges and experiences. The paper by Corsini, Aranda-Jan, Henderson and Moultrie describes a project which applies a participatory design approach in the context of design-for-development in the Global South and, more specifically, what they articulate as 'low-resource' settings (LRS). The paper presents the outcome of their initial systematic literature review that identifies a series of key challenges for such an application which they then map against an analysis of Simprints fieldwork data and interviews with three of the company's employees. Each of these activities looks to frame key challenges in the participatory design (PD) process and how it might have been addressed via a practical or tangible instance or experience. The results of this are a set of eleven key insights, which are discussed in some detail, making reference to both interview data and relevant literature. The authors outline what they feel is a theoretical gap they seek to address - that while there are PD approaches practiced in the Global North and models for methodological application in the Global South, little is available which illustrates or demonstrates an application within technologically-led design for development. The authors make use of a case study (Simprints) which allows for an overview of practical challenges and recommendations as to the use of PD in the complex contexts of LRS, where designer's lack of experience and unpreparedness is clear. Simprints develop biometric identification solutions for organisations developing mobile solutions for wicked problems: integrating fingerprint recognition into development projects, developed initially for patient identification in healthcare in Bangladesh and is being applied into other contexts in the Global South. Taking a PD approach from the outset, the founders quickly realised that there was little practically to help navigate the complex challenges of applying them within LRS. Thus, they set out to bring together research to develop a framework of insights, which act as guidance for future work and as a lens through which scenarios of complexity can be observed and understood. This contribution investigates how researchers may engage with the complexities under discussion. Complexities emerge at the limits of a designers' own experiences, thus they may consider the potential of what they do other than via direct participation in the context of application. As a result, opportunities to consider characteristics of complexity and systems for mitigating challenges or managing them, may emerge. The potential for developing the eleven insights into a workable toolkit or functional project-planning tool is clear - there is good evidence of synthesising a set of challenges that proactively and practically assist in these

complex and challenging scenarios. Research is important not only to address or manage complexity, but to reveal it given the 'unfinished' nature of much PD activities.

As we have seen, a discussion of complex scenarios can (and perhaps must) allow for a focus on the local and lived experiences of those whose needs might only be met by an engagement with, and exploration of, the potential of PD actions. The paper by Woo, Kim and Nam argues for the neighbourhood as a context for challenging designers in unique ways as local knowledge is the key to successful neighbourhood regeneration. The complex heterogeneity of stakeholders, multiple roles, new power relations and the role of residents as local experts with their own expertise can make it particularly difficult for designers to collect and coordinate local knowledge alongside any attempt to turn it into practical solutions. The paper is based on a thorough ethnographic study, and presents evidence that local businesses can have a major role in negotiating the complexities of regeneration projects, thus complementing designers' knowledge as well as helping to ease the challenges that they might face. Based on literature review, the paper presents three key roles of local businesses in participatory neighbourhood regeneration processes. Local knowledge is handled by a: 1) Possessor, 2) Processor and 3) Implementer. Possessors reveal undetermined and flexible local knowledge and inspire others by voluntarily providing their local knowledge for the use of the project. Processors conceive possible solutions, enable collaboration and set up spaces or conditions for cooperation. Implementers deliver and sustain the outcomes of a project. Local businesses can play important roles in discovering local community knowledge, processing it into useful design resources and incorporating it into participatory neighbourhood regeneration. The authors propose that: 1) Local businesses are reservoirs of local knowledge that can assist designers to collect diverse local knowledge, and 2) Local businesses are synergetic partners that can assist designers to mediate cooperation by using their social skills and human networks. A key theme emerging in this paper is of a complexity of the local, a necessity to identify and acknowledge power as it is situated and experienced, but also the potential to excavate knowledge within communities by drawing on local knowledge. The paper presents details concerning a modelling of how local knowledge might be positively mobilised and that co-operation is in itself a complex event.

Shifting perspective from the micro to the macro, Sedini argues for the strategic role of design to influence policy making alongside support from authorities and institutions to sustain the creation of social environments. This collaborative study that is situated within the Sister Cities Policy Programme, was developed by the School of Design of Politecnico di Milano, Institute of Design of Illinois and Institute of Technology of Chicago. The research investigates the complex relationships between design, manufacturing and social inclusion, with a specific focus on the maker's movement, (and again) ideas of locality and spaces within marginalised urban areas in Milan. This first stage of the research concludes that both making and design activities can be perceived as more inclusive and accessible, thus able to facilitate dialogue between different people and stakeholders. Additionally, making and design can stimulate social revitalisation due to the opportunities that emerge for marginal population groups with a positive impact on the creation of socially sustainable working environments. The contribution this paper makes to a discussion on how complexities can be transformed through design in collaborative community-based processes, is that being and acting from the local can activate partnership and dialogue. The need to develop methods to achieve these goals is the primary impact and well-considered in this contribution.

Developing these ideas of design having a role to play in the mitigation of complexities may foster innovation, entrepreneurship and collaboration amongst small-scale producers and designers. Working within and between communities at differing scale, the paper by Hertz presents research conducted with small and medium-sized footwear factories and organisations in Israel. The aim of the research is to identify challenges in the value chains of small and medium footwear factories. A significant insight in terms of a complexity developed by changes in scale of operations is that larger factories, who are more focused on production chains, become distanced from their users with the result that information from the users does not readily flow back to the company. The paper also looks to address how the roles, skills and competencies of designers, and design as such, can mitigate the complexities that emerge during collaborative processes. The proposed design solution aims to minimise the distance between the manufacturers by introducing suitable digital operations, access to digital marketing functions, including customer services and online selling sites. The suggested use of a digital platform that may offer new knowledge sharing and exchange regarding products and consumers, hopefully leads to a competitive advantage for the Israeli footwear industry. Additionally, the platform will serve as a joint R&D system with the potential to develop strategies, production methods, and innovative products, thus minimising the risks associated with investing in innovation by creating a co-production and co-R&D network for manufacturers. This paper's practical contribution to problem solving and

mitigating complexities within and amongst product producing communities is to draw on digital means to achieve a close-ness as opposed to more research-focused approaches found in other papers. This contribution is important for understanding why maintaining links with the local and with a user-derived context are paramount to success in small and medium-scale producer communities.

Design's power to encourage positive and meaningful connections and action is further discussed in the context of its potential for transitioning and transformation in the complex domains of organisational and social change. The authors Mysore and Gady argue for design as a social practice and it is in these complex contexts and dynamic environments that designers can play important roles as facilitators where the embeddedness of practices of facilitation in social design become a vehicle for transformative change. Drawing on a case study of an international design facilitation project managed by the UN Women's Fund for Gender Equality, the authors shed light on some of the critical features of a design-led facilitation process. These features include mediation, the navigation of systems of power and hierarchy within organisations, and important pre- and post-intervention activities during which designers also need to draw on their designerly abilities. The potential for a further development of design facilitation as a critical component in contemporary design practice is explored with the suggestion that it needs more and varied critical approaches together with robust models that are based on mediation and participatory processes. A design facilitation model is proposed as a means of 'working-with', a key need defined by complexities of the social and of how designers can identify and navigate power (as it is situated within pre-determined hierarchies of work and life). Designers have the skills necessary to manage instances and experiences of complexity - they are particularly suited to helping others with this. The contribution of this paper is that a specific context of complexity is addressed, relating to entrepreneurship with a key behavioural outcome (enabling) where methods of design thinking seem particularly suited to help manage this context.

Holierhoek and Price discuss complexity at the logical level of policy making and proposes some reflections on the role and contribution design can offer. The paper conducts a literature review looking at two fronts: 1) Proposing a wicked problems perspective to understand a possible approach to the solution of complex societal problems, and 2) Analysing the design activity as a non-linear problem solving process, which may prove to be more effective in dealing with the complexity of wicked problems. In the second part of the paper the authors analyse two case studies of public design labs, Helsinki Design Lab and MindLab (Copenhagen), to clarify the contribution design can provide to the definition of a new approach to policy making. Design, on the other hand, has been dealing with increasingly complex problems and are now moving to a level of complexity that is also common to policy making. Yet, there is no unified view of how design could contribute to policy making, which role this discipline can have and what specific design competences can contribute to a new way of working. The approaches considered in the two design labs were quite different: In Helsinki complexity was faced by reproducing a similar level of complexity in multidisciplinary teams, whereas the focus of MindLab was to introduce aspects and tools of design to policy makers in order to promote actions that cut across the traditional silo structure of public administration. The analysis of the two cases suggests some common characteristics of design action, namely to be user-centred, iterative, interdisciplinary, and to facilitate collaboration and participation. Additional aspects emerged from the specific cases: The multidisciplinary collaboration in Helsinki highlighted the role of designers in breaking through knowledge and policy domain silos. This was also possible through the designers' typical exploration strategy that is non-linear, and based on the creation of provisional solutions. The user-centred approach in Copenhagen instead, put the civil servant in a better position to develop empathy with the subjects of the policies. Although the focus of design action is moving towards more complex problems - and thus tends to meet the instances of policy makers – the specific contribution that design can provide to policy making, in terms of competences and tools, has not been clearly defined. This is where this paper offers a significant contribution. Competences and strategies considered in the two cases analysed in this paper offer fertile ground for clarifying the contributions that designers can offer to policy makers and the role design can have when working at this level of complexity.

By bringing together the experiences of researchers and practitioners, and the suggestions made by literature, the insights reflect on the complex nature of participatory approaches that are relevant for engaging with participants in and through the design process. Being able to identify and respond to stakeholder needs, including the designers themselves, enables the mapping of expectations against project and work objectives. The necessary ambiguity of participatory work, such as imagining, responding to unfinished ideas, and needs for visualization, generating an understanding of local contexts and culture, in addition to sensitive time-management strategies, relationship-building and the uncovering of issues of where power resides (between designers and stakeholders and within the stakeholder communities) inform the responses to stakeholder

needs. Thus, planning for user-testing and evaluation underscores the importance of risk awareness. Often opportunities can be identified for applying designerly ways of thinking and problem-solving in complex situations (although the contribution of design often reaches significantly further). The contributions in this conference session opens a process of offering suggestions, models, methodologies and tools through which complex problems (and their equally complex scenarios and contexts) can begin to be addressed and the processes for managing and gaining insights and new knowledge are able to emerge.

Articulating a strategic approach to face complexity in design projects: The role of Theory of Change

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In today's world of global wicked problems, constraints and imperatives imposed by an external and uncertain environment render strategic action a quite complex endeavour. Since the 1990s, within community initiatives and philanthropic projects, the construct of Theory of Change has been used to address such complexity. Theory of Change can be defined as the systematic and cumulative study of the links between the activities, outcomes, and context of an intervention. The area of focus for this paper is to explore whether Theory of Change can support more strategic approaches in design. In particular, the paper examines how Theory of Change was applied to DESIGNSCAPES - a project oriented, among other things, toward offering a supporting service for all those city actors interested in using design to develop urban innovation initiatives that tackle complex issues of broad concern.

Keywords: Theory of Change, design strategy, strategy, DESIGNSCAPES

Aims

In today's world of global wicked problems (Rittel and Webber, 1973) such as climate change, social exclusion, economic crisis, and quality of life, design can help frame such problems and work towards solutions. Design can play a role in "sustaining, developing, and integrating human beings into broader ecological and cultural environments, shaping these environments when desirable and possible or adapting to them when necessary" (Buchanan, 1992, p. 10). In most cases, a single design solution is insufficient to address wicked problems, especially when these problems are ultimately global in nature. Instead, a series of concurrent, overlapping design interventions are needed. As such, planning and coordination become a central part of design activities (Boland and Collopy, 2004; Simeone, 2016) especially when intransigent issues or wicked problems are to be addressed systematically as to trigger multiplier effects.

How this coordination is organized is a matter of strategy, seen as a way of "discovering the critical factors in a situation and designing a way of coordinating and focusing actions to deal with those factors" (Rumelt, 2011, p. 3). For long, studies in strategy have acknowledged that the influence of external and unpredictable factors can highly affect even the best-executed plans (Mintzberg, 1994b). Strategy is a paradoxical process where the more organizations plan ahead for success (e.g. committing resources, developing specific capabilities, etc.), the more they may actually increase their chances for failure as the future is uncertain and unpredictable (Raynor, 2007). This is why John Friend and Allen Hickling argued that strategy should accommodate uncertainty and elaborate complexity rather than simplify and reduce it (Friend & Hickling, 2012).

One particular way to elaborate such complexity and improve the quality of planning is by using a framework labelled as Theory of Change (Anderson, 2004). Theory of Change emerged within community initiatives and philanthropic projects in the 1990s and has since been used for planning and evaluating social practice (Stein & Valters, 2012). Broadly, a Theory of Change approach is a process of identifying the current situation (in terms of needs and opportunities), the intended future result (expected or hoped for outcomes), and what needs to happen to move from one situation to the other (Rogers, 2014). The articulation of this 'change journey' through the use of Theory of Change can help identify more realistic goals and the strategies required to achieve the goals (Rogers, 2014). Interest in, and use of, Theory of Change as a programme/policy planning and evaluation tool has increased exponentially, as has the explicit link between Theory of Change approach and complexity (Ling, 2012; Rogers, 2008).

Even though the need to reflect upon theories of change has been deemed as necessary to craft strategies (Mintzberg, 1987) and Theory of Change has been examined as a way to support strategic approaches, e.g. in strategic negotiations (Walton, Cutcher-Gershenfeld, & McKersie, 2000), the nexus between Theory of Change and strategy remains understudied.

Within design research, strategy has long been a central theme explored from various angles (Borja de Mozota, 2003; Boztepe, 2016; Heskett, 2017; Kotler and Rath, 1984; Lockwood and Walton, 2008, Simeone, 2017). However, fewer authors more specifically focused on the ways in which a strategic approach in design could tackle complexity and unpredictable external conditions (Cross, 2008; McCullagh, 2008) and help to deal with systems influenced by a great variety of factors (Meroni, 2008). To this end, it has been suggested that design needs to make more explicit use of Theory of Change (Tonkinwise, 2015). This paper goes precisely in this direction and, as a main research question, aims to explore whether and how Theory of Change can support the articulation of strategy in design. As a case, the paper will look into DESIGNSCAPES, a European Commission-funded project oriented, among other things, toward offering a supporting service for all those city actors interested in using design to develop urban innovation projects and tackle broad problems of a complex and wicked nature. At its heart, DESIGNSCAPES acknowledges the generative potential of urban environments – or urban ecosystems (Peltoniemi & Vuori, 2004) – in which design can support collaborative and innovation processes that engage a variety of actors, including enterprises, start-up companies, NGOs, community-based initiatives, public authorities and agencies (Abbasi et al., 2019). This paper follows the 'change journey' that DESIGNSCAPES intends to spur by supporting these actors in their projects to make our cities more liveable, sustainable and prosperous.

Literature review

Designing for complexity

In this paper, we refer to design as a process to identify, frame and address problems and that uses modelling as an analytic approach to create and evaluate multiple alternatives and a wide solution space (Conley, 2010). Design generally harnesses divergent and convergent thinking (Brown, 2009) through an array of tools, methods, techniques and activities such as early, rapid and frequent prototyping, iterative development, visualization / materialisation techniques at varying levels of abstraction and user research, participation and testing (Buchanan, 2004).

For many years, researchers have explored how such design approaches could be used to tackle contemporary global wicked problems. The notion of 'wicked problems' was formulated by Horst W. J. Rittel in the 1960s and later further developed with Melvin M. Webber to indicate the complexity of some of the problems tackled by design as per their incomplete, contradictory, and changing nature (Rittel and Webber, 1973). Reflecting upon the ideas presented by Rittel and Webber, Richard Coyne (Coyne, 2005) noted how the notion of a wicked problem was formulated as a reaction to Herbert Simon's rationalistic proposition of a "science of design, a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process" (Simon [1969], 1982, p. 58). Against this rationalistic view, the notion of wicked problems more clearly represents those situations characterized by a high level of indeterminacy and in which multiple and conflicting points of view emerge (Buchanan 1992; Teixeira, 2017; Bayazit, 2004). The related conceptualization of VUCA - short for volatility, uncertainty, complexity, and ambiguity (Bennet & Lemoine, 2014) – has gained popularity not only in management studies but also among those scholars more closely interested in how the interplay of strategy and design – as an array of tools, methods, techniques and activities and as a way of thinking (Brown, 2009) - can help organizations to cope with global competition,

geographically distributed supply chains and the growing centrality and proliferation of data (Lafley & Martin, 2013).

In design, one way of dealing with such complexity is to adopt strategic approaches which deliberately acknowledge that plans and decisions are often affected by a certain degree of uncertainty and confusion, turbulence and volatility, pressure of urgency and, possibly, cognitive and emotional overload (Friend and Hickling, 2012). Such strategic approaches might value those design processes that are open to emergent opportunities and that specifically design flexibility into the proposed solutions (Liedtka, 2002).

Strategy articulation and the strategic kernel

Definitions of the word 'strategy' in design differ, even though recurrent components of strategy can be considered: (1) being aware of resources and capabilities (Barney, 2001; Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997) in the designer's hands and knowing where to direct effort and energies, (2) the related ability to frame complex problems as to identify a set of objectives that can be realistically reached (Rumelt, 2011), (3) being aware of the competitive context and the limiting circumstances in which our actions unfold, e.g. competitors or external factors that might affect our plans (Mintzberg, 1994a) and (4) the processes for defining and implementing sets of actions that take into consideration all the above. A recent systematic survey of literature carried out by one of the authors of this paper found that a consensus and quite broad definition of strategy is: "finding a balance between ends, means and ways while keeping an eye on risks as to achieve the impact needed to address a challenge".

Overall, within design research, strategy has long been a central theme explored from various angles and with contributions ranging from engineering design (Holt, 1991; Hsu, 2009), to design management (Boztepe, 2016; Cooper, Junginger, & Lockwood, 2011; Lockwood & Walton, 2008), and all the way up to collaborative design (Hyysalo & Hyysalo, 2018) and architecture and urban planning (Hill, 2012; Kempenaar & van den Brink, 2018). This paper is concerned with the specific processes of strategy articulation, i.e. those processes in which strategy is more or less strictly and explicitly identified and described, e.g. in relation to key ideas, directions to follow, goals and expected results (Love, Priem, & Lumpkin, 2002). In this sense, articulation is regarded as a discursive practice in which representations of what the organization "has been, is, and will be doing" (Mirabeau & Maguire, 2014, p. 1219) are formulated, but also circulated among stakeholders and subjected to their various interpretations. Rather than considering these processes as confined to the initial phases of a project, strategy articulation should be seen as an iterative process in which strategy is continuously re-evaluated and re-adjusted along the way and in relation to the impact of external and unpredictable factors (Liedtka, 2002; McCullagh, 2008; Mintzberg, 1978).

Methods and approaches to articulate strategy abound across fields as diverse as corporate (Andrews, 1971; Ansoff, 1965; Johnson, Whittington, Scholes, Angwin, & Regnér, 2017; Porter, 1980), political (Freedman, 2013) and military strategy (Echevarria, 2017). We will here consider as a starting point of our considerations the approach proposed by Richard Rumelt (Rumelt, 2011), which has spurred further reflections on what constitutes good and bad strategy (Freedman, 2013). Rumelt argues that at the center of good strategy there is a kernel, a coherent logical structure that connects thought and action:

> *Good strategy is coherent action backed up by an argument, an effective mixture of thought and action with a basic underlying structure I call the kernel. […] The kernel of a strategy contains three elements: (1) A diagnosis that defines or explains the nature of the challenge. […] (2) A guiding policy [that is] an overall approach chosen to cope with or overcome the obstacles identified in the diagnosis. […] (3) A set of coherent actions to carry out the guiding policy (Rumelt, 2011, p. 77).*

In the words of Rumelt, coherent actions are those feasible coordinated policies, resource commitments, and actions that are designed to carry out the guiding policy and that are aimed toward reaching long-term objectives or closer proximate objectives. In DESIGNSCAPES, the strategic kernel proposed by Rumelt has been used to initially frame the strategic approach of the project. The subsequent application of Theory of Change allowed to further articulate strategy and to more fully develop the logical connection between the various components of such strategy.

Theory of Change

Theory of Change emerged in the mid-1990s within the Aspen Institute Roundtable on Community Change as a new way of analyzing complex community initiatives working for social and political change. In a publication developed by the Roundtable in 1995, *New Approaches to Evaluating Comprehensive Community Initiatives*, Carol Weiss, an evaluation practitioner and methodologist, argued that a key reason complex social programs are so challenging to evaluate is that the assumptions and theories about how change will unfold as a result of them are poorly articulated (Weiss, 1995). The consequence, she argued, is that little attention is placed on articulating the steps required to achieve a long-term goal. Theory of Change therefore emerged as a way of overcoming this challenge by describing "a process of planned social change, from the assumptions that guide its design to the long-term goals it seeks to achieve" (Mackinnon & Amott, 2006, p. 2).

Overall, the core idea behind theories of change is that they define a sequence where one step (or one activity) leads to another one through cause-and-effect connections. The Tavistock Institute defines Theory of Change as a process which:

> *(...) involves the specification of an explicit theory of how and why an intervention might cause an effect which is used to guide the evaluation. It does this by investigating the causal relationships between context-input-output-outcomes-impact in order to understand the combination of factors that has led to the intended or unintended outcomes and impacts. Theory of Change, therefore, tests, and normally develops the implementation theory of an intervention and allows this to be modified or refined through the evaluation process* (Cullen, Iacopini, Junge, *&* Spielhofer, 2018)

Theory of Change is, on the one hand, a strategic planning tool. It articulates and graphically illustrates the intervention logic of a project, in other words the steps that need to be taken to realise a desired goal or impact, and the expected results of these steps. Theory of Change builds on a set of assumptions and hypotheses about what causes a problem, what particular actions will change that problem and what are the likely outcomes of these changes. In other words, it articulates a project's 'change journey', and shows the theorised causal pathways between a project's objectives, its activities, and its expected outcomes and impacts. It says: "if we take action X, then this will cause effect Y and this will eventually lead to outcome Z" (Cullen, Iacopini, Junge & Spielhofer, 2018). Theory of Change is, therefore, also a key evaluation tool because data collected along the way enables these assumed causal pathways to be tested. After the problem, project aim, expected outcomes and activities are mapped for a project, indicators should be developed to "assess progress and achievements along the 'change journey', and will be used to test the theory" (Cullen, Iacopini, Junge & Spielhofer, 2018). The integral link between Theory of Change and indicator development means that Theory of Change is a useful tool for both strategic planning and continual improvement. As Weiss stated, "The evaluation should surface those theories and lay them out in as fine detail as possible, identifying all the assumptions (…) built into the program. The evaluators then construct methods for data collection and analysis to track the unfolding of the assumptions" (Weiss, 1995, p. 67). This, in turn, opens up the possibility for assumptions to be modified or refined through the evaluation process, supporting the refinement of a strategy or initiative.

A good number of methods are nowadays available to help crafting theories of change for specific projects or programs. Although these methods build on slightly different conceptual theorizations, they share the idea that a Theory of Change should articulate logical steps that lead to change.

Theory of Change has been criticised on the ground that it might oversimplify complex contexts of interventions (Ruesga, 2010) and might not decisively contribute to clarify ill-defined issues (Stein & Valters, 2012). A way to address these issues is to keep a critical eye while taking into account beliefs and assumptions underlying a specific Theory of Change (Archibald, Sharrock, Buckley, & Cook, 2016) and while drawing sequences of steps and related cause-and-effect connections (Ruesga, 2010). Along these lines, DESIGNSCAPES proposed its own model for Theory of Change as "a way of mapping the 'change journey' of a project or innovation so you can see the connections between the 'presenting problem' the project wants to solve, the expected impact on that problem at the end of the project and everything that's supposed to happen in between" (Cullen, Iacopini, Junge & Spielhofer, 2018). Figure 1 shows an overview of the steps needed to identify the five key elements of a Theory of Change for a specific project.

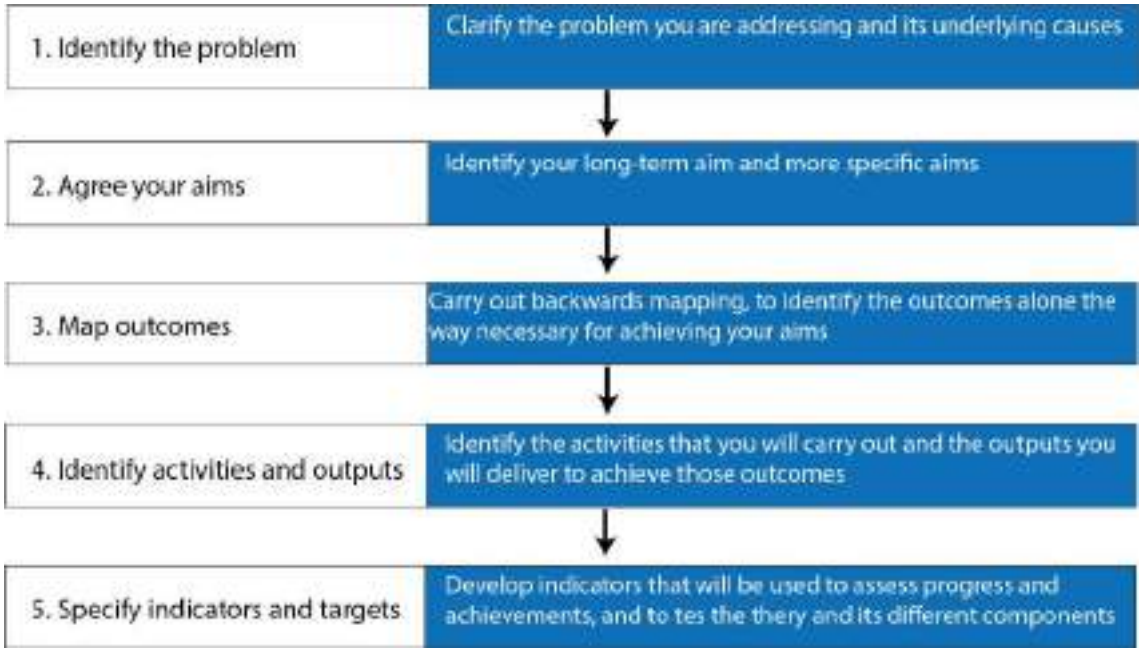

Figure 1 Steps needed to identify the five key elements of a Theory of Change for a specific project. Source: Adapted from Cullen, J., Iacopini, G., Junge, K., and Spielhofer, T (2017)

In the next sections, we will more closely look into how Theory of Change has been applied in DESIGNSCAPES.

Research approach

Methods

This paper uses a case study approach (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2009) which allows analyzing the phenomenon with a certain degree of depth and which is suited to the exploratory nature of this research. Case studies allow identifying key insights over time (Paré, 2004) and work especially when the focus is on a contemporary phenomenon within real-life contexts (Yin, 2009). Case studies have been steadily used in organizational studies in the past decades (Berg, 1968) and more recently (Breslin and Buchanan, 2008, and scholars analyzed the relevance and the limitations of this approach (Dasgupta, 2015).

The authors of the paper are active members of the DESIGNSCAPES consortium and directly contributed to the definition and the development of this project, also through the methods and tools here presented. This role gave the authors the chance to gather data during the first two years of the project, also using ethnographically-inspired methods (Czarniawska, 2012).

The case

DESIGNSCAPES is a project funded by the European Commission and carried out by an international consortium that brings together a group of researchers with backgrounds in design-enabled innovation in cities and urban contexts, expertise in stakeholder involvement, collaborative research and learning processes and experience in linking practice, evaluation, policy and research. One of the core ideas of DESIGNSCAPES – inspired by the work of Jane Jacobs (1969) - is that cities offer particularly promising environments in which local design-driven projects can spur creativity and innovation, improve performance and efficiency (and hence increase the competitiveness of European organizations) and tackle wicked problems and important issues of broad concern. The overarching aim of DESIGNSCAPES is to select a number of promising ideas and projects from various European cities, to provide them with some direct funding and to support them with mentoring and coaching activities on how to use design approaches and methods. In more practical terms, DESIGNSCAPES organizes various open calls in which it asks European enterprises, start-up companies, NGOs and public authorities to submit a description of their design-driven projects. DESIGNSCAPES then selects a total of about 100 projects and backs them through (1) funding up to 25.000 euro, (2) a series of freely

distributed publications, toolboxes and training modules on how to use design methods and tools to support urban innovation processes and (3) a mentorship program.

DESIGNSCAPES acknowledges that the organizations behind these design-driven projects carry out their activities not as isolated entities, but rather as components of a business and innovation ecosystem, i.e. an interconnected population of organizations in which single units are strictly interdependent and influence the whole system (Peltoniemi and Vuori, 2004). Urban innovation has to do with processes of co-creation that actively seek the inclusion of diverse actors. This is why DESIGNSCAPES is particularly interested in supporting those projects that heavily rely on collaborative processes and local communities. The 'change journey' that DESIGNSCAPES intends to spur is precisely a change in some existing business and innovation ecosystems of European cities by offering funding and support to those design-driven projects that have the potential not only to tackle local urban issues, but also to propose solutions that can be scaled and replicated in other urban environments.

A number of factors demonstrate the complexity of DESIGNSCAPES. First, DESIGNSCAPES is embedded in open systems thinking, where a system interacts with internal and external agents to the degree that boundaries are fluid. The funded design-driven projects and interested stakeholders form a dynamic innovation ecosystem which is characterized by a continual realignment of synergistic relationships of people, knowledge, and resources that promote harmonious growth of the system in agile responsiveness to changing internal and external forces. Therefore, DESIGNSCAPES has three complexity based attributes: an emerging intervention which changes and evolves as it is implemented; local interaction between independent units which give rise to system behaviour; and context matters due to local agents interacting in urban settings.

Analytical description of the case

Definition of the strategic kernel

The strategic kernel of DESIGNSCAPES was initially codified in the proposal that the consortium wrote in relation to a call for funding issued by the European Commission in 2015[1]. The strategic kernel initially elaborated in the DESIGNSCAPES proposal can be summarized in Table 1.

Table 1. The strategic kernel of DESIGNSCAPES

A *diagnosis* that defines or explains the nature of the challenge:	The specific challenge to be addressed is that a good number of European organizations miss out on the potential to utilise design as a source for improving their efficiency, stimulating growth and tackling current urban issues and wicked problems.
A *guiding policy* [that is] an overall approach chosen to cope with or overcome the obstacles identified in the diagnosis:	Offering a supporting service that provides these organizations with some funding and with some design-based approaches and methods that help them tap into the generative potential of existing urban ecosystems.
A *set of coherent actions* to carry out the guiding policy:	- Set-up of an open call that offers financial support and mentorship for about 100 design-driven urban innovation projects - Creation and free distribution of a design toolbox and of an evaluation toolbox for urban design-enabled innovation and some related training modules - Creation and free distribution of a series of reports and studies on urban design-enabled innovation (e.g., reports

[1] *http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/co-creation-02-2016.html accessed 21 November 2018.*

	on the results of the open calls, a white paper focused on policy implications and recommendations, city snapshots and academic and popular press publications)

This strategic kernel was further specified in relation to work packages, deliverables and milestones needed to operationalize the whole DESIGNSCAPES project.

However, the articulation of strategy as stemming from this kernel has some limitations which restricted its utility. First, whilst problem, actions and rationale are shortly articulated, a more fine-grained definition of outcomes and impacts is missing. Second, the links between aspects of the coordinated actions are unclear in terms of which steps are necessary and what these steps are a result of. As such, rather than a 'change journey', the kernel provides a logical flow that expresses a linear relation between diagnosis, guiding policy and actions. Third, the underlying assumptions of the programme, where existing knowledge is low or where the model contains risks, are not articulated. Finally, the strategic kernel is not iterative and it is difficult to use as a data collection tool.

For all these reasons, DESIGNSCAPES used Theory of Change to further articulate its strategy.

Application of Theory of Change

In this project, Theory of Change provides a transferable tool to enable i) the partners of the consortium to understand DESIGNSCAPES and its 'change journey', and ii) the stakeholders in the selected design-driven projects to identify the presenting problem they want to change; the desired solution at the end of their project (the project impact) and the steps required to get from problem to solution (activities, outputs and outcomes). In other terms, it is the main data gathering tool to assess the effectiveness and added value of design in the innovation process and its contribution to efficiency and competitiveness.

The Theory of Change is used to shape the plan of the whole DESIGNSCAPES as well as to aid with the evaluation of it, and as a subject of training for the 100 design-driven projects. The Theory of Change articulates the stages of DESIGNSCAPES and the premises underlying the project and guides the project whilst being adapted to changes in circumstance as it is frequently redrawn and reconceptualised. For example, the selection of the design-driven projects to be funded, the training topics, and the dissemination strategy are all considered to be causally interlinked and are considered stages towards the ultimate goals of the project.

The project is still in progress and its most recent Theory of Change articulation is presented in Figure 2.

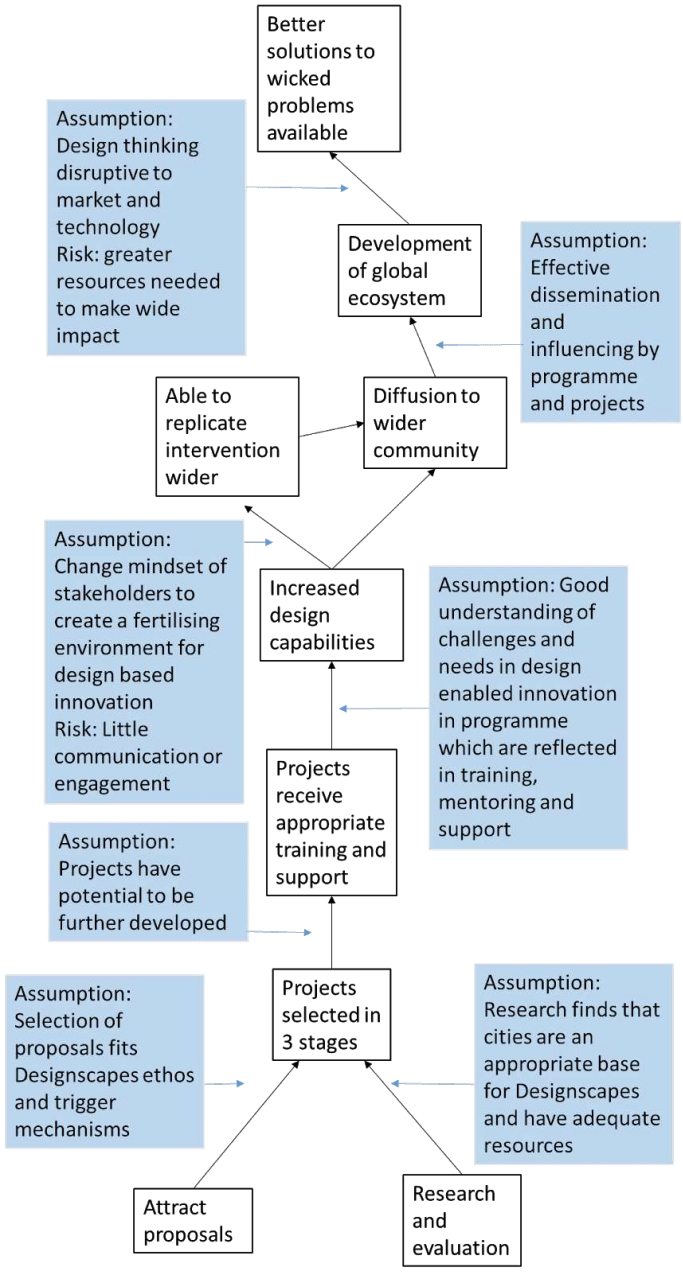

Figure 2 Articulation of Theory of Change for DESIGNSCAPES

The Theory of Change articulated above splits DESIGNSCAPES into seven stages, some of which occur beyond the life-time of the project. These stages are: research and marketing; selection of design-driven projects; training and support of design-driven projects; improvement in design capabilities; replication and diffusion; ecosystem development; and new robust solutions to wicked problems. Each of these stages is along a critical pathway and the stages are causally linked: for example, without appropriate support, project staff will not be able to improve their design capabilities. The assumptions underlying the Theory of Change ladder towards wider impact are articulated for each stage.

As an example of how Theory of Change can shape a project as well as describe it, an early assumption in the Theory of Change is that "selection of proposals fits DESIGNSCAPES ethos". If this assumption is fulfilled, the funded projects will be able to trigger a social movement. The development of local social movements is crucial to achieving later outcomes such as the development of a global ecosystem and the diffusion of innovations. If the approved design-driven projects are not focused on core values such as co-creation and social inclusion, then DESIGNSCAPES will struggle to achieve crucial outcomes; this may mean that DESIGNSCAPES must set up alternative levers and mechanisms to disseminate the innovations funded.

Because this assumption was identified at an early stage, the guidance for the jury members in charge of selection the design-driven projects to be funded was tailored to help fulfil the assumption through assessment questions. These questions asses whether the application submitted to the DESIGNSCAPES open call support co-creation in their proposals:

- Are people, users or citizens put in the centre of the innovation?
- Are users/citizens involved in the development and initiating the project idea?
- Is there any explicit co-creation planned with citizens, consumers or users?

By having an evaluation which uses the Theory of Change, the change potential of these design-driven projects is more likely to be realised. The evaluation assesses the programme – also through indicators and targets - whilst holding it accountable to the theory outlined in the model. By predicting areas of difficulty, plans are more likely to account for these potential issues.

Discussion and conclusions

DESIGNSCAPES is still in progress and various versions of its Theory of Change are being articulated over time. The first batch of design-driven projects are being selected and supporting material and processes are in place or are being finalized (e.g. freely available design toolboxes, training modules, mentorship programmes). While DESIGNSCAPES progresses, we will be able to more fully assess the impact of Theory of Change in the articulation of strategy and in relation to the outcomes of the project. However, we can already share some preliminary considerations.

The strategic kernel that, at an initial stage, was used to describe DESIGNSCAPES in the original application for the European Commission (Table 1) worked quite well to communicate the key strategic orientation of the project. The strategic kernel quite clearly represented the main challenge to tackle, the guiding policy to address such challenge and the related key actions to implement such policy. However, the strategic kernel expressed the relation between these components as a linear logical flow. As such, it did not fully render the complex interactions occurring during the envisioned 'change journey'. Theory of Change worked much better as an instrument to map the assumptions and hypotheses behind the main stages of DESIGNSCAPES and the causal relations among them.

In the 'Literature review' section, we characterized 'strategy articulation' as a process in which strategy is more or less strictly and explicitly identified and described. In DESIGNSCAPES, the strategic kernel provided a simplified and somewhat underspecified articulation. This kernel represented the DESIGNSCAPES strategy as a cascading flow (Table 1). Conversely, the strategy articulated by Theory of Change (Figure 2) is more of a reticular nature. Stages, assumptions and risks are mapped throughout a journey in which it is possible to see dependencies and linkages. While the logic suggested by the kernel is linear, the Theory of Change provides a more spatially distributed articulation in which the temporal dimension (i.e. the progression from one stage to the other) is plotted as to show stages as simultaneous, interdependent or sequential. In other terms, Theory of Change allows working with visual diagrams that articulate strategy at a more fine-grained level.

As Figure 2 above displayed, assumptions underlying a project are crucial to a Theory of Change. Whilst the strategic kernel outlines the overall plan of a project, the underlying rationale or potential flaws remain implicit. The Theory of Change makes these dependencies clear through outlining the implicit assumptions of the whole project logic, which are often unconsciously held by participants, yet are crucial to the success of a project. The Theory of Change model demonstrates that, at each stage of DESIGNSCAPES and before the outcomes can be achieved, the project must address the underlying assumptions. In addition, the theory on which DESIGNSCAPES has been based was inspired by Jane Jacobs (1969) and much of the success of the project will rely on the veracity of her theories as applied to European cities. Therefore, the theoretical aspects of any intervention are laid bare and testable in real-world settings.

The staging of Theory of Change is also worth consideration. Theory of Change requires participants to be specific as to hone an intervention in a clear and explicit way. This is often difficult to do at programme inception when the wider ecosystem that an intervention will be working within remains largely unknown. Because the strategic kernel is a more open and generalised tool, it may be a better starting point for a design strategy as has been the case in DESIGNSCAPES. The adoption of the kernel at an initial phase of DESIGNSCAPES was particularly suitable for at least two reasons: (1) it allowed to present a simplified version of the strategy in a way that was easier to understand by external people, e.g. the EU reviewers (i.e. of the call from which DESIGNSCAPES got funding) that, presumably, had very little time to read and evaluate many

applications; (2) the fact that strategy was not fully specified also allowed the project partners to interpret it in light of their interests, needs and agendas thus avoiding tensions and conflicts in the nascent consortium.

In DESIGNSCAPES, the integration of strategic kernel and Theory of Change helped to articulate strategy at different levels of refinement in relation to the needs of different phases of a project. Possibly, such integration worked particularly well precisely because it allowed to represent strategy at varying levels of abstraction and to translate such strategy for different stakeholders.

In addition, Theory of Change was introduced in DESIGNSCAPES by the Tavistock Institute, one of the partners of the consortium. Other partners of the consortium - some European design schools - were particularly intrigued by the possibility offered by Theory of Change to spatially and temporally visualize strategy in an iterative way. Such design schools saw Theory of Change as a way to use modeling - i.e. various visualizations of the articulation of strategy - as an analytical tool to more fully explore various strategic pathways and alternatives.

Theory of Change is not infallible or even necessarily reliable as a predictor for a project pathway. The assumptions outlined in a strategy are made without hindsight so it is difficult to predict the assumptions. Indeed, the reliability of a specific theory of change is a useful data collection point because if the theory maps poorly to 'reality' it can be an indication that the underlying premises of a project made poor assumptions. This is a particular risk in the complex contexts that projects are articulated within since there are almost always unintended outcomes for the activities undertaken.

However, the identification of poor assumptions and of where causal logic breaks down highlights a further strength of the Theory of Change approach: its iterative nature. In DESIGNSCAPES, the Theory of Change is revisited frequently, by the evaluation team and as a whole consortium at face to face meetings. This allows the project to understand where key blockages and success factors are so that the project team can adapt to circumstances and data as it is uncovered, rather than spend the funding period making similar mistakes.

We conclude this paper by highlighting an important shortcoming of the current study. While the usefulness of Theory of Change (e.g. for strategy and/or program planning, evaluation, reaching shared understandings) has amply been written about, DESIGNSCAPES is still ongoing. As such, future and deeper analyses of the project outcomes will allow a fuller examination of the potential of Theory of Change and the practical implications of its application in relation to a broad array of design-driven projects. This will also probably give us the opportunity to more closely assess some of the critiques presented in academic literature against Theory of Change (e.g. that it might oversimplify complex contexts of interventions). In its current iteration, the paper intends to present preliminary rather than conclusive considerations on how Theory of Change can help address some of the complexity specifically associated with collaborative and community-oriented design.

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Research Perspectives IN THE ERA OF Transformations

Recommendations for participatory design in low-resource settings: a case study of Simprints

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Participatory design is a widely recognised approach in Design for Development projects. It supports collaborative, community-based practices and it empowers users to take ownership. Despite the importance of participatory design in solving global challenges, the majority of research has focused its application in the Global North. Recently, some studies have explored participatory design methods in more low-resource settings. Still there is a gap between the existence of these methods, and designers being able to use them successfully because of the complex realities they face in low-resource settings. Existing knowledge is fragmented and there is a lack of best practice guidance for practitioners using participatory design in low-resource settings. We address this problem by reporting the experiences of Simprints, a technology company based in the UK, providing biometric identification solutions in the Global South. Our study reveals key recommendations for participatory design in low-resource settings, providing useful insights for practitioners and design researchers.

Keywords: participatory design, development, low resource, Global South, developing countries

Introduction

Design for Development (DfD) is a rapidly growing field in design research and practice (Margolin, 2007; Whitehead et al., 2014). DfD is defined as the process of designing products or services aiming to satisfy the needs and improve the wellbeing of disadvantaged or marginalised populations living in low-resource settings (LRSs) (Donaldson, 2009). Schumacher's 1973 publication *Small is beautiful* and Papanek's 1985 publication *Designing for the real world* marked an ontological turn in design, focusing on user needs and their surroundings. Since then, design practice has seen an increasing interest in participatory design (PD) (Björgvinsson et al., 2010). PD is particularly relevant to DfD as it leverages users' socio-cultural insights (Fuge, 2015), whilst empowering users (Puri et al., 2009) and supporting local ownership (Braa, 1996).

Despite the importance of PD in DfD, most research has focused on its practice in the Global North (Kraff, 2018). This limits the relevance of existing knowledge, as DfD contexts are vastly different (Aranda-Jan et al., 2016). Recently, a handful of studies have explored PD methods specifically aimed at use in the Global South. *Lean Design for the Developing World* (Pease, 2014) and the *Design for the Developing World Canvas* (Wood and Mattson, 2016) adapt existing tools to the needs of DfD. Drain et al. (2018) also propose a method for evaluating PD in technology for humanitarian and development projects. Still, there is a gap between the existence of these design methods and designers being able to successfully use them. This is particularly the case of technology-orientated DfD (Zewge, 2015)

In this respect, Simprints, a technology company based in Cambridge (UK), found little practical guidance on how to overcome challenges when using PD in DfD. Whilst Simprints' members had trained themselves in participatory design using tools such as IDEO's *Human-Centred Design Toolkit*, the team experienced challenges in translating the methods into their technical projects. Moreover, they found it difficult to access shared experiences from other organisations working in DfD.

Whereas existing studies have focused on the development PD methods, and some challenges of their implementation in LRSs have been well-reported, there is little precedent that advises designers on how to overcome these challenges. In this paper we investigate and report Simprints' experiences using these methods, highlighting the complex realities that designers face. We do so by uncovering practical recommendations for using PD in LRSs, therefore shortening the gap between existing design methods and their use in reality. We provide this report to help designers to move from knowing what to do to knowing how to do. These findings are particularly relevant for designers with a technical and science background, who are from the Global North and have little experience working in LRSs.

We focus on reporting Simprints' experience, which we consider to be highly valuable, as we are aware of similar projects taking place in the technology clusters around the University of Cambridge, MIT and Stanford University. We have documented anecdotal evidence of Simprints' experiences learning, planning and implementing PD for the design of their technology. We synthesise fragmented knowledge from existing literature and enrich it by providing an in-depth case study. Overall, this study makes an important contribution to the field, by providing practical insights for practitioners and drawing attention to aspects of PD that are particularly challenging, for which there are limited solutions.

The paper is structured as follows. First we describe the Simprints case study. Second we identify key themes in the literature and describe our methods. Finally, we discuss recommendations for PD in LRSs.

Simprints case study

Simprints is a non-profit technology company founded in 2014 and based in Cambridge (UK). They provide a system for integrating in-house designed fingerprint scanners with third-party mobile apps to facilitate identity verification (Storisteanu et al., 2016). Simprints provides accurate identification to organisations using mobile tools in healthcare, education and microfinance in order to tackle poverty. Standard biometric technology is expensive and has been developed for the high-resource settings, whereas Simprints has focused on a solution specifically designed to meet the needs of LRSs (Storisteanu et al., 2015). In August 2017, they were awarded a $2 million innovation grant, enabling them to scale their maternal healthcare project with BRAC in Bangladesh to reach two million mothers by 2020. Currently Simprints operate projects in Bangladesh, Nigeria, Uganda, Zambia, Kenya, Malawi, Somalia, Ethiopia, Zimbabwe and Afghanistan.

Simprints formed after winning a Hackathon in 2012 which introduced the challenge of patient identification in LRSs. The four founders were graduate students, who were inexperienced in product design and had limited experiences working in LRSs. The importance of using PD was clear to them from the outset, and they took steps to search for open-access tools and methods, and completed training using IDEO HCD Toolkit. However during initial field work they quickly found it challenging to use these PD methods because of the constraints of working in LRSs. Simprints found it difficult to access shared experiences from other organisations working in DfD. Moreover, they found that there was a lack of in-depth guidance on how to apply PD methods specifically for LRSs.

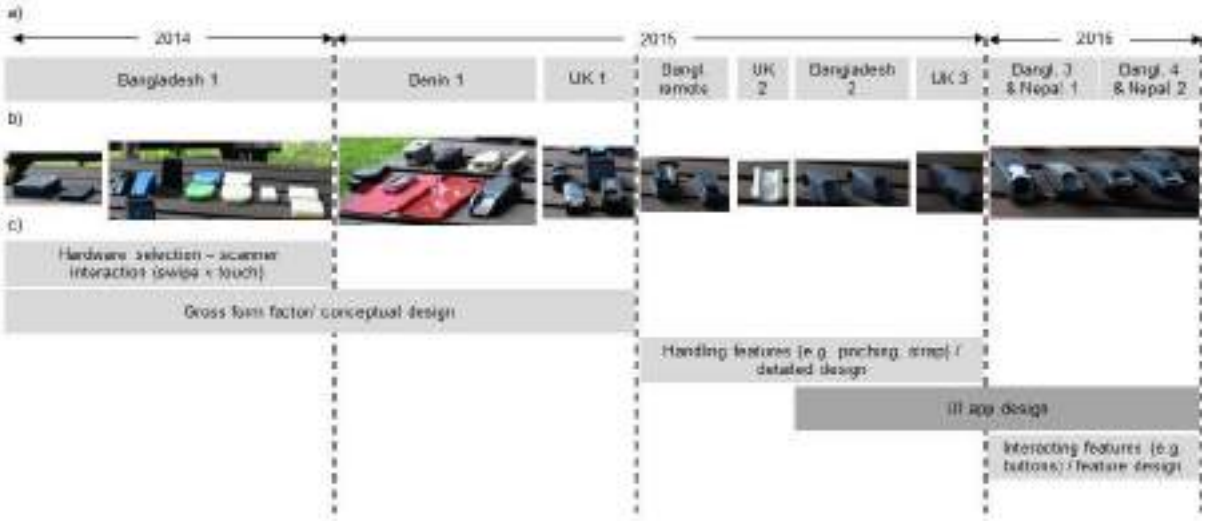

Figure 1: Product development timeline and associated field tests. a) field tests b) prototypes, c) product development

Methods

Systematic literature review

To gather PD experiences in technology-related DfD projects, we searched Scopus to conduct a systematic literature review (Kitchenham, 2004). Workshops, book chapters and any non-peer-reviewed papers were excluded. The key search terms were: (“participatory design”) AND ("low resource" OR "limited resource" OR "developing country" OR “third world” OR “Global South”). This resulted in sixty-seven articles. An abstract review was undertaken based on the following two criteria:

1. The paper describes the design of a product for Development, in a LRS
2. The paper describes and evaluates PD methods

Of the remaining thirty-nine papers, twelve papers could not be retrieved and seven papers were added by snowballing. After full paper review, twenty-five papers met the criteria. The literature was analysed using open and axial coding to group thematically similar concepts (Daengbuppha et al., 2006). Particular attention was paid to the challenges for using PD methods in LRSs. These challenges (Table 1) guided our case study analysis.

Table 1: Challenges of using participatory design approaches in low-resource settings

Challenge related area	*Challenge*	*Reference*
Participants	1. Encouraging participant engagement	Ambole et al. (2016); Del Gaudio et al. (2016); Haque et al. (2015); Kam et al. (2006); Kiura (2006); Manen et al. (2015); Sandman et al. (2018); Wakil and Dalsgaard (2013); Wang et al. (2016);
	2. Creating awareness of design methods	Ambole et al. (2016); Brubaker et al. (2016); Cabrero et al. (2016); Del Gaudio et al. (2016); DeRenzi et al. (2017); Gangadharan et al. (2011); Haque et al. (2015); Hussain et al. (2012); Kam et al. (2006); Manen et al. (2015); Maunder et al. (2007); Puri et al. (2004); Racadio et al. (2014); Roland et al. (2017); Wang et al. (2016); Wakil and Dalsgaard (2013)
	3. Managing multiple and varying stakeholder needs	Mohedas et al. (2014); Roland et al. (2017)

Designers	4. Setting realistic objectives	Ambole et al. (2016); Del Gaudio et al. (2016)
	5. Compensating for designers' lack of experience	Mohedas et al. (2014)
Relationships	6. Building relationships with stakeholders	Del Gaudio et al. (2016); De Los Reyes (2012); Gangadharan et al. (2011); Hussain (2010)Hussain et al. (2012); Racadio et al. (2014); Zegwe et al. (2015)
	7. Flattening the hierarchy	Antle et al. (2012); Brubaker et al. (2016); Del Gaudio et al. (2016); DeRenzi et al. (2017); Haque et al. (2015); Hussain et al. (2012); Kam et al. (2006); Kiura (2006); Korpela et al. (1998); Manen et al. (2015); Puri et al. (2004); Racadio et al. (2014); Sandman et al. (2018)
Context	8. Bridging language and cultural barriers	Ambole et al. (2016); Del Gaudio et al. (2016); Hussain et al. (2012); Korpela et al. (1998); Maunder et al. (2007); Mohedas et al. (2014); Puri et al. (2009); Wang et al. (2016)
	9. Using time-effective approaches	Ambole et al. (2016); Del Gaudio et al. (2016); Kam et al. (2006); Hussain (2010); Hussain et al. (2012); Sandman et al. (2018);
	10. Staying safe and comfortable	Ambole et al. (2016); Hussain et al. (2012); Manen et al. (2015)
	11. Getting access to users	Haque et al. (2015); Roland et al. (2017)

Case study

In order to expand on findings from the literature, a case study approach was taken (Yin, 2018). Efforts to ensure data triangulation and investigator triangulation were made as far as possible (Yin, 2018). Field work data from 2014-2016 was reviewed, including field guides, storyboards, card sorting decks, prototypes, original interview transcripts and communication logs. Semi-structured interviews were conducted with three members of Simprints, who were involved in the product development from the outset: Alexandra Grigore (Chief Product Officer); Daniel Storisteanu (Director of Research); and Toby Norman (CEO). Interview questions were structured around the eleven challenges found in the literature (Table 1). Each interview lasted approximately 60 minutes, and was recorded with the participants' verbal consent. The interviews were transcribed verbatim and imported into MAXQDA.

A code hierarchy was created based on the challenges reported in from the literature (Table 1). Multiple coder analysis was undertaken to identify the challenges and recommendations of using PD in LRSs, based on Simprints' experience. Following this, a validation workshop was set up with the Director of Innovation and Director of Research to verify these findings.

Results and discussion

Recommendations for participatory design for Development in low-resource settings

Encouraging participant engagement

Difficulty encouraging participants to engage with the design process was identified as a key challenge across all stages of the design process. In particular, this presents notable challenges for conducting interviews and focus groups, as well as implementing more PD methods, such as storyboarding and card sorting. For instance, as found in the literature, some participants may fail to contribute meaningfully in design sessions, and instead look to the designers for answers (Ambole et al., 2016; Del Gaudio et al., 2016; Kiura, 2006;, 2013; Wang et al., 2016). Similarly, Simprints noted this challenge as one of the most significant barriers to their work. The most important recommendation for designers in this case, is to make the purpose of the product specific and

relatable for users. If participants recognise the potential value of the design exercise, then this might encourage them to engage more meaningfully with the project. Including participants' ideas and feedback can also make them feel valued and encourage more confidence and participation later in the process.

> *"Some people are very excited to be part of the process and even proud to be part of the process. Especially when we've worked with them and then we come back four months later and they see that some of their ideas have been incorporated. They're very proud and they feel ownership over the product" (Daniel)*

In the short term, translators can also try to encourage participants to respond and emphasise the value of their participation. Moreover, establishing a rapport with participants can help to improve engagement. Empowering participants to feel confident is key to maintaining engagement, particularly in focus groups, in which less confidant participants may be reluctant to voice their opinions. In this case, the designer should be flexible and rearrange groups to establish new dynamics to encourage more participation from quiet participants. Additionally, designers should consider whether one-to-one interviews may be more effective. Alternatively, designers might choose to use more participatory techniques like card sorting or stack ranking to elicit engagement. Observing how participants engage with physical products also removes the need for direct engagement with the designer.

> *"Things like stack ranking are usually more engaging for people… because people have opinions now and you're forcing them to make judgement calls. For direct observation, you don't need their [the participants] engagement with you [the designer] but they definitely need to be engaged with the product or the technology you're testing. For interviews, socially it's hard to totally disengage, especially if it's a one-on-one interaction." (Toby)*

Finally, designers need to be realistic about how much engagement can be expected from participants. Ambole et al. (2016) find that participants do not engage with design exercises independently outside of structured sessions. Awareness of participants' capacities and capabilities is important to avoid burdening participants with unrealistic tasks. At the same time, designers should be aware of the dangers of tokenistic participation of users, which may undermine the value of PD approaches (Yee et al., 2015).

Creating awareness of design methods or reasoning

Participants may not be familiar with the design process and as a result find it difficult to generate solutions or to contribute (Del Gaudio et al., 2016; Hussain et al., 2012; Kam et al., 2006; Manen et al., 2015; Racadio et al., 2014; Roland et al., 2017; Wakil and Dalsgaad, 2013; Wang et al., 2016). Designers should be aware that methods used are typically based on Western orthodoxies of knowledge and reasoning that may be substantially different to approaches in other contexts (Cherlet, 2014). In this case, explaining the design process to participants, as well as the purpose of the product, is essential to improving their awareness of the methods and approaches.

> *"We started every session with an introduction… The translator had a text explaining who we are, why we are there for, what's the context. So giving them actual concrete examples of how the system will benefit them." (Alexandra)*

A major barrier to Simprints in their efforts to get feedback from participants was the lack of understanding about work in progress, also noted in Maunder et al. (2007). Participants struggled to give feedback on unfinished prototypes, as it was difficult to imagine something that had not yet been created. Whilst it is recommended to start field testing as early as possible to avoid incorrect assumptions, designers should be aware of the limitations of testing work in progress and pay attention to avoid including confounding variables in a set of prototypes. Explaining to participants the concept of work in progress is important to encourage more meaningful feedback.

In some cases, being sensitive to different participants' ability is important, and different tasks might be prepared for people with different skills and backgrounds. Generally, designers are recommended to avoid leading questions, however, Simprints found that participants were confused and unsure how to respond to open-ended questions. In particular, 'holding the silence', a commonly used technique to elicit responses in developed nations, was found at times to be particularly uncomfortable for participants. As a recommendation, designers should prepare open-ended questions, but be ready to use prompts or move

towards more closed questions if necessary. In general, designers should avoid unnecessary shortcuts to quick answers by asking leading questions.

The study also found that participants' illiteracy or technology naivety may be a challenge confirming findings in the literature (Ambole et al., 2016; DeRenzi et al., 2017; Gangadharan et al., 2011; Haque et al., 2015; Kam et al., 2006; Manen et al., 2015; Maunder et al., 2007; Puri et al., 2004). In this case, one option is to use narrative and culturally-appropriate styles of communication, such as storyboarding. There was some disagreement however, with regards to the effectiveness of visuals among the Simprints team. Daniel and Toby strongly supported the use of visuals, citing greater engagement among participants. Alexandra, on the other hand, considered that for the most part, visuals were not effective and resulted in greater confusion for participants. More research is needed to clarify the effectiveness of visual aids in PD.

Managing multiple and varying stakeholder needs

Conflicting needs and requirements from the different stakeholders were reported by Del Gaudio et al. (2016), Mohedas et al. (2014), and Roland et al. (2017). These resulted in inconsistencies and incompatibilities between some of the user requirements for the designs. For Simprints, the differences between the requirements of the end users and the donors resulted in conflicting needs. To minimise these conflicts, Simprints made sure that the value of the project was clear and agreed upon by all types of participant (users, program managers and local partners). In this way, stakeholders recognise that the technology is solving a problem which they face, either directly or indirectly. Simprints emphasise the need to choose a user champion and project champion, who take ownership of the project. For Simprints, these champions were effectively 'active citizens' (Yee et al., 2015), operating at various organisational levels to support product testing and adoption.

> *"In every project, we use a user champion and a HQ champion… We want to make sure that there is someone fighting for the users' interests when it comes to Simprints and then someone who is genuinely fighting for HQ interests." (Toby)*

It is important to recognise that impact can only be achieved with the buy-in of participants. Simprints have discussed ways to acknowledge champions more formally by providing certificates and including their bios on the Simprints website. Officially recognising the time investment of champions is an effective way of keeping them motivated and engaged.

Setting realistic objectives

Unmet expectations from participants can disrupt trust and undermine projects (Del Gaudio et al., 2016; Wang et al., 2016). Moreover, misalignment of stakeholder goals can also create confusion, disrupt progress, and divert resources. In particular, Ambole et al. (2016) criticises the 'unquestioned optimism' of design projects that may suffer from unrealistic expectations. This was not a challenge that Simprints readily identified with, however in general they pointed out that informing participants about the project goals and keeping them updated with project process was important.

More specifically, projects should have a clear, public output. In addition, a collaborative relationship should be established with the project partner in order to negotiate objectives and manage collaboration (Del Gaudio et al., 2016). Measuring long term project impact can be challenging, however, one approach suggested by Simprints is to measure impact against the pain points identified by users. Moreover, it is important to set up systems and establish relationships to provide feedback between and after field tests.

> *"We follow up with questions and every week for the first two months we have a project call where we follow up with the users and the managers to ask how the project is going. We also have some questionnaires for the users, where users will just fill in any errors or bugs that they encounter in the system." (Alexandra)*

There is another opportunity here to leverage the capacity of user champions who can be responsible for providing feedback from the field. Simprints recommend that relationships with user champions must be nurtured and they describe varying levels of engagement from different user champions. Designers can be proactive in training champions and keeping them updated with the project, however champions must fundamentally be people who engage with the project's purpose, and who are socially and emotionally connected to the project's value. Considering the most enthusiastic participants during field testing is a recommended way to select user champions.

Compensating for designer's lack of experience

Some designers in DfD projects may be working in LRSs for the first time and they may not have extensive training in design. For instance, designers may come from engineering or other technical backgrounds and have difficulties processing and analysing the information gathered through PD. Mohedas et al. (2014) reports some of the challenges faced by engineering students when using design ethnography. In the case of Simprints, the team also lacked formal design experience, although they did search for commercially available toolkits (i.e. IDEO and +Acumen Massive Open Online Courses). To compensate for their lack of experience, Simprints identified their own weak points and identified mentors and experts who could help them. After initial interactions, they built these relationships further to keep mentors engaged in the project, in order to receive further support from them. Simprints recommend that requests from mentors and experts should be small and tangible.

Another way in which Simprints tackled these challenges was through testing the methods in the field and going through iterative cycles of testing. It is only through learning-by-doing that designers will be able to learn and gain experience designing and connecting with the users.

> *"There is no replacement for field effort. When you do that process multiple times, then maybe you start to get build up a little bit wisdom in this space." (Toby)*

Building relationships with stakeholders

Access to users is a recognised challenge in PD and, hence, stakeholders with user access are fundamental for design projects. A frequently reported challenge is the selection of the local partners and the development of the relationships with them. Simprints found that local organisations often have existing strong relationships with users. They also identified project champions within organisations that could help them to build their network further. Some of the ways in which Simprints built their relationships with project champions included meetings, workshops and tours. For example, Simprints invited champions to visit their headquarters. During their visit, champions were invited to co-design sessions and some of the champions' recommendations were included in the subsequent iterations of the product design.

> *"One recommendation is first establishing a collaborative relationship with a partner in the field. Get them brought in into what you are doing. Make sure that you are going towards a solution that they need so that you are not in a position where you are just using them as a field testing site, but they are invested in you developing a product because it solves one of their real needs." (Alexandra)*

To establish these strong relationships with the local partners, designers need to prepare concise study and field test protocols, indicating benefits to the partners but also explicitly expressing the project goals and the purpose of the project. For Wang et al. (2016), local partners were fundamental for the long-term diffusion, and successful adoption, of PD in rural China. Specifically, identifying qualified stakeholders and sustaining their motivation were key factors for long-term PD processes.

Building rapport with the participants is also fundamental to PD projects. Simprints worked with organisations that had good relationships with the end users but also tried to establish positive direct relationships, by learning basic vocabulary in the users' first language and ensuring that their inputs were included in the iterations of the design.

> *"Show that you've incorporated their advice and then they will become champions for you and help you out." (Daniel)*

Flattening the hierarchy

Power imbalances are one of the key reasons for unreliable responses or lack of participation when involving several stakeholders. During field testing, Simprints noted that differences in gender, age and socially-defined caste groups were notable barriers to participation. Where such power imbalances are identified, it is recommended to separate participants by gender or roles for focus groups. In some other case, one-to-one interviews and interactions can be used to improved users' engagement and participation.

Power imbalances can also occur when individuals or organisations are perceived as having a higher authority. Simprints, for instance, observed power imbalances between the local partnering organisation or translators

and the end users. To avoid this, Simprints conducted workshops in which managers and supervisors were not involved.

> *"I was running a focus group with community health workers who would be our end user. Certainly, the quality of their answers changed significantly depending on whether the boss was in earshot or not." (Alexandra)*

Power imbalances can also result from designers' intervention in the local context. These could be between the designer and the local partner, or between the designer and the participants. Some participants assume that certain answers are expected or that the designer knows the situation better. This power imbalance results in the participant's inability or unwillingness to express difficulties understanding the design-activities, the purpose of the activities. Simprints, used local partners to encourage participation without pushing participants out of their comfort boundaries and allocated time for participants that were more engaged.

> *"They were very concerned of telling us that our product is bad, that something is not working properly. I felt that we did overcome that by training the translators to tell them that 'it's okay, you can tell' and some of them would be much more willing to just say 'this doesn't work.'" (Alexandra)*

Regardless of the source of the power imbalance, overcoming the lack of participation and getting honest feedback from the participants is important when conducting user research or testing. Hussain et al. (2012), as well as Simprints, report using anonymous written feedback, prioritising individual interviews rather than group discussions, and encouraging honest feedback by remarking that the product is only a prototype that needs to be improved with the participant's input as approaches to overcoming power imbalances between designers and participants.

> *"People gave better critical feedback when it was clear that this was really a process because [otherwise] nobody wants to say anything negative about it." (Daniel)*

Simprints also trained the translators to indicate that it was fine for participants to be critical about the product. They also effectively used methods such as stack ranking, which forced people to express preferences and made critical discussion more comfortable for participants.

Bridging language and cultural barriers

This challenge is reported as one of the most significant, as designers lack contextual understanding. Hussain et al. (2012) point out that projects should be based on an in-depth understanding of the history, culture and society of the product's use-context. Technology is not a sustainable solution in itself, but needs to be embeded in a social-cultural framework (Corsini et al., 2019). The recommendation for designers to spend as much time as possible in the local context is noted in Wang et al. (2016), however, as pointed out by Simprints, this might not always be feasible because of resource constraints. Furthermore, there is concern that these experiences may be enriching for designers but will not necessarily lead to tangible design outcomes. Emphasis is placed not just on visiting the design context as much as possible, but on iterating designs and testing them frequently.

Language barriers and translation issues are also frequently reported. If possible, it is recommended to organise workshops in the first language of participants. As noted in Ambole et al. (2016), when workshops were organised in English, participants did not feel confident speaking English and therefore only gave brief responses. It is recommended to hire and train an external translator before designers go to the field to avoid any potential biases. In particular, it is important to train translators on how phrasing questions in different ways can introduce bias, and to ensure that the translator understands the purpose of the design exercise so that they are motivated and engaged. Providing written questions in advance can assist translators and help to avoid leading questions in the moment. Finally, designers should also consider using other methods such as direct observation to complement and verify data from interviews and other exercises that require translation.

It is also recommended to carefully research any symbols and graphic styles being used to ensure that they are culturally appropriate and to test visuals before going to the field with someone familiar with the context. Simprints describe how cartoon style illustrations were recommended to them for producing visual support material for the Nepali context.

"a typical power button symbol wasn't always intuitive… Then there was a frowny face that was put into a positive pile." (Daniel)

Using time-effective approaches

Time constraints affect the design process with respects to both the participants' time and the designers' time. Firstly, finding an appropriate time to meet with participants can be challenging and designers should be aware of the opportunity cost of participants' time. Designers should be flexible and should recognise when particular exercises may have a negative impact on people's responsibilities. On one occasion, Simprints describe cutting short an interview with a doctor, as they were aware of a long line of patients waiting for appointments.

In general, designers should prioritise questions, and have clear and streamlined protocols. Keeping tests concise, simple and focused is highly recommended. Hussain et al. (2012) recommends that it is possible to visit participants in their homes to reduce the participation burden, however, this does not completely eliminate the burden, as described in the extract below.

"There were definitely cases when it was apparent to us that we were taking up time from people that was valuable to them and we would cut something short… I remember doing some shadowing and there was a woman in a slum. We were trying to look at her interaction with the community health workers and it was clear that she didn't want to give the time of day. She was cooking, she was running around, talking to other people" (Daniel)

Ambole et al. (2016) suggest that designers can consider using different groups of participants to minimise the burden on any individuals. Perhaps most importantly, it is recommended that the direct value of the project is fully explained to participants in order that they value the time spent on the project. Designers should also consider appropriate ways of rewarding participants for their time. In cases where participants receive paid salaries, thanks and appreciation may be sufficient. In some cases, Simprints provided gifts in kind, such as providing lunch for participants. More generally it is recommended to discuss incentives with project partners in order to make sure that they are culturally appropriate.

Finally, time constraints are also noted from the perspective of the designers, as they may have limited time in the field. As well as keeping tests concise and simple, designers should bear in mind some of the additional time requirements for particular exercises e.g. the time taken to travel between different locations for shadowing visits.

Staying safe and comfortable

As well as potentially working in an unfamiliar context, designers should be aware that the context may be unpredictable and volatile. Most importantly, designers should create a risk assessment strategy with input from the local partner. It is also recommended that the consent and involvement of all participants should be included (Ambole et al. 2016).

It should be noted that some communities may be concerned about the participation of vulnerable groups, particularly women and children. In this case, it is important to ensure that all engagement with vulnerable groups takes place in an environment where they are visible to communities. It is possible to arrange this such that participants are safe, but also that supervision does not influence power dynamics.

Designers should also be mindful of how poor working environments may affect participant engagement, including heat, light and other comfort factors. Simprints described trying to create comfortable environments for participants e.g. ensure they were not exposed to direct sunlight.

Getting access to users

Remote design is naturally difficult. The distance between users and designers poses challenges that are not only geographical, but also economic and technical. Such challenges were faced by Simprints, who have their head offices in UK and their users in Africa and Asia. Simprints, however, learned to cope with these challenges through the different field visits they conducted and other strategies. Planning and allocating enough resources for field testing is key for getting access to the user, ideally multiple trips. When they are not in the field, Simprints receive support from user champions. At the same time, they recognise that this may have certain limitations. For example, inexperienced user champions may inadvertently bias responses.

"Flying out is very expensive and timely and we've tried to counter that by having local champions to do testing for us... It's up to us to train them on how to get clear unbiased answers. Some people will intuitively be very good at getting the information from end users and communicating back to us and some people will clearly incorporate their own biases into that." (Daniel)

Finally, Simprints has realised that many of their design activities required time in the field. As their product has developed, the need for an in-country office became apparent. In 2018, the organisation decided to set up a local office in Bangladesh and are considering opening representative offices in other locations.

Conclusions and further research

This study explores the application of PD methods in LRSs. The research was prompted by the experiences of Simprints, who found that there was a general lack of information for designers using PD in technology-related Development projects. Our work responds to these concerns, by synthesising fragmented knowledge to identify eleven key challenges for PD in LRSs. We build on this knowledge to provide a detailed case study of Simprints, revealing recommendations that can be taken in order to overcome commonly-faced challenges when using PD in LRSs. We believe this is particularly valuable for designers who are planning to use a PD approach and who are not familiar with working in LRSs. Specifically, it offers insights for designers who may come from a science or engineering background. The authors also believe that this paper provides a valuable resource for academia. It highlights particularly challenging areas, such as power imbalances, cultural barriers and unequal understanding of design methods, for which future PD methods need to be specifically developed.

As interest in DfD projects increases, there is a more urgent need to disseminate this research to designers. As a next step, the authors plan to develop the findings into an actionable tool for designers, to assist with the planning stage of PD for DfD projects. Future plans include the organisation of DfD workshops in Cambridge (UK), using the planning tool for novice designers with a technical or science background.

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Research Perspectives IN THE ERA OF Transformations

The Journey of Local Knowledge Toward Designing Neighbourhood Regeneration

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This research explored design opportunities and new challenges with a paradigm shift toward participatory processes in neighbourhood regeneration. Further, it emphasized the significance of local businesses and their local knowledge to overcome the challenges faced by designers. Three types of local knowledge *Handler* was established based on the Literature Review: *Possessor*, *Processor*, and *Implementer*. Through content analysis on 30 practical cases, 18 types of *Actors* in the process of participatory neighbourhood regeneration were identified. Based on these findings, two ways of local businesses' contributing to neighbourhood regeneration projects were proposed: as a *knowledge reservoir*, and as a neighbourhood *guide*. As future studies, the authors suggest 1) understanding the types and forms of local knowledge possessed by local businesses and how to motivate them to share their knowledge; and 2) devising new methods of participation for local businesses that can enhance designers' capabilities in neighbourhood contexts.

Keywords: Participatory design, neighbourhood regeneration, local knowledge, local business

Introduction

Recently, public participation in urban planning has been highlighted to reflect people's diverse and complex needs. These can be referred to as *local knowledge* (Sanoff, 2005; Berman, 2015; Mueller, Lu, Chirkin, Klein & Schmitt, 2018; Moore & Elliott, 2016; Al-Kodmany, 2001). Local knowledge is defined as the contextual intelligence that only locals possess (Fischer, 2000) and includes needs, perceptions, desires, or information on local contexts (Berman, 2015; Corburn, 2003).

This knowledge poses as key challenges in *participatory neighbourhood regeneration* which means endeavours to involve residents in revitalizing neighbourhoods with their voluntary activities (Tallon, 2013; Yamazaki, 2012). One challenge is that urban planners have trouble rendering local knowledge acquired from residents and incorporating it into planning processes (Mueller *et al.*, 2018; Moore & Elliott, 2016; Berman, 2015). The other challenge is that urban planners have a lack of tools and methods to involve residents who hold local knowledge in participatory neighbourhood regeneration (Sanoff, 1990; Towers, 2003; Burke, 1979).

Both these challenges can be successfully dealt with design as demonstrated in the emerging cases. First, design can render such implicit knowledge into useful resources to solve urban issues. For example, Baibarac & Petrescu (2017) introduced a new co-design process for enabling diverse interest groups to solve urban development issues by sharing knowledge and mutual support. Second, design can develop tools and methods to involve residents and even moderate conflicts among diverse stakeholders. Dalsgaard (2012) conducted a

series of participatory design workshops involving citizens, architects, and others, in developing a public library in Denmark. Pahk, Self, & Baek (2018) developed a novel design method to moderate conflicts among multiple stakeholder groups dealing with neighbourhood problems. These examples show how design can address the aforementioned urban planners' challenges caused by local knowledge. In this context, design can act as an effective means to involve people and mitigate complexity of handling local knowledge in participatory neighbourhood regeneration.

Nevertheless, scholars of design have reported existing difficulties in incorporating comprehensive local knowledge into participatory neighbourhood regeneration (Pahk *et al.*, 2018; Lee, 2008). This is because the urban planning context is different from the typical design context, in which a particular product or service has a homogeneous target user group (Dalsgaard, 2012). Whereas, participatory neighbourhood regeneration projects include heterogeneous stakeholders such as residents, local businesses, technical experts, and government. As such, design has difficulties in mining local knowledge and mediating cooperation within a multidisciplinary team. In other words, the heterogeneity of stakeholders makes it difficult for designers to handle local knowledge in participatory neighbourhood regeneration.

To overcome these difficulties, it is necessary to discover the roles of participants and strategically design projects, but most of the researches focus on involving *general* residents (Toker, 2007). Local businesses, especially, can take critical roles in participatory neighbourhood regeneration for the following reasons. First, local business owners can play multiple roles in their neighbourhoods, including resident, producer, seller, and consumer. They can represent diverse stakeholder groups. Second, local business owners possess both of first- and second-hand experiences (Sánchez-Jankowski, 2008). They frequently socialize with other residents at their own shops, and making them well-informed of other residents' experiences. Finally, local business owners are interested in and have a strong will to discover other residents' needs, preferences, and opinions because such knowledge can influence their businesses (Chapple & Jacobus, 2009). To summarize, local businesses have the potential for providing abundant knowledge and moderating other locals. Therefore, local businesses may complement the designers' challenges in handling local knowledge.

Despite their potentials, there is a lack of design research on the modes of local businesses' participation in neighbourhood regeneration. This research accordingly attempts to explore how designers can involve and utilize local businesses to overcome the designers' challenges.

Three research aims have been formulated:

1. To establish the significance of local businesses and its local knowledge in participatory neighbourhood regeneration and identify knowledge *Handlers'* types;
2. To identify and characterize *Actors* within each *Handler*'s type and identify the *Actors'* roles in participatory neighbourhood regeneration;
3. To propose the ways in which local businesses can contribute to participatory neighbourhood regeneration projects.

To achieve these aims, the research methodology includes 1) Literature Review in urban planning and participatory design to define key research concepts and construct an analytical framework and 2) content analysis with practical cases on participatory neighbourhood regeneration to identify the *Actors* and their roles in the *journey of local knowledge*.

Literature Review

This section reviews the current challenges of participatory design approach for neighbourhood regeneration. Furthermore, it emphasizes the role of local businesses in participatory neighbourhood regeneration. Based on the conclusions of the Literature Review, a conceptual framework including *Handlers* of local knowledge is built. The framework will be used to analyse practical cases during content analysis.

Design Opportunities and New Challenges in Participatory Neighbourhood Regeneration

Participatory neighbourhood regeneration refers to endeavours to revitalize neighbourhoods with residents' voluntary activities (Tallon, 2013; Yamazaki, 2012). It is necessary to explain why the authors set the scope of participatory urban regeneration as a *neighbourhood*. A neighbourhood, the smallest local unit, is regarded as a more effective testbed for experimental projects that require residents' participation than a mega-city.

Within a neighbourhood, residents naturally meet each other and share their experiences (i.e., local knowledge). Consequently, people can have shared goals and challenges associated with individual well-being that improve their neighbourhood environments (Manzo & Perkins, 2006). This enables residents to be more engaged in neighbourhood projects. Through participation in such projects, people become spontaneously tackling complex and *wicked* local problems, and it makes their neighbourhoods more sustainable and resilient (Watkins *et al.*, 2018; Zautra, Hall, & Murray, 2008). Because of residents' willingness for and immediate effect of experiments, many endeavours occur in neighbourhoods. Therefore, the authors selected neighbourhoods where the participatory design approaches to solve urban issue are frequently taking place for reviewing cases.

Scholars of urban planning have trouble handling local knowledge and involving locals in participatory neighbourhood regeneration (Mueller *et al.*, 2018; Moore & Elliott, 2016; Berman, 2015; Sanoff, 1990; Towers, 2003; Burke, 1979) and design can be an effective tool for their challenges. A review of the previous research suggests four roles of design in this context. First, design can make people be engaged in participatory projects even if the topic is unfamiliar (e.g., backward region development) or seems difficult to them (e.g., local housing policies) by using visualization or storytelling techniques (Hanington & Martin, 2012; Kim, Woo, & Nam, 2018). Second, design can facilitate people's expression by using toolkits such as visual aids, cards, or well-planned questions (Manzini & Rizzo, 2011; Baptista & Sampaio, 2015). Third, design can translate invisible and intangible ideas into communicable forms by using visualization and prototyping (Lee, 2008; Manzini & Rizzo, 2011). Finally, design can mediate conflicts among different interest groups and coordinate multi-disciplinary cooperation (Mueller *et al.*, 2018; Manzini & Rizzo, 2011) by translating both expert's and non-expert's language and creating a shared language (Mueller et al., 2018; Lee, 2008). With the recognition of these design specialities, many attempts have emerged to bring participatory design to urban planning projects with the purpose of making locals active players in the process of local problem-solving (Baibarac & Petrescu, 2017; Dalsgaard, 2012; Pahk *et al.*, 2018;).

Despite this potential of participatory design, neighbourhoods provide designers with new challenges caused by the following differences. The first difference is the heterogeneity of neighbourhood stakeholders. Typical design projects conducted in lab environments typically include homogeneous user group who could be clearly identified and have common goals (Dalsgaard, 2012; Schuler & Namioka, 1993). However, stakeholder groups are much more heterogeneous in neighbourhood regeneration (Dalsgaard, 2012). A participatory neighbourhood regeneration project generally includes residents, local businesses, architects, administrators, designers, and others. High levels of heterogeneity among stakeholders induce complicated and even conflicting relationships, which makes it difficult for designers to handle local knowledge. The second difference is that a designer is no longer the sole expert. In typical participatory design projects, designers have the authority to plan workshops, make or devise toolkits for workshops, recruit appropriate participants, moderate sessions, and analyse outcomes (Lee, 2008). In participatory neighbourhood regeneration, however, there are other technical experts, such as administrators, urban planners, architects, as well as designer (Al-Kodmany, 2001). Moreover, residents are not just research subjects, but *local experts* who have local knowledge. This fact makes it difficult for designers to mediate and coordinate communication among multidisciplinary teams.

To summarize, design can be a powerful tool in participatory neighbourhood regeneration and it provides research opportunities for the design community. However, due to heterogeneous participants with their own expertise, it is necessary for designers to deeply understand the context of participatory neighbourhood regeneration and develop the better way to handle local knowledge.

Significance of Local Businesses in Participatory Neighbourhood Regeneration

To complement the aforementioned designers' challenges, it is worth noting that local businesses can affect neighbourhoods. From the perspective of local knowledge, local business owners have richer knowledge than other neighbourhood stakeholders. One reason is that their workplaces (i.e., local shops) are the places where residents naturally gather (Sánchez-Jankowski, 2008). Consequently, shop owners acquire local knowledge including perceptions, opinions, and grievances raised by residents, and hence, Sutton (2010) suggests that a local shop can be the key base for social interaction, inclusion, and social organization. The other reason is that local business owners are willing to acquire local knowledge because such knowledge can affect their businesses (e.g., residents' food tastes, preferences, and dining culture can affect local restaurants) (Noble, Griffith, & Adjei, 2006). For these reasons, local businesses can play a crucial role in discovering local

knowledge, processing it into useful design resources, and incorporating it into participatory neighbourhood regeneration.

Despite their potentials, local business owners often cannot participate in most of neighbourhood projects. The reason is that existing participation channels are not suitable for their circumstances. The most popular channel in participatory neighbourhood regeneration is a workshop (Sanoff, 2000; Toker, 2007). A workshop is a typical participatory design format because it helps diverse stakeholders communicate and set shared goals, strategies, and outcomes through the introduction of novel procedure (Muller, 2003). A workshop invites people to spend hours doing activities in a dedicated place and it is a burden for local business owners to make time to attend workshops away from their workplaces. They need to be present at their workplaces during business hours.

To overcome the limitations of current participation channels for local businesses, Woo & Nam (2018) suggested that local business owners participate in neighbourhood regeneration by providing or sharing their business resources. For example, one supermarket set up a bench in front of the shop to increase revenue. It made pedestrians gather and stay there and triggered the public conversation on their neighbourhood issues. This case shows that local business owners can participate in neighbourhood regeneration even if they do not attend workshops.

The aforementioned case implies that there exist alternative modes of participation for local businesses in neighbourhood regeneration. However, existing participatory design research has little focused on the roles of local businesses in there. Participatory design methods for neighbourhood regeneration should be further developed so that local business owners can fully contribute to projects with their expertise and resources. Therefore, it aims to propose how designers strategically deploy local businesses in participatory neighbourhood regeneration by analysing the current practical cases which involved local businesses.

Conceptual Framework: Handlers of Local Knowledge

To achieve the aims, the authors established three *Handlers* of local knowledge in neighbourhood projects based on the Literature Review. Berman (2015) proposed five stages of participatory process in urban planning: determining project motives, planning the procedures, extracting local knowledge, processing local knowledge, and incorporating local knowledge into planning. From the perspective of local knowledge, this process can be classified into extracting hidden knowledge (tacit knowledge), processing it into explicit insights and workable concepts (refined knowledge), and implementing those concepts on the neighbourhood environment (realized knowledge). Accordingly, the authors redefined three stages of participatory neighbourhood regeneration, and labelled each stage as a role describing a way of handling local knowledge: 1) *Possessor*, 2) *Processor* and 3) *Implementer* (Figure 1). Hereafter, these are referred to as *Handlers* of local knowledge.

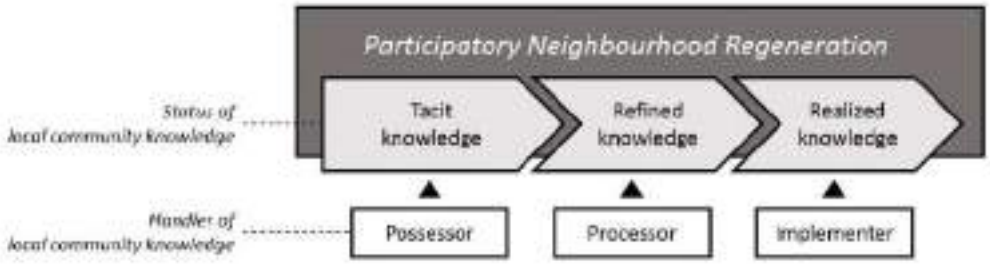

Figure 1: Journey of local knowledge and its Handlers.

First, *Possessor* holds local knowledge, ingredients of a participatory regeneration project. Local knowledge is usually embedded in locals, so it is also called a "local way of knowing" (Corburn, 2003). Accordingly, *Possessor*'s participation can provide not only latent needs of neighbourhood but also useful information on local context. Hence, *Possessor* can be sub-classified according to the types of local knowledge.

Second, *Processor* renders or enables other participants to render tacit local knowledge applicable. Local knowledge is usually too implicit, immature, and abstract to incorporate into the neighbourhood (Berman,

2015). Thus, it should be extracted from *Possessor* and refined by *Processor*. Hence, *Processor* can be sub-classified according to the ways of processing knowledge.

Third, *Implementer* actualizes concepts from the refined knowledge. Usually, the proposed concepts in urban context require construction or permission from the government, because concepts for neighbourhood regeneration need the use of public facilities or public spaces. *Implementer* can be sub-classified according to the ways of implementing the proposed concepts.

This framework 1) provides overall stages of incorporating local knowledge in participatory neighbourhood regeneration at a holistic level and 2) can be utilized to identify the specific role of participants in neighbourhood regeneration projects.

Methodology

To specifically identify types of *Actors*, which is a sub-category of *Handlers*, *content analysis* on practical cases was conducted. The *content analysis* method aims to obtain a systematic understanding of new phenomena using an analytical framework established by existing knowledge (Elo & Kyngäs, 2008). As the analytical framework, three priori codes (e.g., *Handlers*) were established in the Literature Review, which are *Possessor*, *Processor*, and *Implementer*. Two experienced design researchers were participated in the whole analysis process.

Case Collection

Practical cases were collected in advance of the analysis, and case selection criteria were set as follows.

First, within each case, researchers or practitioners should take a participatory approach with the purpose of neighbourhood regeneration. A participatory neighbourhood regeneration project aims to empower people and deals with topics affecting neighbourhood physical environments (Toker, 2007). Hence, it should involve locals (e.g., resident, local business owner, student) in planning process, and its aim can be divided into three: 1) *community building* to enhance relationships between locals (e.g., social dining events) as a prerequisite for planning neighbourhood experiment (Sanoff, 2005; Mason, 2010); 2) *community experiment* to apply a novel participatory approach for urban problem solving (e.g., workshop for identifying neighbourhood problems); and 3) *community business* to take an entrepreneurial process (e.g., job creation or start-up support) by utilizing local knowledge to pursue community goals (Johnstone & Lionais, 2004). Therefore, cases were selected that met at least one of these purposes.

Second, each case should contain a detailed description of its participatory process, the stakeholders' activities, and the outcome implemented in a neighbourhood. The researchers collected cases not only from academic papers, but from white papers, books, brochures, websites, and blogs. The search keyword includes 'community-led regeneration', 'neighbourhood planning', and 'participatory urban planning'.

Lastly, each case should involve at least one local business as local knowledge's holder (i.e., *Possessor*, *Processor*, and *Implementer*) in its process. As this research aims to highlight the role of local businesses in participatory neighbourhood regeneration, local businesses should be involved in each case. A local business is defined as a neighbourhood small-scale enterprise, and such enterprise is generally independently owned and operated (e.g., grocery stores, hardware stores, or restaurant) (Sutton, 2010). The researchers hence looked through each case report and excluded it if there was no depiction of local businesses' participation.

The cases are not confined in the design field in order to impartially analyse the practical cases and characterize *Actors* handling local knowledge at holistically. Ultimately, 30 cases were collected as the sources of content analysis (see Table 1).

Table 1: Cases collected for content analysis.

Case No.	*Project Aim*	*A brief description*
01	Community experiment	To promote an island by preserving the unique value of the neighbourhood without disturbing residents' lives
02	Community experiment	To redesign a public road by involving diverse road users to suit their needs
03	Community experiment	To design specific solutions for improving liveability in the neighbourhood by involving local communities
04	Community business	To encourage the youth to settle down in a neighbourhood by discovering local specialities and growing local talents
05	Community business	To promote local industries by discovering local specialities and growing local craftsmen
06	Community building	To activate conversation among people in a depressed shopping district by sharing local business owners' stories
07	Community building	To strengthen relationships between residents and local businesses by planning local festival together
08	Community business	To revitalize a neighbourhood by making residents encounter each other and investing local start-ups
09	Community experiment	To enable the youth to settle down in a neighbourhood by sharing residents' lives and supporting their local experiments
10	Community building	To strengthen relationships between university students and local businesses by learning cooking skills from local chefs
11	Community building	To design programs for a public park by applying residents' daily community activities
12	Community experiment	To design a playground by involving children in a planning process
13	Community experiment	To design educational programs at a playground by involving children in a planning process
14	Community experiment	To make proposals for the future neighbourhood planning by involving residents
15	Community experiment	To discover the values of a neighbourhood by publishing magazines containing residents' daily lives
16	Community business	To promote local industry by discovering local specialties and branding
17	Community experiment	To make policy for local revitalization by involving residents in writing proposals
18	Community experiment	To make policy for local revitalization by involving children in interviews with local seniors
19	Community building	To moderate conflicts on dam construction between residents and government by designing a deliberative workshop
20	Community building	To build community for revitalizing public park
21	Community business	To support community activities by a shopping mall's providing places for residents
22	Community experiment	To hold a local festival by involving residents in a planning process
23	Community experiment	To renovate a place with historical values by involving residents in a planning process
24	Community experiment	To discover latent problems in a neighbourhood by children's participation
25	Community business	To revitalize a traditional market by utilizing local business owners' stories
26	Community experiment	To promote a neighbourhood by discovering local specialties and branding local identity
27	Community experiment	To promote a neighbourhood by storytelling residents' and places' knowledge
28	Community experiment	To revitalize a neighbourhood by the elderly' art activities
29	Community building	To promote traditional market by publishing a newspaper containing local business owners' stories
30	Community experiment	To discover local problems by involving residents in process of community development

Content Analysis

The collected cases were analysed through priori coding and affinity diagramming (see Figure 2).

First, all corpus describing stakeholders and their activities were extracted. Then, each activity was categorized by the priori codes (i.e., *Possessor*, *Processor*, and *Implementer*) based on how each stakeholder handled local knowledge. For example, Cowley road project aims to redesign a public road by involving diverse road users (Symonds, 2005). In this case, a team of locals conducted interviews of pedestrians and encouraged them to drop by the exhibition site for collecting feedback. The team induced road users to express their implicit local knowledge, and thus they were coded with *Processor*. Another stakeholder group, road designers in the same case developed the final design based on pedestrians' comments, so they were coded with *Implementer*. At the end of priori coding, 48 activities were coded as *Possessor*, 138 activities as *Processor*, and 104 activities as *Implementer*.

Subsequently, the coded activities were grouped with *affinity diagramming* (Beyer & Holtzblatt, 1999), and each group was labelled as a sub-code describing activities precisely. For example, 'to conduct an interview' and 'to encourage people to join' were coded with *Processor*. However, the priori code, *Processor*, cannot concretely describe the way of processing, hence the researchers sub-classified each priori code. Accordingly, each priori code (i.e., *Handler*) is further divided into sub-codes (i.e., *Actor*). The final codes characterize specific *Actors* within each knowledge *Handler* in participatory neighbourhood regeneration (see Figure 3). A total of 18 *Actors* were identified through content analysis.

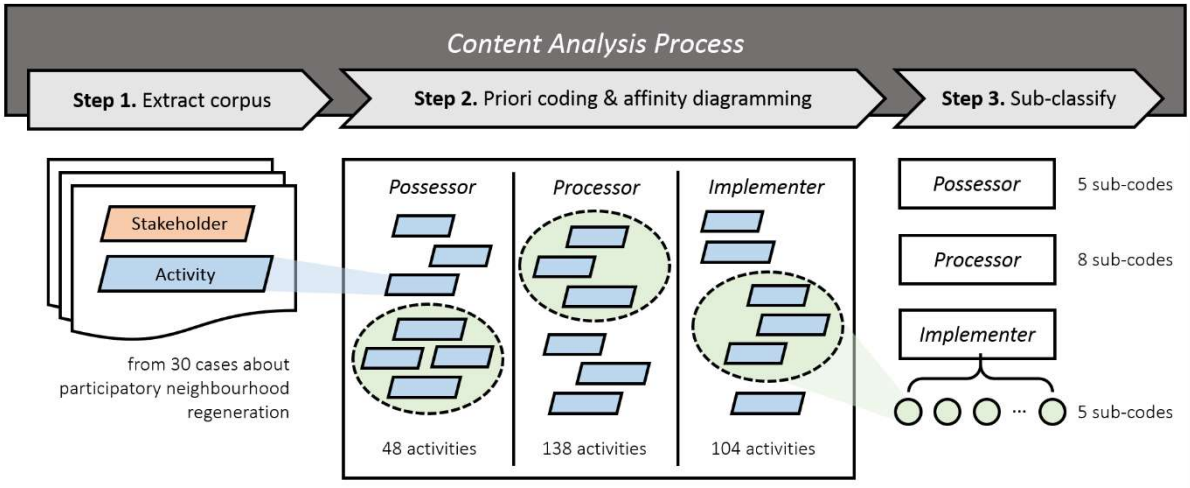

Figure 2: Content analysis process.

After the content analysis, the authors classified the *Actors* within each *Handler*'s by typical design activities. This step aims to identify common or distinctive activity between two contexts, which are participatory design and participatory neighbourhood regeneration. With reference to books published in design field, the *Actors* within each *Handler* were grouped again using affinity diagram method and labelled as a design activity. As a result, seven categories were identified (see Figure 3).

Finally, the frequency of each stakeholder's (e.g., designer, local business, and other stakeholders) performing each *Actor's* role was counted from the collected cases, and its proportion was calculated (see Figure 4). Based on the results, the authors could propose new ways in which local businesses can contribute to neighbourhood regeneration projects.

Results and Findings

Figure 3 shows *Actors* within each *Handler*'s type and the *Actors'* roles in participatory neighbourhood regeneration. There are three types of *Handlers*: *Possessor*, *Processor*, and *Implementer*. Within those categories, there are five *Actors* in *Possessor*, eight *Actors* in *Processor*, and five *Actors* in *Implementer*. *Actors* within each *Handler* are classified by design activity. Each *Actors* and design activity is described below.

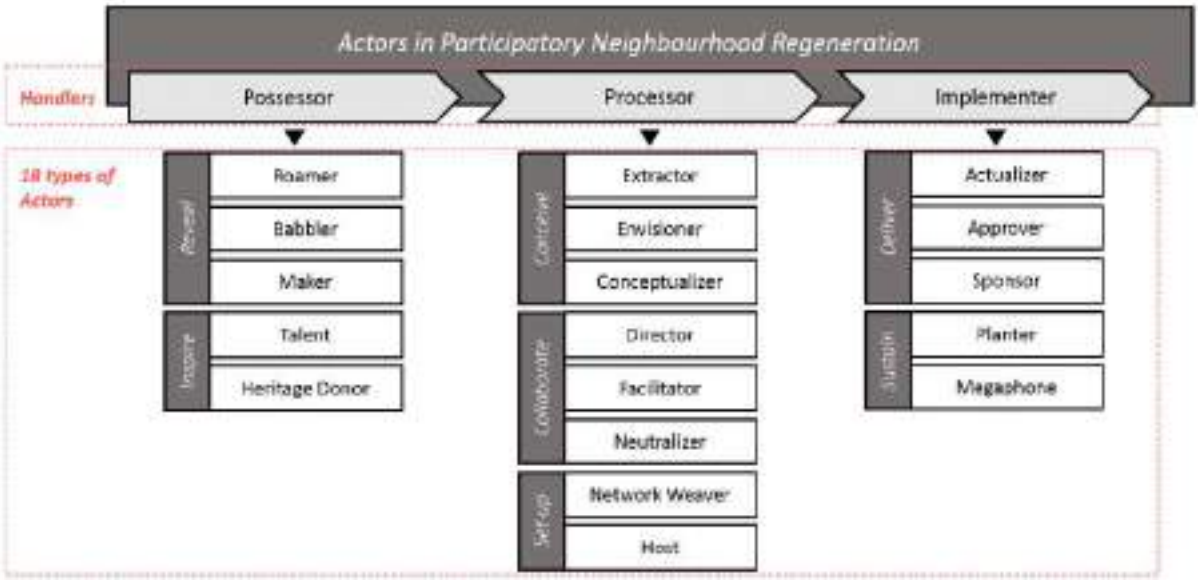

Figure 3: Final codes.

Possessor

Five sub-codes were found under *Possessor,* one of the three priori codes. The sub-codes represent five *Actors*, labelled according to the way in which they express local knowledge:

- *Roamer* displays local lifestyle or local culture just by roaming around the neighbourhood;
- *Babbler* says personal thoughts, opinions, grievances, needs, and information out loud;
- *Maker* creates artefacts reflecting local feelings, dreams, fears, and aspirations;
- *Talent* shares his or her skills relevant to local context (e.g., craft, cooking);
- *Heritage Donor* donates his or her spaces of historical or cultural value.

As seen in the definitions above, *Possessors* hold local knowledge within their lives. To collect such knowledge and incorporate it into a planning process is the aim of participatory neighbourhood regeneration (Al-Kodmany, 2001; Berman, 2015). Accordingly, it is necessary for designers who lead participatory neighbourhood regeneration projects to understand what makes *Possessors* actively express local knowledge. There are two ways through which *Possessors* express local knowledge: revealing and inspiring.

First, *Possessors* **reveal** undetermined and flexible local knowledge as evidenced by the definitions of *Roamer*, *Babbler*, and *Maker*. For example, in Case 15 (see Table 1), residents' daily lives, especially their use of public space, were captured by designers and revealed via a lifestyle magazine. This magazine triggered interaction between residents and promoted the neighbourhood. In this sense, the residents acted as *Roamer*s. In Case 6, designers produced a series of posters containing short excerpts from local merchants' interviews (e.g., their pride and joy, news, and stories) and displayed them in a stagnant shopping district to attract pedestrians. Here, local knowledge was revealed by merchants acting as *Babblers*. In Case 1, children drew pictures of the island where they were born and raised. Their drawings became unique local souvenirs by designers and artists. The children as *Makers* unintentionally and implicitly revealed their perceptions of, desires for, and information on their neighbourhood via creations.

Roamers' knowledge is acquired via observation, *Babblers*' knowledge is acquired via interview, and *Makers*' knowledge is acquired via creation. These correspond with the ways in which designers can learn from users in participatory design, that is, through what users do, what users say and what users make (Sanders, 2003). This fact implies that this area, participatory neighbourhood regeneration, can utilize design methods to collect local knowledge. How, then, can designers facilitate these *Actors* to express their own knowledge? First, *Possessors* who reveal local knowledge express it through natural activities, and hence designers should devise a medium by using *Possessors'* natural interactions, which can encourage them express knowledge more actively. Second, *Possessors'* knowledge can be anything based on the format of projects. Accordingly, to act as useful resources for projects, designers should help *Possessors* express knowledge in a guided way.

Possessors also **inspire** designers by voluntarily providing their own local knowledge, as evident in the definitions of *Talent* and *Heritage Donor*. These *Actors* are newly identified in the neighbourhood regeneration context. For example, in Case 10, restaurant owners acting as *Talents* taught university students who lived alone how to cook. While spending time together, the owners and students shared their stories naturally and developed emotional intimacy with each other. Here, the owners' cooking skills were the trigger for these social dining events. In Case 23, one local business owner acting as a *Heritage Donor* donated his closed sawmill and asked designers to utilize the space for neighbourhood regeneration. The designer extracted the local knowledge (e.g., stories of residents, spatial narrative) embedded in the sawmill and transformed it into a workshop where residents could learn woodworking skills from local craftspeople and make furniture on their own.

In these cases, the skills of the *Talent*s and the places belonging to the *Heritage Donor* triggered neighbourhood regeneration projects. Both cases show that the aim and outcome of the project are aligned with the given local knowledge. *Talent* and *Heritage Donor* provide their knowledge when the aim of a project aligns with community or business value they pursue. Accordingly, designers should plan projects in ways that persuade local businesses to participate, thereby encouraging these *Possessors* to provide their knowledge.

With *Possessor*s expressing local knowledge, the *Processor*s' role begins in earnest.

Processor

Eight *Actors* were coded under *Processor* and labelled according to the way in which they process local knowledge:

- *Extractor* extracts local knowledge from *possessors*;
- *Envisioner* provides vision regarding neighbourhood development that is based on local knowledge;
- *Conceptualizer* creates workable concepts for neighbourhood development that are derived from *Envisioners'* visions;
- *Director* leads and manages the processing of local knowledge;
- *Facilitator* encourages and facilitates the processing of local knowledge;
- *Neutralizer* mitigates conflicts among participants during the processing of local knowledge;
- *Network Weaver* builds human networks for processing local knowledge;
- *Host* stages events or provides spaces for the *Possessors* of local knowledge gather together.

Processing is not only the phase of participatory neighbourhood regeneration in which designers demonstrate traditional design skills but also the phase in which participation and cooperation begin. Based on the results, the authors identified three types of design activities that *Processors* perform: conceiving, collaborating, and setting-up.

First, *Processors* **conceive** possible solutions for neighbourhood development based on *Possessors*' local knowledge. *Extractor*, *Envisioner*, and *Conceptualizer* are the *Actors* involved in this activity. Designers conceive the design matter, define non-existing problems, and plan solutions even in unfamiliar fields (Buchanan, 1992; Lawson & Dorst, 2013). In this way, designers involved in participatory neighbourhood regeneration produce workable concepts for neighbourhood development by conceptualizing *Possessors*' local knowledge. For example, in Case 25, designers as *Extractors* and *Envisioners* discovered the uniqueness and competitiveness of the traditional market, unnoticed by locals, and established a branding strategy to revitalize the neighbourhood. In Case 17, a designer as *Conceptualizer* collected residents' future visions for the neighbourhood and, based on those visions, made a proposal to persuade the local municipality.

However, in neighbourhood regeneration situations, locals often become active *Processors* with an increased emphasis on public participation. For example, in Case 18, children acting as *Extractors* discovered local issues by interviewing elderly residents, and the data was utilized for developing a neighbourhood regeneration policy. In Case 23, local university students acting as *Envisioners* generated concepts for renovating an old workshop.

As the roles of locals in conceiving solutions become more important, *Processors*' roles are expanding to enable **collaboration** among participants. *Director*, *Facilitator*, and *Neutralizer* are under this activity. These *Actors* help encourage collaboration among participants and ensure the participatory nature of processes during projects. Here, participatory design is applied to enable users to easily and voluntarily participate in projects. For example, in Case 2 and Case 3, designers acting as *Directors* and *Facilitators* devised novel

participatory processes to increase residents' engagement in civic public interest and to enable multidisciplinary collaboration in urban development. In Cases 14, 17, and 18, designers planned and organized generative workshops where local stakeholders devised solutions for neighbourhood development.

During these projects, conflicts can be exacerbated due to political conflicts, which can lead to heightened emotions. In such situations, it becomes difficult to properly reflect people's opinions. A new finding in this research was the observation of *Neutralizer* role in which residents ease unnecessary conflicts among people. For example, in Case 15, a vendor selling milk communicated with local elderly people while selling her products. The elderly gathered around the vendor to confide their stories. Case 19 was a participatory process to mediate a dispute over dam construction between residents and the municipality. University students heard both sides and expressed opinions based on their own judgement, and their activity neutralized the conflicts.

The last design activity under Processors is performed by *Network Weaver* and *Host*, who **set up** a project. The processes of setting up the environment and recruiting participants affect the results of the project and, therefore, these processes should be planned out such that they align with the project goals (Kuniavsky, 2003). Symonds (2005) reported that a local shop was a neutral space where many people felt more comfortable than at the municipal office. This suggests that spatial conditions can impact public participation. For example, in Case 22, a designer put together a team to plan a local festival and recruited artists relevant to the festival's theme. The designer in this case acted as *Network Weaver* who had the vision, energy, and social skills to connect with diverse individuals (Krebs & Holley, 2006). Harmonious team composition helps the effective processing and implementation of local knowledge. As such, designers should be skilled at understanding participants' capabilities and capable of managing the team in such a way as to optimize team harmony while engaged in projects. However, designers who are non-locals usually have not developed the local human networks and do not have access to the local facilities needed to set up a project. In these circumstances, local businesses are powerful *Actors* when it comes to supporting project set-up. For example, in Case 28, a café was utilized as the place where the elderly learnt paper-based crafts and exhibited their craftworks. In Case 10, a diner was utilized as the place where youth learnt cooking from a chef. As such, local businesses can provide gathering places for people and indirectly support the processing of local knowledge.

Implementer

Five *Actors* were coded under *Implementer* and labelled according to the way in which they implement proposed concepts:

- *Actualizer* designs and realizes concepts proposed by *Conceptualizer*;
- *Approver* grants permission for the actualization of neighbourhood regeneration projects;
- *Sponsor* provides funds or places necessary for project implementation;
- *Planter* establishes organizations to maintain and safeguard implemented regeneration solutions;
- *Megaphone* promotes the implemented solutions.

After the roles of *Possessors* and *Processors* are carried out, local knowledge is implemented in the neighbourhood. The authors identified two types of design activities that *Implementers* perform: delivering and sustaining.

First, *Actualizer*, *Approver*, and *Sponsor* under *Implementer* **deliver** the final outcome of a project. 'Deliver' is the last phase of the Double Diamond model from the British Design council in which the resulting project is finalized, produced and launched. Designers take a leading role in the actualization phase. However, actualization in urban planning appears in various forms, such as products, services, architectures, organizations, businesses, or even relationship building (Sanoff, 2005), and most of these forms require public goods. Accordingly, *Actualizer* requires permission from *Approver* and funds from *Sponsor*. For example, in Case 2, urban designers acting as *Actualizers* designed and realized concepts that were proposed by residents at workshops. The city council acting as *Approver* and *Sponsor* then permitted the plan and provided subsidies. As seen in this case, implementation of neighbourhood planning requires cooperation from the government. The government or municipality has the authority to approve decision-making, and without their permission, it is difficult to implement ideas in the neighbourhood, meaning local knowledge cannot be manifested. Accordingly, designers acting as *Conceptualizers* and *Actualizers* must take into consideration the need to persuade the government to approve the project in order to carry out implementation.

Sustainability is one reason for emphasizing public participation in urban planning (Amado, Santos, Moura, & Silva, 2010; Manzini, & Rizzo, 2011) Thus, care must be taken to ensure this implemented solution a not one-off event.

In this context, *Planter* and *Megaphone* under *Implementer* **sustain** the final outcome. Participatory neighbourhood regeneration is generally conducted as a pilot study. Designers as a project leader are typically non-locals and, thus, cannot monitor the implemented solution continuously. In the beginning, locals are more likely to actively participate due to curiosity or expectation, but it can be difficult to sustain their interests once the project has been implemented. Accordingly, some designers attempt to *plant* the system and culture of the implemented solutions. For example, in Case 4, the project team developed local specialities based on the neighbourhood's agriculture and fishery using a participatory approach. They established organizations to grow local talents and preserve local specialities. In Case 14 and Case 26, the designer's role was to help locals acclimate to the participatory process and help such culture settle down after the pilot project.

In addition to *Planter*, *Megaphone* contributes to sustaining the implemented solutions by promoting projects. For example, in Case 1, the project team held exhibitions and published brochures explaining their process, achievements, and value. In Case 9, a local municipality promoted the achievement of their project, and this promotion led to an increase in the number of participants as well as subsides from the central government. *Megaphone* thus gives wider publicity to a project's achievements in order to 1) give residents pride and motivation, 2) attract others to join in, and 3) showcase their potentials to investors.

Discussion & Conclusion

Figure 4 shows the proportion of local businesses, designers, and other stakeholders in each *Actor's* role. The figure supports the argument that local businesses can mitigate the designers' challenges discussed in the Introduction section. How, then, can designers strategically deploy local businesses in participatory neighbourhood regeneration? Based on the findings of the research, two ways in which local businesses can contribute are proposed: 1) knowledge reservoir and 2) neighbourhood guide.

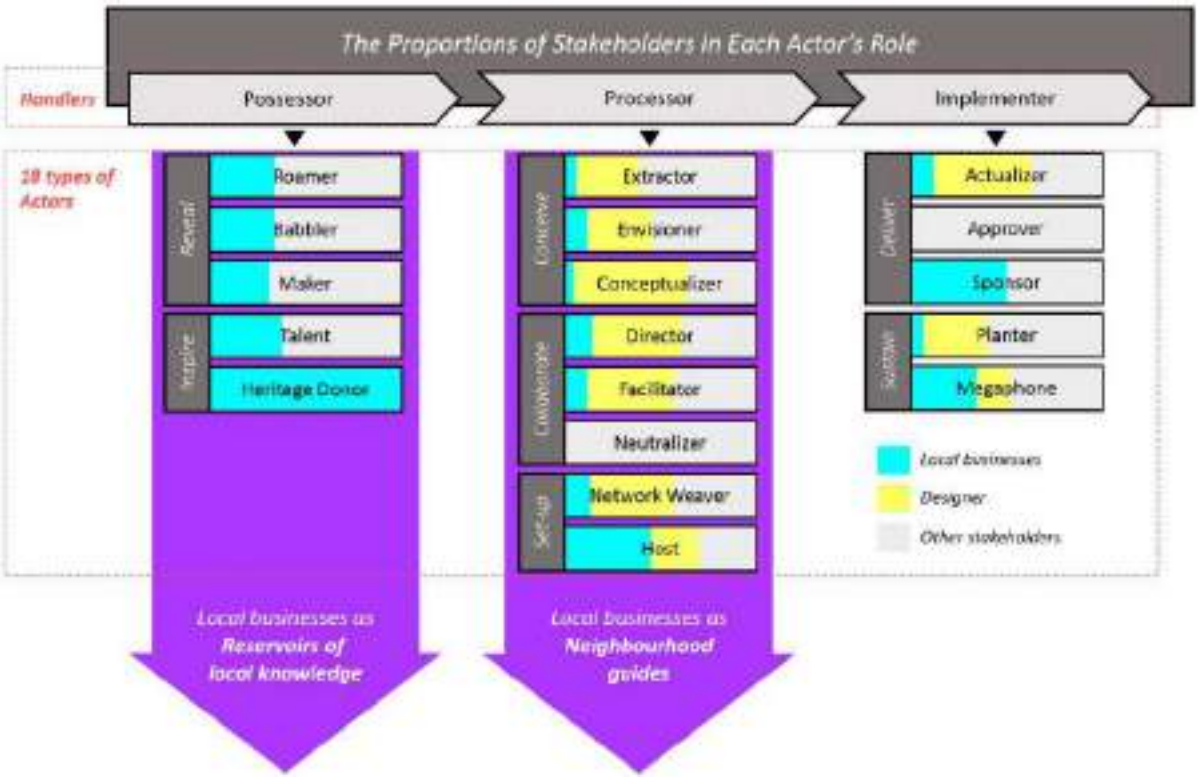

Figure 4: Two ways of local businesses' contribution.

Knowledge Reservoir

The first contribution is local businesses as *reservoirs of local knowledge*, from which designers can acquire abundant and unique local knowledge. As found from the content analysis (see Figure 4), local businesses hold rich and diverse local knowledge including the history (Cases 6, 7, 9, 25, and 29), heritage, neighbourhood locales (Cases 23 and 27), and expertise (Cases 1, 10, and 21) relevant to their businesses, as well as the needs of the local economy (Case 3). Furthermore, they possess stories containing their views not only as merchants but also as residents. Therefore, designers should utilize local businesses as key *Possessors* of local knowledge in participatory neighbourhood regeneration. However, designers often find collecting local knowledge difficult, as previously discussed.

In order to address such a difficulty and strategically utilize local businesses' knowledge, designers should first understand what types of knowledge they have, in what form it is provided, and how to engage them in sharing their specific local knowledge. The research found that local businesses, particularly, the *Talent* and *Heritage Donor* (new and original role types identified through this research) types of merchants, were willing to voluntarily offer their knowledge such as their skills and spaces, if their vision aligned with the goal of the project. Further, Woo & Nam (2018) maintained that the alignment of businesses' vision with the community vision is a potent driver for local businesses' participation in neighbourhood regeneration. As such, designers need to tap into local businesses' vision in order to make effective use of their local knowledge.

Neighbourhood Guide

The second way in which local businesses can contribute is as *neighbourhood guides*, allowing designers to enhance their capabilities to mediate diverse local stakeholders. Collaboration among diverse stakeholders actively occurs during participatory neighbourhood regeneration projects, and thus a designer's role as an expert in moderation and facilitation becomes all the more important. The Literature Review, however, showed that the complex heterogeneity of stakeholders makes it difficult for designers to handle local knowledge and projects. In this context, the authors suggest that local businesses could mitigate such challenges of designers in a way that they lead designers toward the neighbourhoods.

As found in the content analysis (see Figure 4), local merchants are usually 'people-in-the-know' who are well aware of local situations including local issues, culture, talents, and resources. For example, local businesses can envision possible solutions (Case 3) or articulate the future vision of neighbourhoods (Case 8) based on their understanding of the neighbourhood. They can also guide 'the right man in the right place' in their local context. For example, they can discover or persuade people to engage in projects by using their personal connections and social skills (Cases 5, 15, and 21), and provide natural gathering places for locals (Cases 27, 28, and 30). These examples unveil research opportunities for developing alternative modes of participation for local businesses beyond just the workshop format. Although designers have the potential to play more active roles in participatory neighbourhood regeneration, they are often unable to demonstrate their capabilities well due to a lack of infrastructure. By involving local businesses, however, designers can more efficiently and effectively engage in participatory neighbourhood regeneration.

Conclusion

This research explored design opportunities and new challenges in a context which the paradigm of neighbourhood regeneration has been shifted toward a participatory approach. Further, the research emphasized the significance of local businesses and their local knowledge to overcome the challenges faced by designers. This research established three types of local knowledge *Handler* within the framework of participatory neighbourhood regeneration based on the Literature Review: *Possessor*, *Processor*, and *Implementer*. Through content analysis on 30 practical cases, 18 types of *Actors* involved in the process of deploying local knowledge for neighbourhood regeneration were then identified. Based on these findings, two ways in which local businesses can contribute to participatory neighbourhood regeneration projects were identified: as *knowledge reservoirs*, and as a *neighbourhood guides*. The significance of this research is in that it provides evidence suggesting that local businesses can help address the challenges faced by designers. Furthermore, there may be new ways of local businesses' participation for neighbourhood regeneration projects. There are two possible directions for future research to be suggested based on this research. First, it is necessary to understand the types and forms of local knowledge possessed by local businesses and how to motivate them to share their knowledge. Second, it is necessary to devise new methods of participation for local businesses that can enhance designers' capabilities in neighbourhood contexts.

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Making the difference through design: Possibilities for the re-production of Social Capital

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Contemporary societies have been strongly characterized by the emersion of hybrid economies, which in several cases, through *making,* pursue goals of urban regeneration and social engagement. Recently, the Municipality of Milan has started to be interested in several hybrid and collaborative experiences, focused on: 1) the creation of local markets; 2) the revitalization of peripheral areas; 3) the engagement and its inhabitants. This paper presents the first step of a collaborative study developed by the School of Design of Politecnico di Milano and the Institute of Design of IIT of Chicago within the Sister Cities policy program. The results of preliminary research activities, which wanted to investigate the relationship between design, manufacturing and social inclusion will be presented. The main focus will be on the actual and potential role of design within these hybrid activities with a particular attention to its capabilities to support the creation/acquisition of Social Capital both at individuals and territorial levels.

Keywords: hybrid enterprises, making, Social Capital, urban regeneration, civic design

Introduction

This paper presents the first step of the collaborative study developed by the School of Design of Politecnico di Milano and the Institute of Design of Illinois Institute of Technology of Chicago within the Sister Cities Policy Program. Civic Design has been the topic chosen for this collaboration, and the Italian team decided to analyze it through a focus on the local economy (in particular manufacturing), innovation, and social inclusion. This report summarizes the results of a specific section of the field research activities, in order to investigate the relationship between design, manufacturing and social inclusion. Companies and associations which work in these - apparently diverse -sectors, actually mix different characteristics: innovation, social entrepreneurship, (new) craftsmanship, design, storytelling, meanings, a strong focus on territorial development and the relationships.

Then Milanese context, which is the one I am focusing on, has recently been strongly characterized by the emersion of these hybrid economies, which also the Municipality has started to recognize and to be interested in.

The systemic approach, which we propose to use, was initially applied in the environmental field of urban management. This approach focuses on the articulation of the different elements which compose a city and the connection between them (Friedmann, 1987; Taylor, 1998). In more recent years, the ecosystemic approach was extended also to knowledge and creative fields (Becattini, 1989; Harrington, 1990; Landry, 2000; Santagata, 2007). The European Union, as well, has been more and more careful about the development and

the study of creative and innovative ecosystems, which are seen as levers for sustainable growth, because of their focus on co-creation and coopetition among different groups of stakeholders.

This paper focuses on selected case studies, whose spokespeople were interviewed. After the interviewing phase, we organized a co-design workshop called "Let's make room for innovation!" which was held at POLIFACTORY (fablab of Politecnico di Milano) and involved both the group of our interviewees,students, and experts from several fields (e.g. design, architecture, psychology, etc.). The brief of the workshop was co-designing an urban living lab in the Milanese suburb of Bovisa. The workshop was attended by 30 people, divided into 5 working tables; it lasted 4 hours and provided a series of specific questions, which were answered by participants using specifically designed tools. The final output was an idea proposal for an urban living lab were making and culture encountered.

In this paper, I am going to present the interviews results according to the role which design (and making as well) can have in the development of network and in the creation/acquisition of Social Capital both at territorial and people levels.

For a definition of Social Capital

The concept of Social Capital has been used by several disciplines in order to study, discuss and analyze the creation of community networks, the achievement of economic success, and the support to local development. Its definition has been changing over time and often has been taken for granted; however, a unique definition of the concept is not possible and also a complete overview of it cannot be the main focus of this paper. Therefore, in this first paragraph, a possible composed definition which could be useful and effective for the present argumentation is going to be delineated.

The definition proposed by Jane Jacobs (1961) was related to two main levels of manifestation and impact: the individual/personal level and the territorial/urban level. She stated that Social Capital is created and reproduced thanks to the presence of informal relationships, local self-government networks, neighbourhood associations.

The importance of factors such as proximity, on the one hand, and informal networks, on the other, are already present in Jacobs dissertation. By proximity I do not mean only a physical-geographical proximity, which is a condition, but not a guarantee, for the presence and the development of cognitive, organizational, social and institutional proximity (Boschma, 2005); while, for informal networks, the concept of *weak ties* proposed by Mark Granovetter (1973) identified a relationship which is nor of kinship or friendship, but which is expressed in a combination of trust, (non-economic) exchange and reciprocity. These two elements (networks and proximity) are very much connected, indeed networks have a variable length: they can be very local, but they can also extend to the whole city.

The most well-known scholar who theorized the concept of Social Capital, is probably Pierre Bourdieu (1980) who analyzed it in connection and interaction with other types of capital (economic and cultural) and defined it as the set of real or potential resources that depend on the possession of a lasting network (of relationships) and of more or less institutionalized relations founded on high levels of respect and reciprocity.

Therefore, as mentioned before, the utility of Social Capital is recognized at two levels, which are simultaneously separated and connected: the personal and the collective. Social Capital supports individuals in solving everyday problems, such as finding a job; at the same time, by doing so, it can generate broader positive effects on the city and beyond. According to Enzo Rullani (2006) Social Capital is embedded and rooted, often implicitly, in territories. This approach clearly states the shared and collective nature of this resource, which is particularly useful for the attainment of economic and social improvement of places. As far as the economic competitiveness is concerned, for example, the importance of Social Capital has been widely discussed in the constitution of districts, first industrial, then cultural and creative (Becattini, 2000; Scott, 2006).

As the shared value of Social Capital is concerned, Arnaldo Bagnasco (1999) analyzes what Robert Putnam called *civicness*, that is a fabric of values, norms, institutions and associations that permit and support civic engagement, mutual trust, and widespread tolerance, where the interest is no longer (only) private and personal but becomes public. The possibility that a culture of *civicness* found fertile ground is directly influenced by the presence of high levels of Social Capital. According to Putnam (1993), the possession of Social Capital can directly have a positive impact on a territory (nation, region, city) and on the functioning of

its democratic institutions; therefore, territories need strong social participation to attain certain levels of efficiency. Putnam developed this statement thanks to Tocqueville's work on civic participation in America in the 1830s; however, as Ferragina (2012) highlighted, Putnam did not consider Tocqueville's main explanation about the conditions which allowed high levels of social participation at that time in America, which was the widespread condition of equality. At the same time, it might seem quite optimistic to talk about "widespread equality" in order to define the general environment of America in the 1830s. Surely, America was a more equal country compared to others but, if compared with 1993 (when Putnam wrote) or with the current situation, notwithstanding the permanence of social and inequality issues, we might say that at least basic rights have been conquered since then[1].

As said before, Bourdieu theorized that the different typologies of capital (Economic, Cultural and Social) are able to influence each other's and in particular the possession of high levels of Social Capital could favor the acquisition and accumulation of Economic Capital. In this paper, I want to highlight also a backwards process, which thanks to the participation in economic and cultural activities allow people to improve their levels of Social Capital. The (strategic) collaboration between governmental institutions, civil society, enterprises and academy (in our case represented by Politecnico di Milano) can be able to open their close networks. In line with what Rullani (2006) proposed, I am going to question if design can act as a facilitator in the production of new bonds and - therefore - new forms of Social Capital.

Making: from business to local development

"Making" and the Fourth Industrial Revolution has been extensively investigated in the last few years by academics, journalists, politicians, and have also raised the interest of many entrepreneurs and passionate people.

Several pieces of research have been developed on the topic of fab labs networks and makers movement; in many cases, these studies highlighted problems of economic sustainability of these activities, but a more cultural-related role of these places emerged (Wang, 2015; Taylor et al, 2016; van Holm, 2017). Indeed,

> *"For makerspaces to become similarly ubiquitous and sustainable platforms, they need to offer the kind of institutional stability that will support meaningful community programming, educational opportunity, and grassroots economic growth. A glance at the history of makerspaces illustrates both the challenges and opportunities of building communities, and businesses, around the ethos of shared making." (Holman, 2015)*

In order to theoretically frame our study, we took into consideration the social and cultural side of "making". "To make" (*fare*), in Italian, is often associated with the concept of capability, of "being able to make" (*saper fare*). These capabilities are both objects and contents of places such as makerspaces and fab labs, but also districts, regions and even nations are often recognized as repositories of specific making/artisanal cultures.

Makerspaces and fab labs, specifically, are not only connected with the physical production of goods, but also with the production of knowledge and relationships, which sometimes are expressed through the physical production/practice. Harvey Molotch (2003) stated that goods and social practices are directly connected and are able to sustain each other's. This means that the availability of a certain object is able to influence the endurance of people habits (e.g. what and how they eat); on the other way around, habits influence the consumers request of certain typologies of goods, and therefore their production.

In order to define our field of interest, we connected making with knowledge and social inclusion issues, identifying several pieces of evidence:

- production is an urban and cultural fact, which is able to re-signify places;
- in many cases, makerspaces and fab labs are located in peripheral areas because of the availability of empty and large spaces, and because there are more accessible areas compared to city centers. The

[1] "Every boy knew that he might be the governor of the State, or a member of Congress. There was nothing to hinder him from being President; all he had to do was to learn. No position was beyond his reach if he chose to work for it. Franklin was a printer's boy and Andrew Jackson a poor boy who worked his way up from the humblest position." In this caption from the article "A Portrait of America, 1830" (EyeWitness to History, www.eyewitnesstohistory.com, 2008) for example, it is very clear that the equality was at that time extended to white boys, excluding women and Afro-American people.

localization in the suburbs often contributes to the physical and cultural regeneration of these areas. This aspect is particularly evident in Italy and especially in Milan (Armondi & Bruzzese, 2017);
- rediscovering craftsmanship means to uncover a deeper relationship between people and their work (Friedmann, 1987). We assist nowadays to a new idea of craftsmanship, which owns a renovate dignity and value (Sennett, 2008);
- craft knowledge is based on mutual, learning, cooperative, collaborative connections, and development of dialogic competences (Sennett, 2008);

In line with Molotch view, there could be then the chance that also the production of goods (and I am not referring to GDP production) might be able to sustain positive and innovative social practices, looking in particular at inclusivity.

In the following paragraph, I am going to focus the attention on Milano, making a rapid overview of research and activities which were particularly useful to frame our study.

Milano: theoretical framework and reference research

Makerspaces and fab labs, even if take back on the production working activities, are clearly part of the panorama of so-called Post-Industrial societies (Touraine, 1969; Bell, 1973) defined by:

- Closing down of several factories and the consequent need to re-define the identity of cities whose economy was based on manufacturing industry.
- Flexibility of workers, products (customizable), production quantities, etc.;
- Growth of the service sector: people working in commerce, tourism, health, education, entertainment, transport, etc. sectors become more numerous than the workers in the industrial sector;
- Increase of the importance recognized to knowledge (scientific and theoretical);
- Global networks of interaction (Castells, 1989).

As Antony Giddens (1990) highlighted, globalized societies and the working sectors which characterized it, are defined by dynamics of time-space compression. This last aspect is represented also by the faded boundaries of traditional urban functions: different tasks co-exist in the same places (work, consumption, leisure, etc.) "and new functionalities emerge as people take spaces into new uses" (Di Marino & Lapintie, 2017: 1). Di Marino & Lapintie (2017) talk about Post-Functionalist cities, which are characterized by hybrid forms of work, enterprises, and spaces, in general. For this reason, as I am going to deepen later, we decided to take into consideration for our research, not only makerspaces and fab labs but also other kind of spaces where sharing, encounter, production, socialization, etc. happened in order to delineate a complex ecosystem which characterizes also the directions taken by the municipal administration of Milano.

In the last few years, many Milano-focused research studies, and projects have been developed on the topic of "making". I quickly summarize those which were useful to theoretically frame our research.

Studies and research developed within the Design Department of the Politecnico di Milano by Stefano Maffei & Massimo Bianchini, directors and founder of POLIFACTORY, were particularly interesting for their analysis and reflections on the urban dimension of the phenomenon. They developed the idea of micro-urban manufacturing applying to it the concept of ecosystem (Maffei & Bianchini, 2013; Bianchini et al., 2014). At a national level, in 2015, with other scholars, they produced the "Maker's inquiry" (Bianchini et al., 2015), with the purpose of studying and analyzing the makers phenomenon in the Italian context. They investigated also the economic sustainability of the sector discovering that the majority of makers (54.4%), who participated in the survey, confirmed that making was a secondary and complementary economic activity; in addition to that, the majority of respondents (36.5%) declared an income range between 10,000 and 25,000 euros per year, and on the other hand, 23.1% of them declare an income between 0 and 10,000 euros.

Inside the Department of Architecture and Urban Studies (DAstU) of the Politecnico di Milano a research group, coordinated by Ilaria Mariotti (Armondi & Di Vita, 2018), carried out a FARB project called "New Working Spaces. Promises of Innovations, Effects on the Economic and Urban Context". The importance of the political framework, in which the investigated phenomena takes place, was particularly relevant in this research; indeed, one of the main focus and result is about the regenerative capabilities of these new working spaces, which often substituted old typologies of production. The research used the interesting interpretative category of proximity, proposed by Ron Boschma (2005), who analysed different typologies of proximity

(cognitive, organizational, social, institutional and geographical) and how they might influence learning and innovation processes.

Professors and researchers in Sociology (mainly from The Sociology and Social Research Department of the Università degli Studi di Milano Bicocca) stressed the current re-specification and re-signification of the manual and productive work focusing also on the cultural value of makerspaces and fab labs, which actually seems to be the most important value if compared with the economic one (Colleoni, Vicari Haddock & d'Ovidio, 2015; d'Ovidio & Rabbiosi, 2017). In addition to that, a research carried out in collaboration with *cheFare* and Fondazione Feltrinelli, "broke" the wall which separated culture and production, developing an analysis of 6 different case studies which involved both cultural and art spaces, makerspaces and fab labs (Giuliani, 2018).

To conclude, I want to mention a project which wasn't developed within academy: *SUPER - Il Festival delle Periferie* (The festival of the suburbs). We had the opportunity to discuss and involve their initiators and researchers in order to compare our projects since they had several points of contact. In particular, we were interested in their idea that peripheral neighborhoods of Milano are important pieces of the whole Milanese ecosystem, and, in the strong connection between culture, making and social innovation, which they wanted to highlight thanks to the organization of workshops and events around the city.

In light of the core concepts, which emerged from the research listed above, we decided to look at "making" in a wider way or in an "open" way as Sennett suggested (2018). Indeed, making is not only oriented towards utilitarian purposes but also towards sociality goals (Sennett calls it "limited fraternity" relationships) favoured by processes of co-creation, collaboration or even by the possibility to meet and interact with other people in the same (physical) place (Fassi & Sedini, 2018).

In the following pages, the study that we carried out starting from February 2018 to September 2018 in collaboration with the IIT of Chicago will be presented.

Made in Milano: a collaborative research

The idea of considering all those activities able to bring together people both for economic and leisure purposes as making was quite "extreme". However, it has been thought that it would have been an interesting point where to start from and then eventually focus our attention on more specific and coherent issues. However, using an ecosystemic approach and having as a research goal the identification of a possible definition of Civic Design, we thought that this was the right path.

In collaboration with the IIT of Chicago, we identified our common research questions and 10 key concepts which would have been driving our research.

In this paper is going to present only the work developed on the Milanese territory by the School of Design of Politecnico di Milano. Not all the steps and results of the study will be taken into consideration, but only some specific research activities, focusing mainly on the following research questions: How can the goals of social innovation and inclusion be achieved through making? What's the role of Design in these processes?

The initial mapping activity involved places and initiatives of (and for) (new) work, creativity and aggregation:

- coworking spaces;
- fab labs & makerspaces;
- service centers and hubs;
- incubators;
- cultural centers;
- spontaneous engagement spaces;
- cafés;
- events.

Then, our first group of case studies was selected among the 180 mapped activities. The selection was based on three main factors:

1. their mission: more or less focused on social innovation
2. their location: peripheral
3. their originality: they had not already been investigated by other recent research (in particular by those mentioned in the previous paragraph).

Figure 1: Matrix of the selected case studies. source: Vanessa Monna.

We interviewed also some key informants from the Public Administration (the Municipality of Milan and the Metropolitan Area of Milan). Additionally, we decided to interview some artisan entrepreneurs, because they had been suggested to us from the previous interviewees or because their activity was particularly interesting for us; indeed, all of these spaces owned crucial characteristics of innovativeness (e.g. integration of traditional and 4.0 tools and technology), openness to a wider public, connection with the design field (in terms of competences, strategy, collaborations, etc.), suburban localization. We involved in the interviewees' group the following sectors: jewellery design, lute manufacturing, typography, bakery, bicycle manufacturing, brewing.

In total, we interviewed 19 people. The interviews lasted on average 45 minutes; they were recorded and fully transcribed.

Made in Milano ecosystem: vision and mission

Some of our case studies were actually born from previous spontaneous experiences of political and social activism, then they associated themselves and, after a while, they decided to become enterprises or associations. Others were initiated thanks to the Municipality or the Academy with the purpose of regenerating places/spaces, and with the purpose to involve specific marginalized populations or to favour the encounter between citizens. Others were already mainly business-oriented.

Social issues were often at the core of our interviewees' mission. Even if social innovation is harder to pursue by artisans, many of them pay specific attention to sustainability.

Several activities are focused on empowering marginalized people, such as immigrants and refugees. In addition to that, sometimes, they were able to help people who lost their jobs (or just wanted to change it) to reinvent themselves, thanks to the participation in their courses or activities.

> *"The isolation issue is very strong; being an unoccupied woman or with bad conditions of work in a period of general crisis is a very strong weakness." Piano C*

In general, a common characteristic of these case studies is that they try to promote *social mixité* (Wirth, 1938; Sennett, 2008) in the composition of their workers, collaborators, users, and clients' groups. *Social mixité* is also obtained thanks to the design of new products and new hybrid spaces, which for example are capable of trigger a change into the average target by diversifying it.

Figure 2: Noor, nato con la camicia banner. source: Serpica Naro.

I can mention here the activity "Noor nato con la Camicia" (*Noor born with a shirt on)*[2] carried out by Serpica Naro association. This initiative was started in February 2016 to promote the work of Noor Zaman, an Afghan tailor who was waiting for the approval of his request for political asylum in Italy.

> *"Anyone could come here to get custom made shirts or a kurta (a traditional vest), upon payment of a deposit. Now Noor continues to have his private customers who contact him via Facebook. He also teaches in some courses here about shirt and vest tailoring, we also went to Pavia to organize an ethical fashion show with his collection. We tried to create some opportunities for him." Serpica Naro*

He has now obtained the status of refugee and works as a tailor. Sometimes he still goes to SerpicaLab to make the tailored shirts committed to him.

Made in Milano ecosystem: localization and relationship with the territory

Figure 3: Localization of case studies and artisans-entrepreneurs (pinpoints) selected. source: Carla Sedini, with snazzymaps.com.

[2] The name of this activity in Italian is actually a wordplay, since "being born with a shirt on" means "to be lucky".

The reason for being in Milan was always identified as quite strong for our interviewees. Milan was recognized as the right place where to invest because of the presence of several *soft* factors, together with the *hard* ones.

The localization in a specific neighbourhood, though, while in some cases was a choice in other cases happened by chance. Indeed, some interviewees declared that the localization in a specific area of the city was part of their entrepreneurial project, not only because of accessibility but also for reasons of cognitive proximity. The connection with the territory was often stressed as a win-win element both for the enterprise and for the area, which underwent a social, economic, and territorial revitalization also thanks to the localization of these new businesses.

In other cases, the location was mostly due to the availability of a space with the right economic and structural characteristics.

Sometimes the peripheral localization represents a weakness and a challenge in attracting users and clients. This difficulty seems to be much more related to a mental prejudice than to actual problems connected with safety or accessibility.

> *"The location does not help. There's a wrong perception of suburbs. But the policy helps (Suburbs delegation in the municipality of Milan). It's not that easy to reach us, there's no subway lines, for example. But it is more a mental constraint." FabriQ*

The impact of these spaces is not measurable yet. However, in some cases, just the fact of regenerating an abandoned area was able to make it accessible and to attract people.

In addition to that, several initiatives were also able to change the perception of places which were once felt as private and closed from the outside, turning them into spaces open to the community (local or not). Indeed, the relationship with the city emerged also from events and activities aimed at opening these spaces and connecting the inner community with the external one.

> *"Cavriano [an area of Milan] has a forgotten identity. The action of making a place accessible to different targets is something that you can measure in terms of presences. Farms and vegetable gardens make a place an important social device." CasciNet*

FabriQ, for example, is the first incubator of the Municipality of Milan specifically dedicated to promoting social innovation. The launch of FabriQ in 2014 is part of a wider long-term plan of the Municipality to relaunch the North-West area of the city and a wider policy of recovery of empty or abandoned spaces. FabriQ is located in a suburban area of the city, called Quarto Oggiaro, which does not own a very good reputation. FabriQ is located in a regenerated 650 square meter space.

One example of initiatives developed for and with the neighbourhood was "The Street Art week" which was one of the activities composing the wider project "Mettiamoci in gioco" (*Let's get involved*)[3] focused on the social regeneration of a small playing field close by FabriQ. In particular, during "The Street Art Week" painting and street art activities were developed at the playing field, under the conduction of the well-known Milanese street artist, Bros. Involving people from inside and outside the neighbourhood, this marginal and residual space was given new life thanks to co-drawing activities.

[3] It was a project carried out by a local partnership - created thanks to a tender promoted by Timberland and King Baudouin Foundation - made up of FabriQ, Save the Children, ASD Futura, and Ambiente Acqua Onlus, acting in the Quarto Oggiaro.

Figure 4: The playing field in Valsassina street (Quarto Oggiaro) before and after. source: FabriQ.

As it is possible to understand from this example, our case studies were characterized by a multiplicity of activities and purposes.

Made in Milano ecosystem: design role

Several managers and entrepreneurs, who were interviewed, studied in a Design School. They stressed how the role of designers have changed over time: there has been a return to analogic processes and tools, often (but not always) connected and integrated with digital fabrication and, in general, new technologies. This clearly has an effect on productions which are composed of small quantities and high-quality goods in opposition to large-scale distribution processes.

The contribution of design in our case studies happened both on tangible and intangible aspects. Therefore, design was helpful both in the ideation of specific tools, in the design of the space and its interior, and also in the activation of networks and good practices.

In general, there is wide recognition of the value of a design approach and where design is not immediately at the core of the entrepreneurial or associative strategy or it is not an "in house" resource, our interviewees declared that they try to collaborate with designers and design schools.

According to the answers collected, it is possible to identify three main roles that design can play for these spaces:

1. The first two can be combined. Design has an **envisioning** role to imagine good practices and project opportunities; and it has a **facilitating** role able to activate relationships (which will be discussed in the following section).

"In 2007, we looked for external [from the company] product design for our guitars. A young designer came in, bringing the idea of a shape linked to gestures. That same year, Giulio Iacchetti proposed bringing the topic of music to the Milano Design Week. Each designer was linked to a company in order to make a musical product. So, we also made an instrument for this event." Noah Guitars

2. Design has a **strategic** role within enterprises from other fields, allowing the reinvention of traditional businesses, expanding their offer, developing a communication plan, and attracting new types of clients.

"We use a method which we called 'work design'; it tries to connect already existing resources. Your job is a project. This method is based on the design thinking approach." Piano C

Coltivando, a community garden within the Bovisa Campus of Politecnico di Milano, is another interesting case study to be mentioned. Coltivando was ideated in 2011 and developed in 2012-2013 and it is addressed to two main purposes: allow the local community to discover a public place which they usually do not attend, and create connection between people from different communities, such as students, citizens, scholars, etc. with - it is possible to say - the pretext of growing their own food. Service design combined with a community-centered design and a spatial design approach were used to develop Coltivando.

"In the preliminary work, we had spent a lot of time figuring out how to divide the harvest among people. Unexpectedly, we realized that people did not care: they came regardless of the collection, it was more for meeting people. For this reason, we have also organized harvest days." Coltivando

Figure 5: (left) first Coltivando Happy hour; (right) a usual saturday at Coltivando. source: Coltivando

Today Coltivando is managed by a team of 15-20 people plus some "supporters" who pass by sporadically or on special occasions. Indeed, the permanent people who take care of the garden meet there every Saturday but Coltivando organizes and hosts also workshops and convivial events which are able to attract people who usually do not participate in it as well.

Made in Milano ecosystem: network

Some of our case studies were born thanks to the connection between different actors and stakeholders: Academy, Government, Civil Society, and Enterprises, according to a Quadruple Helix approach (Carayannis & Campbell, 2009). In other cases, this network was created after their constitution. In others more, institutions have taken an active part in the project, through specific offices.

The creation of networks, in most of the cases, is not limited to the business activity or association, but it is also extended to their workers, users, clients, "friends" as it was mentioned also in the previous pages. These spaces are indeed platforms for encounter where the creation and accumulation of Social Capital is made possible. This goal can be already declared in the mission of the space or it can be a (positive) side effect. Design plays an important role for this purpose; the creation of networks can be achieved by design or with design, where in the first case design is the content and-or the agent and in the second it is a tool and-or a strategy.

"Our vision was to create a place where people could work supported by adequate spaces and equipment. Above all, a place where there is a real exchange, sharing, putting aside the competition, and embracing the idea of internationality (because we believe in it)." About Officina Orafa (About Goldsmith Lab)

A good example of network creation at different levels is the MakersHub Design Hostel initiative: during the Milano Design Week, the spaces of MakersHub were transformed into a hybrid hostel and exhibition space.

The creation of networks works both at the organizational and territorial level (e.g. among institutions) and at the users' level; in addition to that, in this case, design worked both as content and as a tool for the ideation, realization and the experience itself.

Figure 6: Design Hostel, day (left) and night (right). source: MakersHub

Starting from the idea of Davide Crippa, founder of the Ghigos architecture studio, MakersHub offered the space, realized the technical project and the set-up, and coordinated the whole operation. The collaboration with the Design Department of Politecnico di Milano and POLI.design was crucial, in order to internationally spread the call. This was the first level of creation of networks, which during its second year in 2018 actually started the Bovisa Design District.

> *"We understood that playing 'solo' was not sustainable. We had to think in a wider way. It was a win-win partnership with the territory: the birth of the Bovisa Design District has brought to light Bovisa potentialities, which we only had imagined years before." MakersHub*

The second level is represented by the fact that several young designers (and design lovers) from all over the world slept and lived together for several days, knowing each other both personally and professionally, since they could use their accommodations also as showrooms.

Making the difference through design: first conclusions

In these first conclusions of the collaborative study here presented, I want to highlight the main roles played by design with a particular focus on the topic of social inclusion and Social Capital improvement.

First of all, apart from the results collected by the research, design had a wide **political** role. Indeed, in light of the general concept of Civic Design, which is based on the central role of citizens in the creation and diffusion of civic visions (Saunders, 2008), two Universities (School of Design of Politecnico di Milano and the IIT of Chicago) started a collaboration after being involved in the policy Milano-Chicago Sister cities program.

Looking specifically at what emerged from our study in Milano, design served as a **content**. Indeed, the topic of making is strictly connected both with traditional and advanced design and this is pretty evident in artisans, maker spaces, and fablabs case studies.

Design was also a **strategic** lever for innovation and development processes inside other hybrid enterprises, such as co-working spaces, incubators, social gardens.

A transversal role of design and making was the creation of **networks** and - as a consequence - the support given for the development of Social Capital.

Indeed, making, manual, artisanal, and design activities:

- are perceived as more inclusive than intellectual ones, and therefore able to create a *social mixité* and favor the dialogue between different people and stakeholders;
- can positively influence social redemption, because they also offer opportunities for excluded and weak population groups.

In this sense, design can have a positive impact on the creation of more suitable and sustainable working environments.

Milano, as an ecosystem, is an interesting case study because it seems that the role of making and design has been recognized at several levels from the political to the entrepreneurial and the social side.

A dense environment is already empowering and stimulating by itself; in addition to that, the continuous support for the creation of new initiatives to connect different stakeholders is a way to create a legacy, a reputation, and an environment defined by values of openness and empowerment. Richard Sennett in his most recent book (2018) talked about the Open Smart City, a city which support non-required encounters. Indeed, cooperation has not necessarily be driven by consent, but can also be supported by different stakeholders, collaborating in the accomplishment of impersonal tasks (such as growing tomatoes or co-design a hostel). The creation of such social environment which does not only answer to utilitaristic purposes is made clearly possible by the personal commitment of people but, in order to become a consistent /persistent practice, needs institutional and political support, which could be mediated by the strategic role of design.

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A Story of Journeys: Contemporary Design Facilitation

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How is design itself transitioning and transforming as it moves into more complex domains of organizational and social change. In many of these contexts, designers now play roles as facilitators, working in complex systems and dynamic environments. Design facilitation itself is moving from being a vessel for participation and becoming a vehicle for organizational transformation and change. The authors use a case study of a multi-stakeholder international design facilitation project with UN Women's Fund for Gender Equality to highlight some of the critical features of a design facilitation process, from mediation and navigation of systems of power and hierarchy within organizations to an expansion of designerly duties 'before' and 'after' a design intervention. Reflecting on this experience the authors propose possible models for design facilitation to further develop its approach, and offer future questions for the nascent field as it develops into a critical component of contemporary design practice.

Keywords: design facilitation, social innovation, social field, transformation, strategic design

Introduction

A key point in a discussion of design is its own process of transition and transformation as it moves into more complex domains of organizational and social change. Design has expanded into new fields, from visual communication to industrial design to now a focus on the non-physical. Designers now work on problems of organizational and social structure, on interpersonal interactions, service and experience design. (Norman, 2010). In many of these contexts, designers now play roles as facilitators, working in complex systems and dynamic environments.

While many, since and including Papanek and Simon have anticipated this transition of design to new realms of the non-physical and intangible, design education and practice have still fallen behind. Designers often fail to understand the complexity (see Fig. 1) they are dealing with, and lack the tools and models to approach the interlocking complexities of human and social behaviour, of business and culture, of privilege and power.

Correspondingly, there is a challenge and question about the role of the designer themselves, the role of expertise and the skills they provide and bring to processes described variously as "co-design" or "participatory-design" or perhaps even design facilitation. Sanders and Stappers identify the need for the inclusion of non-designers in such projects, and begin to explore how this inclusion blurs the lines traditionally held between roles in the design process. (Sanders & Stappers, 2008).

Manzini pushes forward with his provocation that an expert designer must be wary of merely fulfilling an administrative role. What, therefore is the role of expertise in these new design processes? Manzini expresses that the expert designer can select and develop design methods and tools for use in their practice, but also that their practice must be discerning and self-reflexive. For this reason, he argues, the expert designer must

also create artifacts, proposals, and provocations that can be used in tangible processes. Manzini argues that this understanding holds true for all levels of design from the local to the systemic and therefore whoever is classed as a design expert also carries within them a design methodology and design culture. (Manzini, 2016).

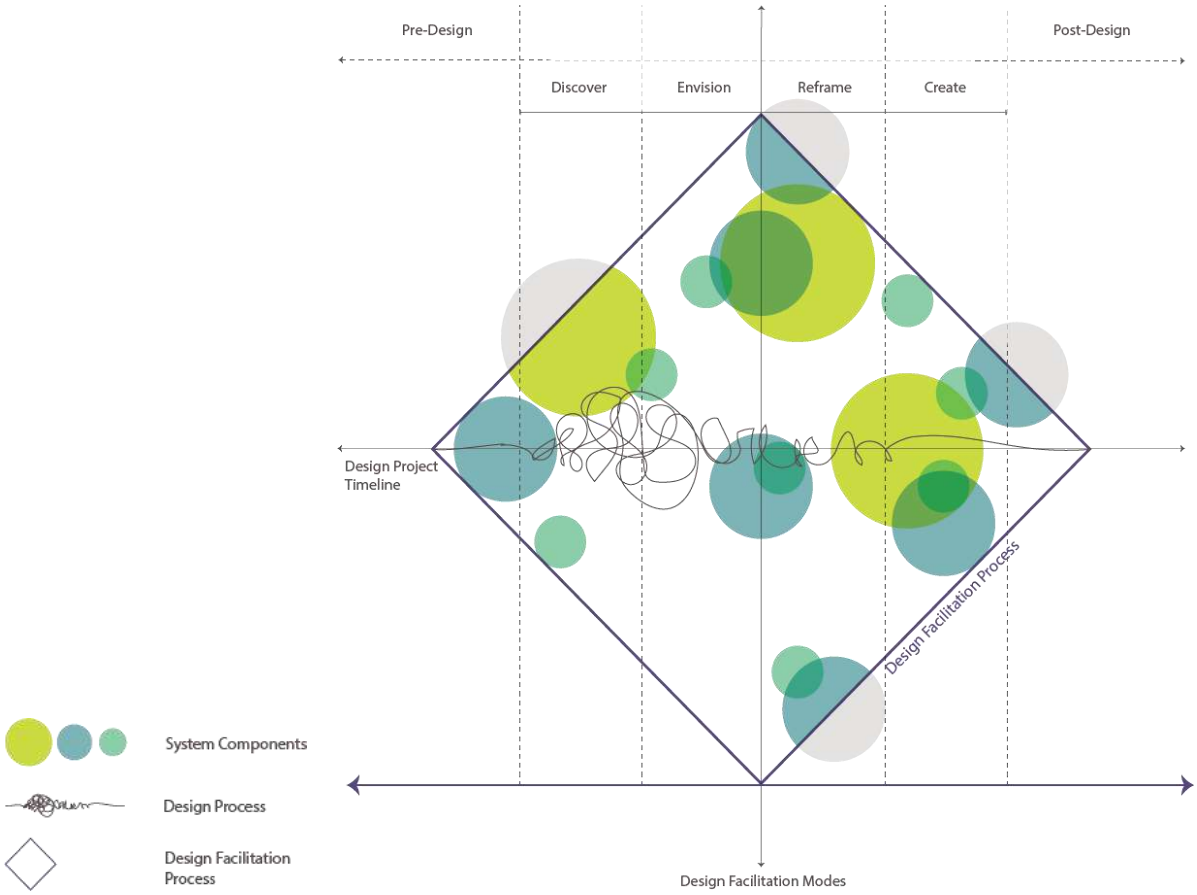

Fig. 1.: Design Facilitation. Facilitation Design.
As the design field moves into more socially complex domains of systems-wide change, new tools and practices are needed to suit new roles. In these complex adaptive systems, designers need to create contexts for distributed participation. In these living systems, designers must address the underlying conditions for spontaneous emergence, or creativity, in the generation of new forms, that drives self-organization and system evolution. Designers need to be stewards, coaches, and shepherds of the process, designers need to be facilitators for emergent transformation.

Along these lines, Sanders and Stappers underscore that the move from the traditional user-centered design process to a design process based on collective creativity. Whereas a traditional design process may have a designer translating between different user groups, a co-designed initiative turns the designer into a facilitator between participants, designing a process of guiding and supporting individuals of varying levels of inclusion and creative confidence, to participate within a process. (Sanders & al., 2008 and 2012).

However, is this too narrow a view of facilitation and the role of designers in this process? If the role of the designer is to operate as vessel does it not miss the role of the designer as participant? What happens to agency of designers facilitating such processes as roles increasingly start to blur? Yet, design, whether graphic, industrial, multimedia, interior or architecture, and whatever the intention, purpose or function, is a discipline that requires the shaping of form. (Wahl, 2008). Designers, therefore, bear responsibility to a future output; this also proves to be true when designing the invisible. Furthermore, the concept that co-design is inherently ethical because of the reciprocity that it entails also suggests a profoundly interactive and user-orientated aspect to design.

This paper explores the evolution of the design field and the rise of the practice of design facilitation as a significant component of contemporary design practice. Using a project co-implemented by the authors as an example of what this work looks like in action, we observe a mismatch between current literature and the needs of the design facilitation process. Arising from this, the paper offers criticisms as well as potential

pathways for design to further develop design facilitation, and begins investigating what such development would need to involve and include.

Contemporary Design Practice and New Design Methods

Design has developed dramatically over the last twenty years, and strategic design practices have matured into a real alternative to conventional problem-solving strategies.

This contemporary view of design not only encompasses the traditional alliance of design with market-based considerations and consumer culture, but also accounts for design as a locus for public and social innovation: design intended as a combination of ways of thinking, knowledge and skills to be applied to the most diverse kind of artifacts, provision of services, communication, organizations and policies. (Manzini, 2012). Increasingly, designers are facing these open-ended challenges head-on, and are called upon as uniquely effective translators and synthesizers of this class of societal problems that are not neatly bounded, but ill defined, ill structured and "wicked". (Rittel & Webber, 1973). Yet, as many scholars and practitioners have noted, most models of the design process fail to capture the new reality of contemporary design.

Designing for systems and social change is not the same thing as designing physical artifacts. It is more than a question about a linear increase in scope and scale. It is a qualitatively different act. Therefore, it needs its own theory and grounding to be successfully applied. Prior models of design while often necessary cannot be sufficient. *And when one is designing to catalyze social change through systemic reconfiguration, the problem grows even more complex. The process changes, the content changes, and outcomes change in ways that present unique and vexing challenges for traditionally trained designers.* (Hunt, 2014, p.14).

Papanek may have been masterful at rethinking the process of design, but the opportunity he missed was that process could also be designed. Too often, designers go through the motions of creating inclusive, participatory design projects that follow, with pious devotion, the rote clichés of participatory methods; they surrender all creative capacity to non-designers, as if it were the case that the only things those communities lacked were enough marker pens, sheets of paper, and Post-it notes to see their way out of the challenges they face. According to this playbook, the designer's role shifts to facilitator, as if this were a capacity inherent to designers (which it is not). (Hunt, 2018, p.187).

This suggests an evolution in how we think about the design process when it applies to these kinds of complex systems and organizational moments. Design research is now a participatory process, sense-making a dynamic facilitation, ideation part of a negotiation of vulnerability and power, and iteration becomes grounded in capacity-building. Yet even here, perhaps we can move further. As Scharmer argues, "the key for successful prototypes lies in creating generative holding spaces." (Scharmer, 2007, p. 204). Yet to what extent are design facilitation and its tools being developed to create these spaces? How are designers being trained to build and rise to these moments?

Design Facilitation

With design at times being closer to a social process than craft, the designer's role is changing. Often times, designers find themselves in roles mediating a consensus amongst participants who may have differing interests both within the design process and in terms of its outcomes.

Napier and Wada identify as design facilitation a process of including individuals with differing decision-making capacities and areas of expertise in order to develop more desirable, viable and feasible design outcomes. (Napier & Wada, 2016, p.156). Embedded in the understanding of design as tool for strategy and innovation, Martin describes the term as a process that has been shown "to aid and abet innovative practices within and between organizations and organizational cultures, and, in some cases, to help them gain competitive advantage in particular markets." (Martin, 2009, p.57). Design facilitation moves our focus as designers from products and artifacts, from apps and brand architecture, to process; in surfacing the needs and goals of participant populations and better understanding what is needed next for a design intervention to succeed. (Napier & al., 2016).

For designers to be successful facilitators, it entails development and competency in skill sets focused on participatory practices. Qualities of listening, consensus and relationship building between individuals and organizations, a social and inclusive understanding of a community and its diverse constituents all emerge as critical skill sets for designers acting as facilitators. (AIGA, 2017).

Thus a question must be asked in how might one differentiate design facilitation from more general facilitation practices. Body, Terrey and Tergas, through this contrasting, argue that design facilitation entails a focus on creation, a human-centered and user-centered design research process, and one that embodies design attitudes, competencies and capacities: to be deeply empathetic, iterative, oriented towards abduction and anchored within a design methodology. (Body, Terry & Tergas, 2010)

From this review, when taking on the role of a design facilitator, the authors recognize the development and enhancement of the collective capacity of the group crucial to the achievement of transformative design processes considering the high involvement of participants throughout the process. It is apparent that such a process entails distinct instantiations of designerly skills from other areas of design practice. It is also embedded within a design strategy process; and successful, participatory social innovation design often necessitates design facilitation within the context of a particular project or practice.

Design Facilitation in Practice

Drawing from our shared experience and research, what follows is an attempt to reanalyze key elements of a design process in terms of a design facilitation practice. To do so, we will be introducing a pilot initiative - *Rethink.Experiment* - launched by the Fund for Gender Equality (FGE), a grant-making mechanism of the United Nations Fund for Gender Equality and the Empowerment of Women, that aimed at exploring the potential for design to serve as a tool for innovation in women's rights programming by involving partners and beneficiaries in the construction and implementation of programs. (UN Fund for Gender Equality, 2018)

In doing so, the project team saw an opportunity "to do international development differently" with the objective of creating positive and more lasting impact while at the same time, putting into practice much of what the FGE had been advocating for - placing beneficiaries at the heart of the work, flexible and adaptive processes, addressing root causes using systems thinking, and co-creative approaches that allow for inclusive and participatory development. Furthermore, the project team also meant to encourage women civil society organizations (WCSOs) to explore, generate and test design as a tool for their own social innovation in a safe-to-fail environment.

We, therefore, use this initiative as an example of contemporary design practice and design facilitation, and through this example reveal some of the deeper considerations and complexities at play within the design process that current models are insufficiently addressing or missing entirely. Summarizing the previous discussion, that process currently entails (1) develop a collaborative design process, (2) utilize appropriate design research methodologies and (3) channel results into stakeholder appropriate action.

The Rethink.Experiment

Over the past nine years, the UN Women's global grantmaking mechanism, the Fund for Gender Equality (FGE) has directly impacted the lives of over 580,000 women and girls from the most marginalized groups across 80 countries, and reached millions through policies and public campaigns. Its strategy combines the provision of grants for high-quality projects supporting women's economic and political empowerment and strengthening the capabilities of women's organizations through technical assistance and training has been validated by independent evaluations. Its projects have demonstratively advanced gender equality, especially affecting changes around social norms, the creation of women's collective structures and development of their skills on the local level.

However, following its first independent evaluation and a self-reflection exercise, the FGE realized that its projects were not tapping into the full potential of the organizations driving them, that much more could be achieved with the same of even fewer resources: Are we grant-makers and project implementers working in the most efficient and effective ways? Are our projects designed to respond to the real needs of the furthest behind? What alternative approaches and tools can lead to more transformative results?

These questions were the starting point of the Fund's *Rethink.Experiment* initiative, launched in 2018, through which nine women-led civil society organizations operating in eleven countries, over a period of nine months were introduced and trained in key principles of the design process to address a specific project challenge using a beneficiary-centered design approach reaching from "how might rural women from disadvantaged communities transition from small-scale producers to profitable entrepreneurs" to "how can we find creative solutions to keep women's rights in the political agenda in a conflict setting".

As the Fund supports women's organizations that can reach end beneficiaries – especially the most marginalized communities – and have the capacity to influence at a national level, investing in their innovation capabilities has a powerful catalytic potential hoped to result in positive changes in the lives of marginalized women and girls. (UN Women, 2018).

While structured into six main phases of iterative character: 1) Identify a challenge, 2) Understand and Emphasize, 3) Redefine the challenge, 4) Ideation, 5) Prototyping, and 6) Testing, the process was designed with the intention of creating participants with a safe-to-fail environment that encourages participants to explore, generate and test design as a tool for social innovation.

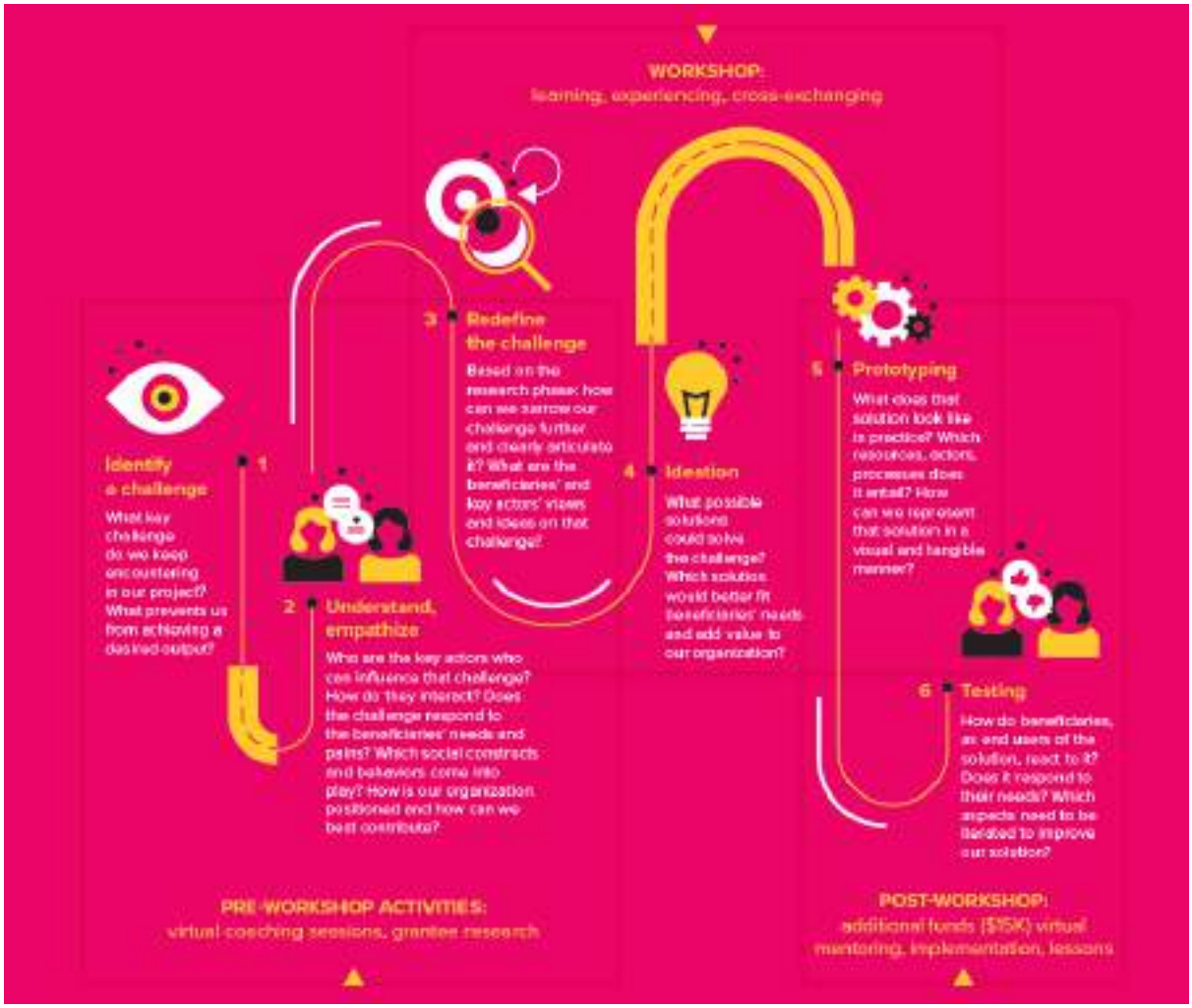

Fig. 2: The Rethink.Experiment Process*: Nine FGE grantees with capacity to absorb additional funds, potential for larger scale impact, and strong reporting skills were selected. With the support of social innovation experts and the FGE team, they are learning about and experiencing the stages and loops of innovation processes thanks to virtual coaching, one face-to-face training, peer exchanges and $15,000 to test their solutions. Source: Fund for Gender Equality*

Given the current literature, a designer looking to facilitate such a process, would most likely follow similar steps, and might even consult the literature cited earlier for a framework of design facilitation. However, as many practitioners might attest, there is a mismatch between current literature and the needs of the design facilitation process: designers working in such context are required to use their designerly expertise and skills to design individualized processes using contextual-design tools.

In the case of the *Rethink.Experiment*, as this was the first time for the Fund and its grantees to explore the potential benefits of applying design methodologies to gender equality programming, the project followed a multi-phased approach that included an expanded phase of coaching on design and research methods in the early phase of the project as well as allowed for testing of tools and adjustment of working methods in real

time. The extended focus on research also aimed at deepening understanding and building empathy with the multitude of constituents involved in each context.

Considering that the participating organizations were located in nine countries taking into consideration the specific complex context of each one not only seemed crucial to the success but also ethically appropriate considering the nature of interventions. All research activities were, therefore, co-created taking into careful consideration the specific reality of each context, leading to to different research activities for each organization. For example, while in conversation with grantee partners in the Philippines, observation was considered to be an apt method, others, such as the Paraguayan partners, were encouraged to engage in in-depth interviews or mapping exercises, or - as in most cases - a combination of multiple methods.

Furthermore, through acknowledgement of the unique, complex environment of each organization and a strong emphasis on co-creation and capacity building, the team hoped to fabricate the condition that allowed partners to adopt broad and general design principles to their very specific contexts. Additionally, "exporting" particular design practices - which might be seen as political as they often come value systems attached - might lead to unintended consequences and hinder pluralism in design practices.

Using this specific context to raise more general concerns, the authors observe that models design facilitation neglect critical areas of practice in the field and raise the following questions of the design facilitation process.

What is the role of the designer in mediation within a design facilitation context?

This kind of multistakeholder process involves multiple actors co-creating with multiple interests and multiple dynamics and processes at play. This includes navigation of systemic power biases and structures within the organizations and participant social structures. Through the construction and activation of a design facilitation process, how are designers successfully identifying and managing these mediatory considerations? If facilitation is a designed process more than a crafted artifact, and therefore if the success of a design initiative is to be impacted by the success of that social process, what are the skills and techniques to be employed by designers? How are designers providing value as mediators?

In the FGE example, how do designers mediate a process between various international and local organizations, mediate an intersectional process, mediate a collaboration between those funding the funders, the grantees and the funding organizations - each with their own concerns, vulnerabilities, anxieties and interrelated power imbalances?

How is design facilitation developing and connected to strategic vision?

A critical piece of all design practice is the articulation and formulation of the design problem. That itself is a process of discovery, introspection and transformation. How does design take this deeply internal process embedded in design expertise, and enable its exploration in collective, collaborative processes by multiple stakeholders? How is vision, and the design problem at play, turned into a dynamic investigation as opposed to a static destination?

In the FGE example, the complexity and diversity of challenges faced meant that identifying the design problem was a critical collective competency to be developed. Designers could not come and provide the frame of the problem, and instead had to help participants develop intuitions and insight into their own evolving situations. Yet simultaneously, and paradoxically, vision, structure, purpose and strategy, needed to be developed out for participation to occur. The process had to both provide form and help generate form simultaneously for vision to emerge.

What is the role of the designer before and after the “design process”?

What are the considerations designers need to manage and maintain in the introductory phase of this work? When building space for co-creation and building a culture through a project for a design mindset and orientation? How are designers practicing preparation of their participants in this kind of transformative process? Furthermore, what are the roles, responsibilities and expectations for designers at the culmination of a design sprint or project? In a systems context, there is continuing work that must be planned for and accounted for in helping build solutions that possess resiliency and sustainability in their scale of impact and endurance of effect.

In the FGE example, how does design prepare participants who are not otherwise exposed to design processes, encourage vulnerability and risk-taking, and prepare participants to engage with discomfort? How

do we prepare participants to be open to the new, and move beyond the cynicism of failed initiatives past? How do designers help participants understand and approach future prototyping and development of design competencies and approaches after the end of the workshop, and help participants as they face challenges previously unanticipated?

How are we creating space for reflection and transformation within the facilitation process?

Co-creative approaches rely on participants coming to new kinds of approaches and embodying that newness in their work moving forward. Such processes are by definition transformative, yet how are designers trained and practicing personal and organizational transformation?

In the FGE example, how do designers make space and provide form for participants to become anew, and create the opportunity for new initiatives to take shape. How are we designing for embodiment, designing for resonance and designing for new futures and possibilities to take flight?

Social Models to Underpin Design Facilitation

These questions suggest a much more fundamental need for models to apply in design facilitation. When and what is design operating on within the context of a team, within the context of an organization? What are we focusing on when design acts through facilitation upon a social dimension?

One answer may lie in the work of Scharmer and the social field. In Peter Senge's description "...in every setting, from working teams to organizations to larger social systems, there is much more going on that meets the eye. Many of us have known firsthand the excitement and energy of a team that is deeply engaged in its work, where there are trust, openness, and a pervasive sense of possibility. Conversely, we have also seen the opposite…where each statement has thick political overtones of defending one's position or attacking others'. Scharmer calls this the 'social field'". (Scharmer, 2007, p. liii.).

To us this immediately calls upon a quality, or dynamic that a design facilitation seeks to develop and embody. Scharmer, in his work on a theory of organizational change, theory u, argues that fundamentally, a key aspect of facilitation and transformation comes from an attention paid to a "blind spot" (ibid), "From a structural point of view, the blind spot concerns the fact that most of the key issues of institutional development cannot be solved at the level of the organization. Today's organizations are often too big to deal with the small problems that are better solved locally, and too small to adequately address the big problems that must be considered in the context of the larger ecosystem of value creation". (ibid).

What is critical in our context as design facilitators is then understanding that beneath the veneer of a facilitated group process is a complex social dynamic that must be charged and cultivated, redirected and opened. And immediately lays bare a paucity of design training in the underlying transformational issues at play, Adding to this complexity, is the inherent need for translation of and between disciplines, contexts, communities, and organisations that designers are required to fulfill.

Using such a model leads to questions and considerations that are provocative additions to the practice of facilitation. One such example is the creation, use, development and nature of "vision" and strategic intent within the facilitation process. This model suggests that the concepts of vision and intent are dynamic, and their interpretations are both temporally and socially bounded by the individuals connecting to them at any given point in time. Building on Scharmers' work and Senge's *creative tensions*, Stroh emphasizes: "If people hold to the vision of what they want and are simultaneously clear and candid about where they are, then the tension will tend to resolve in favor of what they want. This principle applies both at the individual level and the collective level. Translated to the collective level, when people have a common aspiration - as expressed by a shared vision, mission, and set of values - and a shared understanding of not only where they are now but also why - then they establish a creative tension, which they are drawn to resolve in favor of their aspirations". (Stroh, 2015, p.73).

Designers therefore need new models of facilitation and even of what their participation entails and requires of them. It would involve new models of training to see and preparing to do.

Such models of design practice would involve an articulation of and an understanding of collective intelligence, of shared and built capacity and the ways by which art and form give these conceptions shape and direction. It would be impossible, in such a practice of collectivity and awareness to ignore the hermeneutic element in such a process. "The hermeneutical dimension of the process [of experience] is inescapable: every

examination is an interpretation, and all interpretation reveals and conceals at the same time". (Depraz, Varela, & Vermersch, 2003, p.9).

In such facilitation practices, there is a goal or moment of transformation. How are designers being trained to identify and help coalesce participants around these critical moments? We have discussed them in terms of *crystalizing moments* and in terms of *blind spots* within a social field. Capra offers another model to approach the same moment in terms of critical junctures within living systems. There is a spontaneous emergence of order at critical points of instability - emergence or self organization; "in other words, creativity - the generation of new forms - is a key property of all living systems. And since emergence is an integral part of the dynamics of open systems, we reach the important conclusion that open systems develop and evolve". (Capra, 2002, p.13).

This has yet to entail and involve a clarified and critical discussion of power and privilege, of the role of the designer within participatory processes. Design as a discipline has always been vulnerable to a charge of irresponsibility, of creating and designing artifacts with consequences, often dire, beyond the initial intent and predictions of their designers. Through his work and writing, Papanek repeatedly emphasized that "the designer must be conscious of his social and moral responsibility" based on his underlying understanding of design as "the most powerful tool yet given man with which to shape his products, his environments, and, by extension, himself". Designers, he warned, "must analyse the past as well as the foreseeable future consequences of his acts". (Papanek, 1985, p.103). This dynamically comes to the fore within facilitation practices, wherein a designer's actions as facilitator, their wielding of power to enable and disable participants within a process is a significant act of franchisement and disenfranchisement.

Towards New Models of Design Facilitation

As design facilitation evolves and emerges as a form of design practice in response to a need to develop systems-level design interventions, we must continue to build our understanding of its process and impact. And through these mechanisms develop a deeper understanding of the critical inflection points and key skills of designerly facilitation. As with every discipline and practice of design, some of these skills are a resuscitation of design practice through the ages, albeit through a different lens, and some are the appropriation of other traditions and practices now within a context of design praxis.

To remain relevant in these new professional realities, a sought-after, and, more to the point, effective designer will need to be able to formulate, conduct, analyze and synthesize the results of research that informs design processes and design decision-making beyond the traditional, cursory client interview and a narrowly framed, shallowly plumbed survey of secondary resources. Rather, the contemporary designer will need to possess the ability to cultivate and effectively utilize meaningful input from the varieties of people who both affect and will be affected by the design processes that guide the development of these projects and their outcomes. Failing to broadly account for the social, economic and technological biases of eventual users and audiences will limit the designers' abilities to create useful, usable and meaningful artifacts, services and experiences with, rather than for, these groups.

As we begin to understand this dynamic of design as social practice, design facilitation as intervention, we will need to develop more robust models of design facilitation in practice. This paper proposes but a few critical pathways to address. We will need to draw from schools of mediation and build a designerly practice of mediation within participatory processes. We will need to draw from schools of organizational dynamics and change to build better practices of shared vision development and the collective development of high quality design problems. We will need to expand our view of the design process itself and build new forms and approaches to form for an wider area of design intervention. And we will need to integrate a more collectively reflexive and reflective process to facilitate the underlying social transformation, to better identify the right questions to ground intervention and to even understand our role and impact as designers embedded within and active contributors to a system's change process.

We would speculate that such a process may also involve a return to the artistic, to develop methods and approaches that inspire and are evocative. Design must still delight as well as inform, and operate in a space beyond and between scientist and artist. It could also question the use of the term facilitation itself and whether it is appropriate for the lexicon of contemporary design practice.

Our research into design facilitation questions where and how a designer must carry expertise, and what are they approaching when designing the non-physical? How are designers approaching the design of and for the

social field? Current definitions of the design facilitation process outline a series of steps and checklists. Yet as we are finding, when design is a social process, it is a story of journeys and no longer an inventory of destinations. How might we move towards a more plentiful model of design facilitation?

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The Role of Design in Policy Making: A Wicked Problems Perspective

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The design discipline is of increasing appeal to a public sector confronted with ill-defined problems consistent with the socially-embedded. This paper explores the role of design in policy making projects, by means of two case empirical case studies. We establish and apply a wicked problems perspective to analyse data from; (1) MindLab and (2) Helsinki Design Lab. Findings reveal that design is specifically useful in the mitigation of wicked policy problems when harnessed by a strategically composed multidisciplinary team including designers. The characteristics of design that are identified as essential are an interactive approach to problems, a holistic perspective, and a user-centred way of working. This paper contributes empirical evidence toward the role of design in policy making, drawing the two domains together via wicked problems theory.

Keywords: social design, social innovation, public sector, co-evolution of problem and solution, problem framing

Introduction

A powerful convergence is underway. Problems that affect society are increasingly being acknowledged to be interrelated – crossing borders, cultures and falling into the portfolio of the collective (Tromp & Hekkert, 2018). Public trust in political leaders is low, with the immediacy of social media encouraging if not amplifying extreme ideological views (Im, Cho, Porumbescu, & Park, 2014). Citizens are increasingly critical of government institutions and political partisanship that plays out via inaction or counterproductive policy directions, ("let's build a wall"; "let's exit Europe") ibid)). The fourth converging factor is associated with the design discipline. The design discipline has been elevated from the realms of project and operational subject matter associated with artefacts, products, services and processes - to areas of strategy, culture and organisational reform (Sharma & Poole, 2009; Muratovski, 2015). Buchanan describes this change in subject matter as an evolution – the *design movement* (2015).

While the last ten years strongly heralded a view of design as powerful business capability, attention regarding the power of design when unleashed into socio-embedded problems is also garnering interest. Methodological developments demonstrate a discipline undergoing maturity yet retaining a sense of deep responsibility for social matters. Methodological developments include but are not limited to:

- **Vision in Product Design** (Hekkert & Van Dijk, 2011), future focused, designers taking responsibility for the impact of their design;
- **Transformation Design** (Jonas, Zerwas & von Anshelm, 2016), with the goal to drive positive change within organisations via design;
- **Transition Design** (Irwin et al., 2015), designing transitions for "more sustainable futures" and;

- **Designing for Society** (Tromp & Hekkert, 2018), designing with the social implications in mind, or even *for* certain social implications.

Yet achieving policy reform requires overcoming political plurality which is inherent in democracy. The construction of a policy must work to the interests of multiple stakeholders in order to surpass the rigours of political negotiation. Policy makers rarely succeed in making the change they envisioned, which means that policies are not as effective as they should and could be (Bason, 2014). Yet how to design necessary policy reform required to capture system-level and social change remains an area for further exploration.

This paper explores the role of design in policy making projects, by means of two empirical case studies. The greater purpose of this paper is to contribute toward a growing body of literature associated with the role of design in policy making. We apply wicked problems theory to analyse two case studies; (1) Helsinki Design Lab (Finland) and, (2) MindLab (Denmark) in order to evaluate how design as an approach assists policy making. The paper responds to two research questions:

> RQ1: In what way do dedicated design labs aid governments in the mitigation of wicked policy problems?
>
> RQ2: What methods, tools and techniques of design are effective in design lab projects where policy planning and design are combined?

The paper proceeds in the following manner; beginning with a review of relevant literature; detailing a case study methodology; describing results related to the two individual case studies; a discussion of the comparative findings before concluding. This paper contributes empirical evidence toward the role of design in policy making, drawing the two domains together via wicked problems theory.

Establishing a Wicked Problems Perspective

Complex problems in policy making are common. In 1973, Rittel and Webber attempted to understand the nature of these kinds of problems, assigning the title 'the wicked problem'. Wicked problems are characterised as, "a class of social system problems which are ill-formulated, where the information is confusing, and where there are many clients and decision makers with conflicting values" (West Churchman, 1967, p. B-141). In more recent research, wicked problems have been described as problems with high levels of complexity, uncertainty, and divergence of values between different stakeholders (Head, 2008). In isolation, these factors do not make a problem wicked. However, once present simultaneously, they reinforce one another (ibid).

The wicked problem theory is resurgent today, due to the increasingly complex challenges society faces on a day-to-day basis (Buchanan, 2015; Norman & Stappers, 2015). These arise not only in the policy making field, but in other fields as well. Since its introduction, the theory has eagerly been adopted by scientists in the fields of business strategy (Camillus, 2008), design (Buchanan, 1992), and knowledge management (Courtney, Merali, Paradice & Wynn, 2008). Despite the attention 'wickedness' is attracting, there is no academic consensus on an approach to negotiating such problems, merely that traditional approaches (i.e. technical solutions and routine administrative solutions) fail to deliver sustainable outcomes (Rittel & Webber, 1973; Roberts, 2000; Head, 2008). Perhaps the main reason for this weakness can be found in the general point made by Rittel & Webber (1973) and Schön & Rein (1994), that the definition of a problem discretely suggests an approach for resolution as well. As each wicked problem is unique, an approach is likewise unique. As Head (2008, p. 103) puts it: "It is not clear that labelling a project as 'wicked' will readily assist in solving it." Approaches that are advocated by policy scientists lie among the lines of (stakeholder) collaboration and consultation, incrementalism, and iteration. These approaches share theoretical and practical affinity with design as an activity.

The Design Activity

Design as a discipline of practice is historically defined as the process of planning and creating ideas, then implementing these ideas to improve the artificial environment (Simon, 1969). Cross (2006) defines design thinking as a type of problem-solving cognitive process utilising a unique type of intelligence based on reasoning and logical inference. The cognitive process allows the central activities of design to extend beyond problem solving to describe problem identification, solution generation and strategy (Cross, 2006). The presence of creativity within the design process, and within design thinking as the intangible articulation of the

design activity, is considered central to the designer's ability to frame and reframe the problem at hand (Dorst & Cross, 2001). Creativity is often associated with the fine arts but also drives an important component of design — the ability to imagine what could be, not just what is. Creativity rests within the design process as an imaginative ability that links ideas. Cross (2006) refers to the 'creative leap' as a vital moment within the design process where novel concepts emerge. Schön (1983) had earlier described the notion of 'surprise' that prevented designers from routine behaviour; the type of behaviour that might inhibit original thoughts.

Dorst (2015) further explores the approach of framing and reframing problems, which is enabled by design thinking. Dorst (2015) describes design thinking as a paradigm for problem solving. Problem-solution framing is critical in determining different kinds of design reasoning, design processes and design skills that are utilised within a design approach (Dorst, 2011). Designers' are reflective practitioners, who engage in reflection-in-action during their work. This means that they search for problem and solution pairs, also identified as an activity named framing (Schön, 1983; Dorst, 2011). The activity of framing results in the co-evolution of problem and solution is a fundamental component of the design activity, see Figure 1 (Maher et al., 1996; Dorst & Cross, 2001).

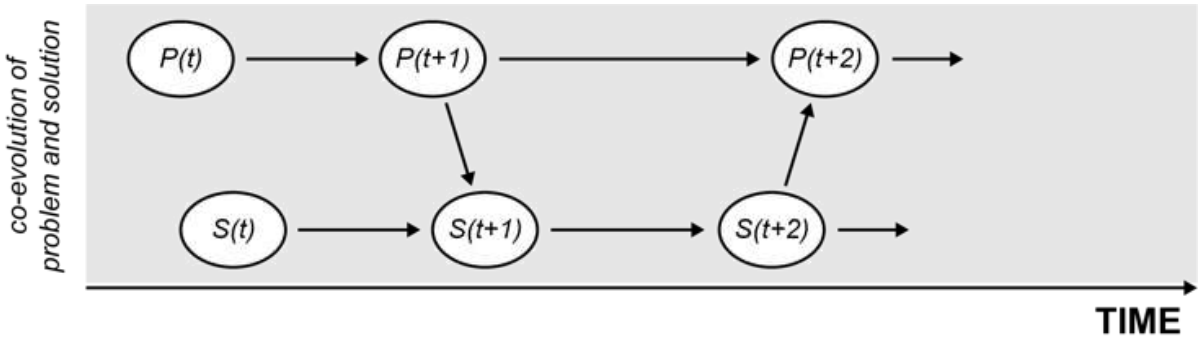

Figure 1: The co-evolution of problem and solution model (Maher et al., 1996; Dorst & Cross, 2001)

Policy Making and Design

Wicked Problems and Public Institutions

When looking at examples of wicked problems (climate change, obesity, racial discrimination, etc.), the origins seem to lie outside of public organisations—the institutions we generally point at to solve these problems. However, the very way in which governments are organised often sustains or even reinforces the prevalence of wicked problems. (APSC, 2012; Carstensen & Bason, 2012; Head & Alford, 2015). For example, politicians generally have a preference to address highly visible or tangible parts of the problem, which they do by proposing concrete and simple solutions ("Let's build a wall"). Politicians are not alone in this preference. The (financial and political) accountability systems that are in place in public organisations tend to favour discrete and finite solutions over complex, interconnected solutions. Such solutions don't necessarily have the potential to solve a problem as they are often short-term fixes, and don't approach the problem comprehensively (Head, 2008).

Additionally, public institutions remain highly hierarchical and bureaucratic, having different sectors both vertically between administrative levels, and horizontally between policy domains (Carstensen & Bason, 2012). Hierarchical bureaucracies have not yet been successful in grappling wicked problems (Head & Alford, 2015), as they tend to be risk-averse, are intolerant of messy processes, perform better when issues have clear boundaries, and hinder collaboration across domains. The opposites of these characteristics have been labelled as useful for the mitigation of wicked problems (APSC, 2012; Carstensen & Bason, 2012).

Policy Problems as Design Problems

Buchanan (1992) compares design problems to wicked problems and states that the two are similar. He also points out that a linear approach to such problems is rarely effective, as this approach derives from definite conditions, whereas wicked problems are characterised by the indefiniteness of conditions. This implies that putting together a team of designers and having them follow an iterative design process will result in a

successful solution, but this is not necessarily the case. Norman (2014) argues that complex problems require complex solutions. In order to resolve a complex problem, a multi-disciplinary team needs to be put together, in which all the disciplines relevant for the problem are united, including the design discipline and the user. In a follow-up paper (Norman and Stappers, 2015) the point is made that the complexity in a complex problem is not so much about the solution, but more about the implementation. They propose an approach much alike Lindblom's 'muddling through' approach (1959): an incremental approach that makes for a satisfactory result, rather than an optimal result. In general, the problems that are addressed by the design discipline have been increasing in complexity (Sanders & Stappers, 2014). Moderately and highly complex problems in the meso and macro level are now the subject matter of designers (Figure 2). Examples of projects that apply design in public innovation are 'Future of Fish', a non-profit social incubator aimed to end overfishing ("About Future of Fish | Future of Fish", 2017); and InWithForward, a social design organisation mainly active in Canada (Van der Bijl-Brouwer & Malcolm, 2018).

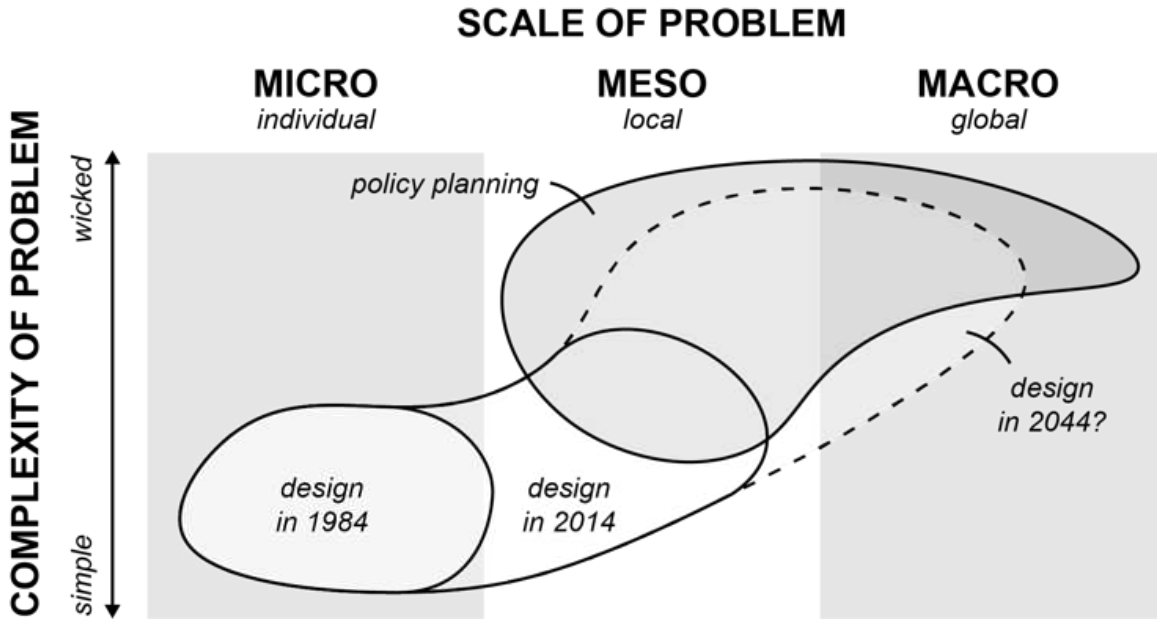

Figure 2: The field of policy planning, the expanding field of design, and the complexity they address, adopted from Sanders & Stappers (2014)

Research gap

That applying design principles to wicked policy problems is considered a good fit, is reflected in the growing number of government design units and external design agencies that assist governments in policy making. The names these units often go by— "labs" —imply a certain openness to experimentation and iteration that is not necessarily present in governmental organisations *themselves*, but that is natural to design. Even though there are a lot of examples of successful design interventions, and there are numerous examples of government design labs, academic knowledge on the topic of policy making via design remains limited. There is no unified view yet on what the specific role of design in policy making can and should be. This paper aims to explore what aspects of design are helpful in the mitigation of wicked problems, by studying the activities performed by design labs for governments.

Research Design and Methodology

Case Study Method

Considering that the aim of this explorative study is to clarify the role that design can play in the mitigation of wicked problems, it is necessary to study the actual contribution of design to existing addressing wicked problems. The unclear boundary between phenomenon and context in this case, make experimental settings with any form of manipulation a nonviable option. Creating a representative simulation of reality would be

nearly impossible. As such, case study is considered the most suitable approach for this study (Yin, 2009; Gray, 2014).

This study takes a multi-perspective approach by implementing methodological triangulation (Ravitch & Mittenfeller, 2015). The phenomenon and accompanying data are viewed from multiple perspectives, increasing rigour in the study. Between-method triangulation was achieved by using primary, public and third-party information as data sources.

Two Cases

There is a large number of design institutions (i.e. labs) in Europe that assist governments in policy making. Two of the more significant ones—because of their lasting influence on governing and the example they have set for other labs—are MindLab (Denmark) and Helsinki Design Lab (Finland). Both labs are among the first design labs in Europe, and both have made available a considerable amount of information on the way design has helped mitigate complex problems for their government. This available information has been largely self-reported and not critiqued by a third party. This makes the cases very suitable for a comparative case study.

Helsinki Design Lab

One of the more significant and earlier design units is *Helsinki Design Lab (HDL).* HDL was a platform set up by SITRA (the Finnish Innovation Fund) with the aim to advance strategic design within the Finnish government. It consisted of a small team of about three or four trained strategic designers. The initiative ran from 2009 till 2013. Helsinki Design Lab performed several pilots, with two formats. The first format was to set up one-week 'studios', in which multidisciplinary teams try to tackle policy problems suggested by local governments. The other format was to place designers in-house at city governments, where they participate in a policy making team. HDL has extensively and openly recorded the progress of their projects through project pages and blogs. Next to working on government projects, HDL performed research themselves, and published books and articles on the topic. These documents will also be studied. An overview of the case data used can be found in table 1.

Table 1 Overview of data sources, Helsinki Design Lab

Data on performed projects	*HDL research output*	*Third party information*
Project pages and blogs ("Dossiers - Helsinki Design Lab", 2012)	Book: Recipes for Systemic Change (Boyer, Cook & Steinberg, 2011)	Report Design Council: Design for Public Good (Design Council, 2013)
Interview with HDL Director (30 mins)		Interview SEE Bulletin nr. 8 (Whicher & Cawood, 2012)

MindLab

MindLab is a cross-governmental, internal innovation unit for the Danish government. Running from 2002 till 2018, it was one of the longest running government design units. It was originally set up to find new ways to craft policy, as approaches used at the time were not delivering successfully. MindLab's responsibilities and corresponding composition have varied over time, ranging from creative facilitation to informative support in high-level strategic decisions. Due to its lengthy operation, MindLab has a vast amount of high-quality information concerning its responsibilities and activities. An overview of the case data used can be found in table 2.

Table 2 Overview of data sources, MindLab

Data on performed projects	*Research output*	*Third party information*
Conference presentation director (Bason, 2014a)	Paper on collaborative policy innovation and design labs (Carstensen & Bason, 2012)	Report Design Council: Design for Public Good (Design Council, 2013)

Tool overview on website ("MindLab - Methods", 2017)
"The journey of MindLab" (MindLab, 2016)

Qualitative Data Analysis

A thematic analysis was performed on all material from each case separately with major predefined codes established based on literature. Predefined codes included the design process, policy making challenges and elements of wicked problems. Codes were also expanded during an open-analysis where data repetitively pointed toward new themes; both major and minor. The results of the two cases were then compared and contrasted. The results are presented in the results chapter, with the findings from the comparative analysis forming the basis for the discussion.

Results

Helsinki Design Lab

Grappling complexity through supporting multidisciplinary teams in design

One of the ways in which Helsinki Design Lab aims to grapple the interconnectedness that characterises the complex problems they are facing, is by forming multidisciplinary teams with people both closely and distantly related to the problem. As a result, the composition of the teams is similar to the problems the teams have been created for, in that they are both multifaceted. Having these multiple perspectives helps in creating a rounded view of the problem. Similarly, as each complex problem is different, each team has a different composition, representing the most relevant disciplines.

> *We tried to construct a 360° perspective around the problem, so Lai came from Singapore, she runs one of the top secondary schools; Juha works in the Ministry of Health on health policy but also as a practising physician […]; Ann is an educational software specialist; and then Darryl and Maja were the two designers. The designers are in a clear minority and their role is to help bring synthesis to the conversation.*

Within the multidisciplinary team, there are two designers. Their main role is to steer the team towards synthesis when this is needed, but they are a core part of the team, and act as such: "They are expected to bring their expertise and experience to the table by actively contributing like everyone else." Of the two designers, one acts as *design lead*, the other remains in the background but can jump in for "back-up".

During the one-week project the multidisciplinary team is led through a typical design process, of which this inclination towards synthesis is but one of the relevant characteristics. In the next paragraphs, the design characteristics that were considered relevant for this multidisciplinary approach to mitigating wicked policy problems will be discussed.

Synthesis mind-set

One of the core capabilities of designers that Helsinki Design Lab identified as valuable in designing for wicked policy problems, is the ability to think in solutions rather than problems, even if the problem is not completely framed yet. This is important, because the complexity of these kinds of problems makes it almost impossible to fully comprehend the problem before moving on to solutions.

> *The machinery of government in general in the West has been designed to consider objective facts and make decisions based on those facts. […] There are areas where we just don't know enough yet, so there are decisions that we're being forced to make without having complete data…That's a design challenge; that's what a designer does on a daily basis.*

As having a synthesis mind-set is not a skill commonly present within the multidisciplinary teams, it was the task of the design lead to steer towards synthesis when needed. Sometimes that meant having to make tough decisions to move the process along, but other times a synthesis-mindset was achieved early on in the process through the creation of a strong shared vision.

Synthesizing the various inputs and needs of all partners was not that hard, in the end, because we had invested a lot of time up front in aligning everyone behind a shared vision.

Facilitating participative governance

When studying the activities HDL performed to design for policy problems, it became clear that one of their main objectives was to bring user-centeredness to both policy making projects and the Finnish government in general. This was meant to reduce the gap between the government and its citizens, which eventually could lead to the delivery of better services.

We are putting designers in different ministerial and municipal positions to help create a better interface between public and private.

Policy makers rarely have contact with the 'users' of their policy, mostly making estimations on citizen interests based on their own experiences. By putting the team or policy maker in contact with the people they're working for, HDL is making sure that the user is incorporated earlier on in the process, so that user interests are treated with equal weight as other stakeholders' interests. Considering the complexity of the problems, there are often stakeholders whose voice is not represented because they are hidden within a system. These stakeholders carry no political weight under a conventional system. They have no capital or room to negotiate. When using design, stakeholders see their needs represented the best.

On day two they visited a school and spoke to as many people there as possible, including the principal, teachers, pupils and caretaker. In the afternoon they got to know the wider context, visiting places like family counselling centres and sports clubs.

Interactive approach

In all their projects, HDL adopts the interactive (i.e. iterative) approach that is characteristic to the design process. In their experience, a linear approach does not help in tackling complex problems, whereas an iterative approach can. This is where designers come in.

Industrial society is predicated on the idea that you can look at the world, identify a problem, think about it really hard to identify an answer, make a plan, and then execute on that plan, all in a linear manner from beginning to end. That linear approach worked when human society more or less agreed that the world was simple. […] Human economies, and perhaps human societies, were oversimplified.

Working on a problem iteratively is useful for complex challenges as it enables constant evaluation of the problem and its solutions, learning more about both in the process. This behaviour can be recognized in the way the teams begin to think of solutions and themes *during* problem analysis.

We end Monday with a lightning quick summarizing discussion just to get some ideas on the whiteboard. Tuesday ends with a download session back in the Studio where everyone shares their insights from the day and the group begins to assess emerging themes and questions.

Another important aspect of design iteration is the 'doing' element. By visualizing and prototyping solutions, themes, etc. intangible objects become tangible, making them a subject for discussion and experimentation. This tendency is known to greatly help in steering towards synthesis – which is essential in design.

Pairing a complex web of problems with a holistic set of solutions

The problems that are given to Helsinki Design Lab are perceived by them as "a complex web of factors creating the problem", in which the factors don't function independently and are instead interconnected. The problem is multi-layered, for the factors that create the problem are situated on the micro, meso and macro levels.

In education, this is about the individuals and their lifestyles; it's about the teaching methodologies; it's about the classrooms; it's about how you educate teachers; it's about health; it's about mental health, it's about after school; it's about early child education; about jobs.

Top-down government responses to problems tend to be reactive, addressing symptoms in isolation rather than engaging with the often complex web of factors that create a problem.

While governments often tend to address symptoms of the problem, Helsinki Design Lab respects this complexity and aims to understand and reframe the problem without needlessly oversimplifying—in their own words: "developing the architecture of the problem". This is done with synthesis in mind. Linked to this acceptance of complexity in the problem, is the acceptance of a complex solution, or rather a holistic *set* of solutions.

> *Amid this inherent complexity, the challenge is to find the right dependencies and to avoid oversimplifying things.*
>
> *Propose an architecture of solutions that highlights the top ten opportunities to help move closer to the vision.*

HDL sees design as a very suitable approach for dealing with this complexity, but at the same time it recognizes that it still has to evolve in order to truly mitigate complex problems. In the policy making field, designers are out of their comfort zone.

> *Sitting around the table with world-leading experts from other fields, working in abstract systems, strategy and policy recommendations is something that designers often aren't used to doing.*
>
> *To really contribute in the public sector, designers need to become better at juggling data and engaging broader communities of stakeholders.*

MindLab

Needing new ways to approach challenges

At the time when MindLab was set up (2002), the Danish government was in need of new approaches to successfully develop and implement new policies and address wicked problems. Even though small policy changes could be successfully implemented, bigger policy changes or complete policy reforms often weren't completed. At the time, most of the public organisation's innovation efforts were inwardly focused, and innovation was not an activity that came naturally to the organisation.

> *How do you work with innovation in government, when the whole institutional setup of our public organisations is to emphasize stability over change; predictability; mass production of services; application of law in an equal way, and so forth. That's why a lot of people would say that innovation in government is an oxymoron.*

When the Danish government set up MindLab, it showed that they had the desire to change this status quo. It became MindLab's responsibility to disrupt the Danish government in their current way of policy making, by cutting through silos and aiding them in innovating *outwardly.* This need for disruption was reflected in the initial (unofficial) goal set by MindLab's new director:

> *Mindlab is the equivalent of throwing a hand grenade at bureaucracy.*

This was to be done by finding and creating new strategies for policy making—adding new tools to the policy maker's toolbox (Table 3). One of the primary ways this was done was by introducing aspects of design to policy makers. Design was considered a good fit because of its user-centred way of working, which could increase empathy and serve as inspiration during the policy making process.

> *The pursuit of a more contextual and fine-grained appreciation [by civil servants] of how people experience public services and regulation is at the heart of the approach.*

Design was also beneficial because of its proactive nature, having the tendency to both *do* and *think*, and keeping the future in mind at all times. This is also reflected in its ability to work visually and physically, enabling effective communication between civilians and policy makers, but also among policy makers.

> *Through [tangible & intangible] prototyping, they could produce more workable solutions and communicate them to decision-makers so as to have a good chance of implementation.*

Lastly, design's iterative approach was estimated to be beneficial for the complexity of wicked problems, as it enables the evaluation of solutions and using this knowledge for the development of new ones.

Table 3 MindLab's tools

Tool	***Primary application***	***General goal***
Plan of Change	Process management	n.a.
Project Focus	Process management	n.a.
Project Journey	Process management	n.a.
Interview	Research	Analysis
Portrait	Research	Analysis
	Communication	Synthesis
User journey	Research	Analysis
	Communication	Synthesis
Film & sound	Communication	Synthesis
Pattern recognition	Analysis	Analysis & synthesis
Perspective cards	Ideation	Synthesis
Brainstorm	Ideation	Synthesis
Development questions	Ideation	Synthesis
Practice check	Idea evaluation	Synthesis
Proto- & 'provotypes'	Idea evaluation	Synthesis
Priority grid	Idea or concept selection	Synthesis
Idea development	Converging	Analysis & synthesis
Concept development	Converging	Analysis & synthesis
	Communication	Synthesis

A systematic approach for design in the public sector

MindLab functions as a link between policy and services, "combining the high-level macro calendars of policy, with the nuanced details of qualitative research." In order to do this effectively, it had the objective to create a systematic approach for user-centred design within the public sector.

> *Working effectively with user-centred innovation requires a systematic approach to what needs to be investigated, underpinned by a wide variety of methodologies.*

This systematic approach takes the user-centred and iterative way of working of designers as a basis, but expands it by working with multidisciplinary teams and introducing design tools suitable or adapted to the public sector (Table 3).

User-centric way of working

By design's ability to "make problems experientially available", the policy maker comes closer to the people who are experiencing a problem, which can serve as inspiration during the policy making process and increases empathy.

> *By enabling the civil servant to 'see' the world differently and with empathy, and understand that things could be done differently.*

Partly because of its user centric way of working, design was able to help identify problems earlier in the policy making process, because you operate 'on site'.

> *I got some really nasty statistics about this implementation process, and then my staff came up and told me that they knew already it was coming, because three months ago they ventured into the field with MindLab and took a look at what people are experiencing. And that is just now showing up in the statistics, but we could see that in the behaviour and experience already.*

Iterative way of working

As Figure 3 shows, the systematic approach MindLab has created for design in the public sector is iterative, building in room to go back to implemented policies and adjust them. Next to this large iteration loop, smaller loops can be recognized. In its way of working, MindLab is taking an evaluative stance, constantly evaluating problem frames, ideas and solutions and consequently adjusting. This is also reflected in the tools it adopted in their processes (Table 3), where most of the tools are means to generate, prioritise and evaluate ideas.

> *MindLab was to take a longer-term, project-based focus by: Developing new ideas based on user needs, analysing, qualifying, and possibly testing ideas, and – after a deployment and operational phase – evaluate and measure the impact of new action.*

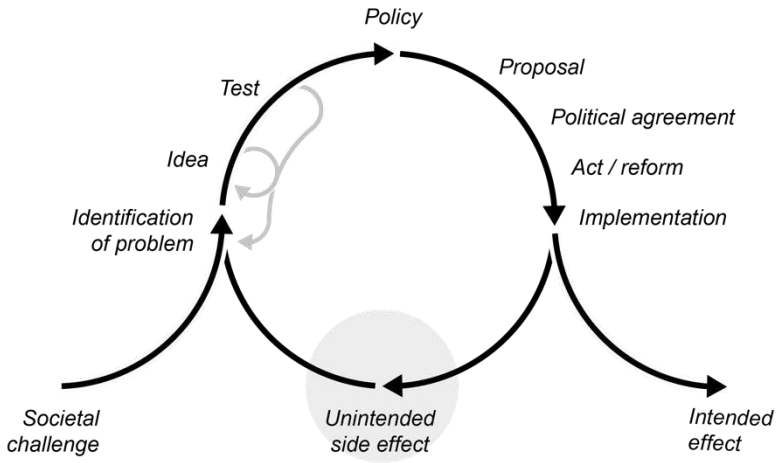

Figure 3. MindLab's systematic approach for user-centred design in the public sector (Carstensen & Bason, 2012), with extra iteration loops added by the author

Working with multidisciplinary teams

MindLab attends to the policy making projects of three different ministries that normally operate separately, even though their policy domains overlap at places. An example is school reform, which affects more than just schools.

> *How do you create school reform if you realize that it does not happen just by getting the law through parliament? It is ultimately powerless, unless it finds a way to work with school principals, teachers' unions, parents, local governments, other ministries.*

> *We're working on an intersection of so many different fields.*

In an attempt to mimic the problems their ministries are facing, MindLab not only performs user-centred design, it also facilitates short- and long-term team work with people from across ministries and departments, to create situations in which overlapping problems could be explored, e.g. by exploring joint solutions.

> *MindLab management and team developed the layout of the lab so as to facilitate design activities such as multidisciplinary teamwork. […] To help cut across disciplinary and departmental silos.*

Major themes identified for each case have been presented. Findings from a comparative analysis will be discussed in the following chapter.

Discussion

The key problem of policy making that comes forward in both case studies, is that there is a big gap between the original intent of a policy, and the way it is eventually implemented in society. There are three main barriers that cause this problem. Firstly, it is rarely the case that the problem addressed in a policy making project is rightly understood; secondly the policy making process is a linear, evidence-based process, which is passed on to different parties in different stages, causing for a lot of leakages in the project; thirdly, projects are placed within single policy and knowledge domains. The designers working in the labs attempt to address all these barriers with their processes, which will be described in more detail in the next sections.

Designing with non-designers

One of the more striking similarities between Helsinki Design Lab and MindLab was that they both opted to let their teams of professionals go through a design process, albeit in unique forms. In both cases, following a design process was key in addressing the complex policy problems they were facing. The holistic perspective and the interactive way of framing and solving problems are most important here. Designers are trained in these capabilities, and therefore support and participate in the team throughout the process.

Co-evolution of Problem and Solution as a Challenge to Mind-set and Procedure

The policy making process as described in the case studies is a linear process, in which problem, solution and implementation are handled subsequently and in isolation. Moreover, in the process of defining a policy or social problem, policy makers often take an evidence-based approach, in which a policy is based on (quantitative) evidence. This is done by doing desk research and talking to (a limited amount of) stakeholders in the system. Both strategies have been argued to be ineffective in dealing with wicked problems. Taking a linear, rigid and rational approach to wicked problems is believed to be ineffective (Lindblom, 1959; Buchanan, 1992; Schön & Rein, 1994). Lindblom proposes a different approach: 'muddling through' (i.e. the 'Branch method'). In this approach, the problem solver tries to reach his goal by making incremental decisions and solutions, and evaluating the effect.

By exploring problems through creating provisional solutions, design when used in both labs eliminated a linear approach, and instead applied a process of co-evolution of problem and solution. Both co-evolution of problem and solution and 'muddling through' are approaches in which the final problem and final solution co-evolve. Schön and Rein (1994) offer an alternative, albeit similar, approach, called 'frame reflection': a reflection-in-action activity in which the frame of problem and possible solution, but also the value perspective of the project, is continuously evaluated and reframed (Head & Alford, 2015). As established earlier in this paper reflection-in-action and framing are key design activities, however Schön and Rein's proposed approach hints to another key design characteristic as well; understanding and keeping in mind the *value* of a project. The user-centric thinking mechanisms of design and the empathy for the needs and interests of stakeholders this generates, provide one way to achieve this.

Inciting empathy and decreasing the distance from the problem

Another characteristic of design that played a substantial role in the design lab's activities was its human-centric point of view. The link between a human-centric way of working and the mitigation of wicked problems is not strikingly evident. It gets clearer when considering that most of major system failures can be dedicated to the disregard of human-factors (i.e. human behaviour) (Norman & Stappers, 2015), and that it is with the addition of human-beings to a system, that it becomes unpredictable (Van der Bijl-Brouwer, 2018). A human-centric point of view allows for solutions that fit within the user's world view and behaviour, as such increasing their conformance to the system. Moreover, human-centeredness allows for empathic and culture-specific decisions, aspects that are generally missing from decision-making mechanisms in public organisations (Bosch, 2016). An additional benefit is that policies suited to its users can aid public organisations in regaining trust of its subjects (Bosch, 2016). The simple activity of taking policy makers into the 'field' to interact with the environment they were writing policy for, had profound consequences. The HDL quote;

> *On day two they visited a school and spoke to as many people there as possible, including the principal, teachers, pupils and caretaker. In the afternoon they got to know the wider context, visiting places like family counselling centres and sports clubs.*

Not only did it allow for quicker insight building, (where waiting for statistical data may take months to be gathered and fully analysed), it also aided policy makers to connect the abstract nature of strategy and policy to a set of concrete experiences.

Multidisciplinary design work

When crafting teams to work with, both Helsinki Design Lab and MindLab chose to put multiple disciplines together in one team. MindLab sought these different disciplines within the government but across policy domains, HDL sought them across the world. Their objective was the same: to create a well-rounded view on the problem. This is supported by Norman & Stappers (2015). An indirect, but probably even more important consequence of multi-disciplinary team work, was that it enabled the design labs to break through knowledge and policy domain silos. If wicked problems fall beyond the parameters of one discipline alone, then the convergence of disciplines will be effective in approaching problem framing. Important to note is that, even though the design characteristics discussed in the previous paragraph show to be essential in the mitigation of complex problems, its benefits truly come to fruition when combined with multidisciplinary teamwork.

The problems addressed by designers when dealing with wicked subject matter seldom fell within the boundaries of *one* domain of knowledge. The very nature of design might force the breaking of silos (Buchanan, 1992). The notion of 'throwing a hand grenade at bureaucracy' (MindLab) is just one illustrative example. Norman and Stappers (2015) suggest that "In the best of cases, these different participants combine their expertise in creative, effective ways, often compromising goals and principles for the greater good. In the worst of cases, there can be strong ideological and political arguments behind the scenes that disrupt collaboration." Observed in the material of both cases is the role of designer, and function of design as an underpinning process, as connector across silos to set up collaboration as a purposeful activity. One of the challenges here is encouraging non-designers to harness the design process in their work.

Conclusion

Today, the majority of policy making processes do not reach conclusion or are deemed to fail even if their implementation is completed. Being a consequence of the social systems in which they are situated, the challenges public organisations face can be characterised as 'wicked'. Considering its failure rate, the strategies public organisations do adopt to craft policies for these challenges are not always successful, which means that policies are not as effective as initially intended (Bason, 2014).

This paper shows that the way in which designers think and do can be very valuable to the solution of wicked policy problems. We applied a wicked problems perspective to analyse two cases in order to reflect a holistic view of the challenges of development through new policy frameworks. Findings point toward the future role of designers' not specifically crafting policies alone, but as facilitators of multidisciplinary teams who are 'designing'. Multidisciplinary teams are needed for policy making because it ensures multiple perspectives on the problem are established and that breaking through knowledge and policy domain silos occurs daily. Design labs have taken on the role of stewards or guides, aiding public organisations in developing characteristics that are inherent in design, valuable to the mitigation of wicked policy problems, but not naturally present in public organisations: a holistic perspective, an interactive approach, and human-centeredness.

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Motivating Growth in Low-tech Manufacturing Industries: A Case Study of the Israeli Footwear Industry

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Intensive manual labor enterprises in the developed world face challenges competing with products imported from countries where manufacturing costs are low. This reduces the volume of domestic production and leads to rapid loss of knowledge and experience in production processes. This study focuses on the Israeli footwear industry as a case study. Qualitative methodologies were applied, including in-depth interviews and field observations. A literature review on previous research, and contemporary trends was conducted .The field research examines challenges along the value chain in small factories. It finds that mass production paradigms impose a decentralized process between designers and manufacturers and therefore do not leverage local potential into a sustainable competitive advantage for small factories .The proposed solution is a digital and technological platform for small manufacturing plants. The platform mediates and designs the connections between production, technology, and design and enables the creation of a joint R&D system.

Keywords: New Product Development Innovation, Design Management, Sustainable Development, Open Innovation, System Design

Introduction

Over my ten years as a designer, developer and teacher of footwear, I noticed that the local market was showing a growth in designers opening a local brand. On the other hand, the producers I was working with where not growing as a result and were struggling for survival.

looking at the problem through a wider lens, I realized that in fact many low-tech traditional industries in the mature economies are now facing a similar challenge. This challenge affects levels of low-skilled employment and deepens social gaps. It also causes a loss of opportunities for the development of new innovative knowledge, which relies on manufacturing 'know how' of producers who: "actively pursue strategies to maintain competitiveness and increase the value added of products and processes" (Hansen & Winther 2015)

Returning to my local case study of footwear in Israel, I began my research by asking, how might we sustain growth in local manufacturing industry? The research plan followed the value chain of footwear production: design, development, production and market.

Traditional production of footwear relies on manual labor and is considered a low- tech industry.

Changes in global and local market conditions have led to a reduction in local footwear manufacturing. In Israel today, there are only a handful of functioning industrial footwear factories. There are also a few dozen

micro-factories, reduced by market conditions to small-scale production, and an almost complete reliance on manual labor. These are on the cusp between factory and workshop. They maintain production relations with the local design industry and thus, in practice, enable organic growth in the industry. And yet, mapping of the local footwear market indicates that products developed by small manufacturers for local designers are not competitive in the saturated domestic market. This threatens local knowledge and capabilities. As a result of the research insights, the research question was rephrased for the process of developing a solution: How might we preserve knowledge in the footwear manufacturing industry in Israel, and leverage it to create new knowledge and a sustainable economic practice that can compete in the global market?

As a designer I began to wonder how might we design the system of production instead of the product it makes.

The proposed solution is a digital and technological platform for small manufacturing plants. The platform mediates and shapes the connection between production, technology and design. It therefor enables the creation of a joint R&D system with the potential to develop strategies, production methods and innovative products, while overcoming the barriers of the global market and leveraging the advantages of personal contact with the consumer.

Literature Review

Local industry does not exist in a vacuum. It is influenced by and reacts to large and complex systems globally and locally. In this review, the impact of market conditions on local production was examined to identify issues that could serve as a basis for creating opportunities for intervention, as defined in the research question.

The following is a list of the topics reviewed:

1. Recent changes in global market conditions.
   This includes how innovation and creating new knowledge has become a currency companies use to compete with countries with low manufacturing costs.
2. Changes in global production trends.
   This includes changes in the relationship between producers and consumers, as well as economic strategies that have been developed to suit these changes, while maintaining a sustainable economic practice.
3. Innovation in low-tech manufacturing industries.
   This includes practices of creating new knowledge in the low-tech industry and dealing with barriers to leverage it for innovative practice.
4. Reciprocal relations in the fields of production and design.
   This includes the relationships that exist between participants in the Israeli footwear industry and points out to the potential for innovation in production skills.

Recent changes in global market conditions

Globalization and the information revolution affect the global production market. In recent decades, there has been a dramatic shift of production from places where production costs are high to places they are low. This was driven by the fall of trade barriers and the opening of previously closed markets. (Buciuni & Pisano, 2015). The communication revolution reduced communication costs between geographic regions to almost nothing and led to the creation of a knowledge society (Audretsch & Thurik, 2000). In the “knowledge economy” the acquisition, creation, and utilization of knowledge provide a competitive advantage between companies (Hansen & Winther 2015). This had changed production clusters and the structure of companies’ supply chains. The surge in global production enables R&D to be carried out in one place while products are manufactured elsewhere. This now-common practice creates value in sectors that deal primarily with intangible assets such as intellectual property. The textile, clothing, and leather production sectors were significantly affected by the opening of trade borders (Buciuni & Pisano 2015) since they are traditionally based on manual labor and therefor easier to transport.

Changes in global production trends

Changes in the production model

According to Hegel & Brown (2008), there are two models for resource mobilization: *Push*, created by the Industrial Revolution, and *Pull*, created by the Knowledge processes, and predicting consumer behavior. Push-type production is characterized by: forecasting demand, high economic investment, production of surplus stock, and work with intermediaries that weaken consumer attachment (Deloitte, 2015). The Push model is less competitive in contemporary changing market conditions (Hegel & Brown, 2008). The Pull model of on-demand production allows for reduced investment and inventory costs. It relies on technology enabling direct access to consumers (Deloitte, 2015). Future models of production will have to consider new market trends (Deloitte, 2015):
A. Increased consumer power. Unwillingness to compromise on standards of mass production. Growing desire for authenticity, customization, and niche markets.

B. "Smart" products with new technological capabilities. Transition from material products to those that enable access to services.

C. Technologies enabling rapid, small, and local production.

D. Elimination of mediation between manufacturer and customer.

Business strategies in the PULL model

Mass Customization (MC) is a business strategy that aims to sell products that are mass-produced but are adapted to the needs of customers, at a near-standard production cost (Bruneo & Nielsen 2016). Together with the benefit of inviting customer input and responsiveness, as a business model, this offers significant cost advantages by eliminating inventory costs resulting from forecasting and purchasing (Anderson 2011).

Koren, Shpitalni, Gu & Hu (2015), propose an advanced Pull model, an open platform enabling individualized mass production. They suggest that using individually optimized production and open platform principles will lead to a sustainable industry and innovation. They note customized production is enabled by modular architecture and flexible production systems, such as Additive Manufacturing.

Innovation in low-tech manufacturing industries

Innovation has been defined as the effort invested by companies in research and development (R&D) (Cardoso & Torkkeli, 2014). Indices for measuring innovation include the number of R&D studies and the number of people committed to R&D in a company.

Patents are a primary product of innovation and create opportunities. However, while patents are compatible with technology and science-oriented industries, they are not commercially viable for sectors characterized by rapid change. Design, training, consulting, and practical knowledge are key resources for innovation, particularly in low-tech industries (Cardoso & Torkkeli, 2014).

Knowledge resources of low-tech industries

Hansen & Winther (2015) distinguish between two types of innovation: cumulative and radical. Cumulative innovation refers to ongoing improvement of a product or process ("to do what we already do better"). Radical innovation is a complete change of the product or process in the market ("to do something we did not do before"). Norman & Verganti (2012) note two major drivers of radical innovation: technological invention and changing the meanings of existing technology.

Hansen & Winther (2015) further differentiate between analytical and synthetic bases of knowledge. In an analytical knowledge base, scientific data coding is the input and output of the knowledge creation process. In a synthetic knowledge base, existing and tacit knowledge acquired through practice and use are used in new product development.

A synthetic knowledge base can help companies shift from standard products towards customized products (Hansen & Winther, 2015). Most low-tech companies rely on synthetic knowledge, which is globally available and context-specific. They innovate through collaboration, redesign, and tapping into knowledge repositories (Bender & Leastadius, 2005, as cited in Hansen & Winther, 2015).

The inherent innovative potential of low-tech industries

Innovation creates potential for growth, but involves risk (Bougrain & Haudeville, 2002, as cited in Cardoso & Torkkeli, 2009). In small or medium-sized companies, it is difficult to allocate resources to high-risk projects. Several strategies have been proposed to address this. First, internal and extra-sectoral networks and co-operative structures can minimize risks to individual companies from the insecurities inherent in innovation (Cardoso & Torkkeli, 2009). Second, inter-sector collaboration among craft industries can drive innovation and growth through evolution of techniques, discovery of new materials, and application of new tools, which can be applied to multiple industries (British Craft Council, 2016). Third, a case study of managerial innovation and collaboration in the footwear industry in northern Italy finds that a "Knowledge Integrator" enables sharing knowledge related to production, ideas, design, and global markets (Buciuni & Pisano, 2015). This led to an integrative supply chain, development of original knowledge, and a competitive advantage for all partners.

Reciprocal relations in the fields of production and design.

Production skills

Pye (1995) distinguishes between "the workmanship of certainty" - mechanized production, and "the workmanship of risk" - manual production. Manual production depends on manufacturers' skill and familiarity with materials and relevant processes. Risk and skillful manipulation of materials enable unplanned breakthroughs.

According to Sennet (2009), craftsmanship adds quality to the world around us. The quality of work is embedded in an ethic to do a good job for its own sake. The development of skills becomes implicit knowledge, enabling discovery of new techniques and achievement of different results. Knowledge-building is a circular, operational process that transforms implicit knowledge into explicit knowledge. This process requires many iterations of trial and error. Niderer (2009) points out that craftwork can express values that transcend time, space, and social boundaries. Its strength is based on an authenticity and intimacy with the object, which is absent from mass-produced products.

Design-production relations in the development of a new product

The combination of design, craft, and manufacturing has the potential to create innovation (Tomeltas, 2017; Wolley, 2011; Yair, Press & Tomes, 2001). Craftsmanship enables the selection of appropriate materials, structures, and technologies (Wolley, 2011). Ongoing involvement of design throughout the new product development process has a high potential for radical innovation (Roper, Micheli, Love & Vahter, 2016) The designer's contribution to the production process may be expressed in various stages of knowledge creation (Temeltaş, 2017). In craft industries, product development tends to be cumulative rather than collaborative. Products are derived from predefined capabilities.

Research Methodology

The research methodology included interviews with 11 informants from the industry and three experts. The interviews were recorded, analyzed, and categorized. A literature review was conducted on relevant issues in the field and global market trends. The study sought to deepen understanding of the various users and their relationships in the footwear industry in Israel. While developing the proposed solution at the final part of this paper, design thinking methodologies where applied including ideation meetings, prototyping and co-design.

The system is divided into five main axes corresponding to the stages of footwear production: market, design, technical development, production, and design training. These axes enable a broad perspective within the short research time. Informants represent different points of contact with various delegates in terms of enterprise size, place of production, and seniority.

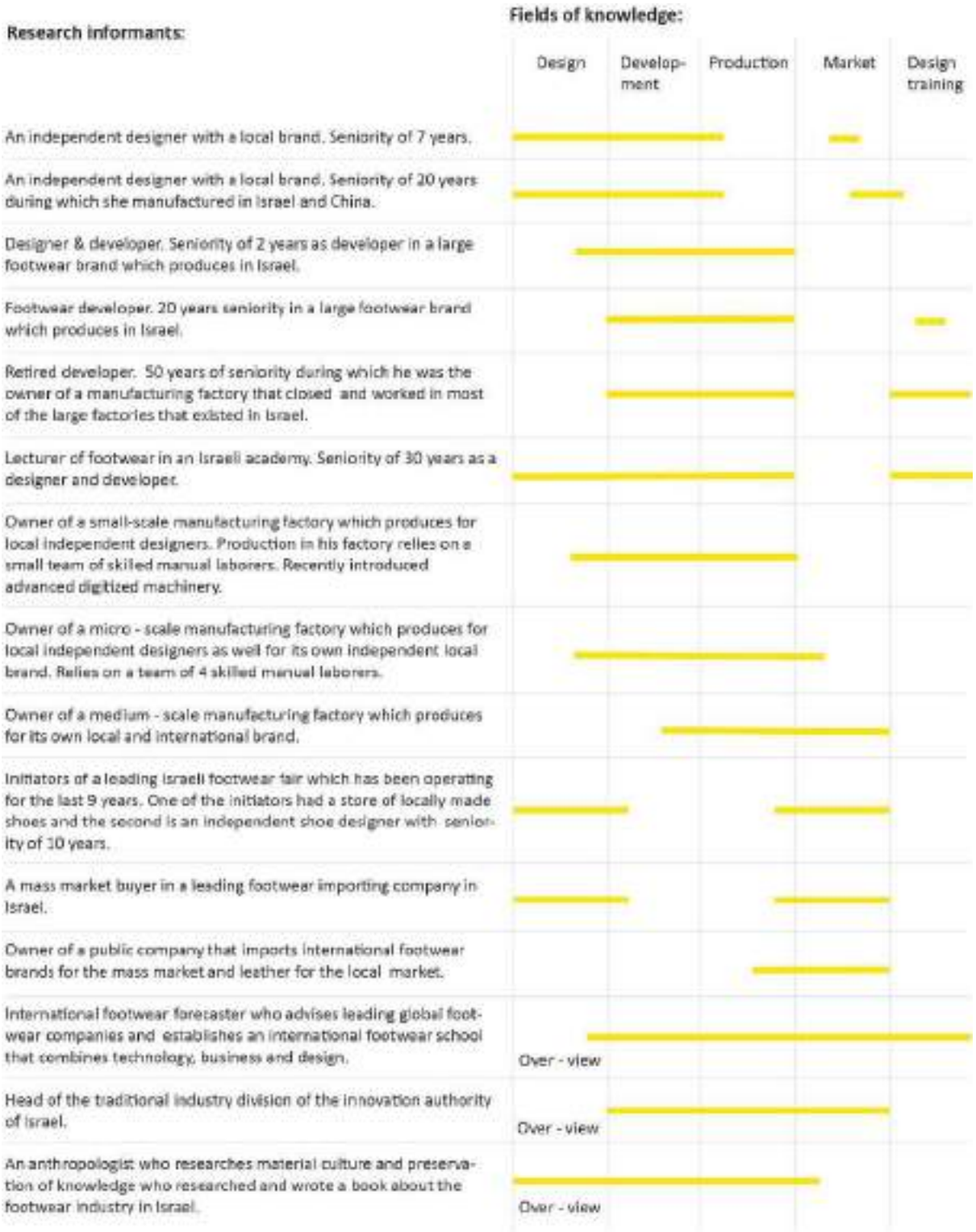

Figure 1: Research informants rationa

Variables prior to field research

This short-term study (four months) did not enable representation of all participants in the field. The researcher's professional experience in the field enabled access. However, some informants might have viewed the researcher as a potential competitor. The proximity of the researcher to the field is liable to distort the data due to prior assumptions.

Approval was received for recording each interview. Factory managers granted prior approval for interviews with workers. The purpose of the study was explained prior to the interviews. There was a request not to disclose details of confidential business information.

Research findings and insights

General background: The effect of opening trade borders on the local ecosystem.

Until the 1980's, footwear factories in Israel were family enterprises based on professional knowledge brought from the owners' countries of origin. They were protected from a competitive environment. In the 1980's, the Israeli government began to open the domestic market to foreign competition, in response to inflation. The local market was flooded with previously unavailable products, which varied in quality and price.

Background finding: The high production costs channel local production to medium- high-priced niche products

At present, there are three medium-sized factories and 30-40 small-scale factories in Israel. Footwear production costs in Israel are four times higher than imported footwear. The average expenditure on footwear in Israel in the mass market is around $62 US. Footwear produced in small factories in Israel costs between $110-350 to the final consumer. Operating in a niche segment reduces the target audience. The local market is small, as Israel is country of 8.5 million inhabitants.

> *"It doesn't pay off to produce here, it is suicidal - unless you have something very special." (importer of leather and footwear in a leading company in the market)*

> *"The biggest challenge in the local market is to get people to buy from me, there is a lot of competition and the market is small." (independent local designer)*

Differences in strategy between large and small producers

Insight: Medium -large factories emphasize professional management. Small factories specialize in professional knowledge of footwear.

Since the 1980's, many factories closed due to competition with global markets. The remaining enterprises have taken various approaches to survive in the new conditions. Large factories introduced professional management and strategic knowledge external to the field of footwear. Their products are of a functional nature aimed at a niche market such as comfort and outdoor. In contrast, small factories specialize in professional knowledge of footwear and are service providers for local designers who design stylish boutique footwear.

Secondary insight: The nature of the product affects planning, development, and production.

The findings show that large factories produce independent brands of functional character, which meet physiological needs (convenience and outdoor use) of customers in local and global niche markets. Small factories usually do not have an independent brand. They provide their services to local designers and produce fashionable products. The Israeli fashionable footwear market has a diverse price range and has been flooded in recent years by global retailers.

The literature indicates different processes of design and development for functional versus fashionable products. Functional products remain relevant long-term. Their development is a process of improving existing products and streamlining production. Fashionable products have a short shelf life. The pace of their development process is high and most of the production line changes every season.

Secondary insight: The factory's work practices change production costs and, accordingly, the factory's profitability.

Large enterprises produce in large quantities; they can therefore lower the cost of production through mechanized production. On the other hand, small factories that work with a variety of designers fail to maintain production lines that are broad enough to operate machinery; they therefore produce manually at a higher cost.

Secondary insight: The work practices of the enterprise impact the employees' knowledge base *and its ability to adapt flexibly to changes.*

Large production lines can be divided into many workstations. Thus, workers do not need to have professional skills for all steps in the manufacturing chain, and they are sometimes only familiar with a few specific workstations.

In contrast, small factories that rely on a varied but small customer base have small-scale, diverse production lines that require skilled workers who have a broad, flexible, professional knowledge base.

A large plant relies on mechanized and complex production lines. Therefore, creating a change in the production system requires heavy financial and logistical investment. On the other hand, a small plant is capable of changing the type of product produced and the production system relatively easily while relying on the knowledge of its employees.

This insight has helped identify the potential ability of small factories to adapt and implement faster, radical changes. The rest of the insights presented will therefore focus on small factories.

Disconnected manufacturers

Key insight: Service providers have lost the ability to respond appropriately to market conditions.

Small-scale manufacturers and service providers are alienated from the distribution system and end users. They remain dependent on the marketing and distribution capabilities of local designers.

Secondary insight: The development process replicates manufacturers' capabilities and does not encourage innovation.[1]

Designers are in direct contact with consumers. They mediate knowledge about customers for the factory, in the form of product design. The literature suggests that collaboration between craft and design encourages innovation. A continuous, rather than collaborative, product development process tends to replicate known capabilities. The development process adjusts the design to the production line, but designers are not involved in the production process itself.

> *"People do not think creatively about the production process because they are not exposed to it ... If a designer understood how things were made he could make better designs and if he felt the system was limiting he could redesign the production process." (trend forecaster)*

> *"When production and design were a single department, the designer brought a design that had a technological change in the performance and composition of the shoe. The approach to the shoe was completely different … and required a new production line and new equipment. This line became so successful that gradually most of the production changed to this method." (senior development expert)*

The distance between producers and consumers prevents them from identifying needs and offering a new value proposition. Manufacturers lack tools that allow them to offer an independent identity to customers.

Secondary insight: Designers' distribution challenges affect their ability to increase production. This prevents growth of small enterprises.

Most local designers use the same suppliers, distribution methods, and production methods, resulting in similar products. This congests the local market, preventing growth without additional resource investment.

Independent designers in Israel lack sufficient time and money to create efficient distribution networks and reach beyond the local market. Their distribution and marketing are often not based on professional business knowledge. Distribution depends on their ability to invest in development of an online shop, work with distributors, maintain a physical store, and sell at local fairs. Their distribution is mainly to local markets.

[1] *The creation of new knowledge that is the basic condition for innovation.*

"What designers need is help with advertising. 'Shuphuni' (the largest fair of Israeli shoes) gives them a big opportunity as a window display." (small manufacturer).

"The main obstacle to growth is lack of market. Going abroad is a much more complex operation" (entrepreneur of local shoe fair)

Inability to reach a wide market prevents designers from increasing production. The reliance of footwear manufacturers on the distribution capabilities of designers prevents them from influencing factories' production quantities.

Secondary insight: Identifying commercial and market realities is necessary for cooperation and innovation.

Small factory managers lack business and professional knowledge, leading to nonprofitable investment decisions and preventing return on investment.

Example 1: Manufacturer A invested in an advanced cutting machine and software. This increased product quality and improved the development process but did not return the investment due to lack of sufficient production.

Example 2: Manufacturer B invested in creating a website for direct sale to customers but did not consider the costs of digital marketing necessary for promoting it.

From a factory to a workshop

Key insight: The mass production model is not economically feasible for a workshop that produces in small series.

Most small factories were formerly medium-large family enterprises with independent brands and a mass production model.

"It's like producing just samples all the time. It does not permit for a flowing production line that can allow a sale or a production line to earn." (a senior development woman and a lecturer for footwear)

Manual production requires fewer employees, but each must have a broad skill set and responsibility for the final product. Therefore, manual production is a "work of risk".

Small factories operate more like workshops than like industrial mass production plants. Their small series production line is not profitable and traps them in survival mode. However, the literature indicates producing in small series presents an opportunity to move from a PUSH (build to stock) model to a PULL (made to order) model. To stimulate the innovative potential inherent in craft work, it must be combined with elements from other disciplines.

Survival mode

Key insight: Survival mode does not enable development of long-term strategies and differentiation from competitors.

A long-term strategy requires investment of time and economic resources. When the owner is struggling to maintain the business, investment of resources constitutes an existential risk.

"It's hard to manage a factory when you manage the nuts and bolts." (senior developer in a medium-large scale factory, former manufacturer)

Secondary insight: Differentiation and competitive advantage result from new knowledge or a new value offered to the customer.

In open markets in a competitive global capitalist economy, knowledge building is an indispensable resource enabling innovation.

"Traditional industry is defined as an industry whose knowledge is known. There is no change of knowledge here." (owner of a medium-large factory)

Creation as identity

Key Insights: Many factories in Israel were originally family enterprises, and the threat of losing their identity leads small manufacturers to perform radical changes in order to survive. Even when the enterprise is unprofitable, they try to maintain it.

> *"Whoever knows how to do, has to do. When I closed my factory, it was as if I was frozen. I was like a bird that had its wings cut off." (a small manufacturer)*

Decentralization versus union

Key insight: Creating partnerships in the footwear industry may reduce risk in development of knowledge and innovative products.

The reports of the Israeli Association of Craftsmen and the Israeli Association of Industry and Trade have not covered the footwear industry since 2007, due to its minimal contribution to the economy. This reflects the political attitude to the field.

Decentralization of the industry isolates each participant in their daily challenges and with limited resources. For small manufacturers, designers, and suppliers, unsafe investments endanger survival. Decentralization eliminates potential power and the ability to manage it systemically in current market conditions.

Risk of innovation can be minimized through internal and extra-sectoral cooperative networks, use of a knowledge coordinator (KI), and combining resources. This enables each network member to reach its potential and a competitive advantage.

Summary of findings and insights

The above insights were aimed to identify challenges and barriers in the industry which prevent its growth and threaten its existence.

The first major insight differentiated between two types of factories in the Israeli footwear industry: medium-large and micro-small. These differ in management, strategy, product character, distribution, product development, production quantities, job character, and employee skill. A comparison of these enterprises highlighted their strengths and weaknesses and led to the identification of opportunities for intervention specifically with small producers. From this point onwards, the research focused solely on these small factories/workshops.

Four *areas of opportunity* were observed:

Motivation - Small producers are willing to make radical changes in order to survive and maintain their identity.

Knowledge - The labor force in the small enterprises is more skilled and has broad responsibilities and therefore a broad knowledge of the entire production process.

Flexibility - Working with a variety of small producing clients in a market where the product turnover is high (fashionable shoes), established a working paradigm on small series that requires flexibility in planning and manufacturing.

Cost of changes - Small plants rely on skilled manual labor with relatively simple machinery. In contrast, the automation infrastructure in large enterprises is complex and extensive. It follows that change in small enterprises would mean retraining a well-skilled workforce and introducing new technology, and this would be considerably cheaper than the replacement of large existing automation infrastructures and the training of a new workforce.

Along with the opportunity zones, *barriers* were observed that prevent small enterprises from realizing their potential:

Disconnection - manufacturers have lost their ability to sense their environment and therefore respond appropriately to market conditions. This is reflected in the lack of independent distribution capabilities and working for customers that limit their knowledge of their end users. This detachment usually leads to the conservation of previously known abilities, and therefore does not encourage the creation of new knowledge.

Survival practice - the designers' distribution challenges influence the factory's ability to increase its production. The practice of mass production is not economic for a workshop which produces small quantities and leads to a state of continuous survival. This survival mode does not allow the mental and economic well-being needed to develop long-term strategies and differentiation from competitors.

A scattered industry - The Israeli footwear industry does not provide a significant profitable economic return, and therefore is not integrated by government agencies. There is no independent industrial association. This means that the industry is not valued, has no systemic vision, and has no collective power.

Drawing from the insights, the following *principles* led towards the proposed solution:

Additional perspectives from different disciplines must be introduced to the industry. This could serve as a basis for the development of strategies, production methods, and innovative products. *Collaboration* could help facilitate investments for innovative products and reduce the risk that comes with innovation.

Project Outputs

The insights helped reframe the research question as follows: *How might we preserve knowledge in the footwear manufacturing industry in Israel, and leverage it to create new knowledge and sustainable economic practice that can compete in the global market?*

The RQ formulated the basis for proposing a solution:

1. "Preserve existing knowledge by leveraging" - a mixture of existing knowledge with new disciplines.
2. "Sustainable" - beneficial for the producer, consumer and the social and ecological environment.
3. "Competitive economic practice" - creation of knowledge enabling a competitive advantage, differentiation, and added value to the consumer.

This preliminary research and ideation session yielded two outcomes. The first is the collaborative design of a product and its manufacturing process. The second, a derivative of the first, is a technological digital platform to be used by small manufacturers.

First outcome – Design of a product and its manufacturing process

First, since the research identified the manufacturers' disconnection as one of their main challenges, a new model of a shoe and its production process were co-designed with a local manufacturer. During this process the researcher served as a knowledge integrator (KI), mediating knowledge on market trends, consumers, and advanced production technologies.

This led to the selection of a triple bottom line business strategy which allows for sustainable innovation.

Following by are the characteristics and decisions that compound the design of the product and its manufacturing process:

Consumer trends: The rise of online consumption has changed consumer expectations from service providers and products: Consumer power increased, niche markets expanded, and consumers began to express a growing desire to be involved in product design and its adaptation to their lifestyle. An example of this trend in footwear is the steep drop in sales of tailored products and the growth of a new segment, *Athleisure*, indicating a leisurely and sportive lifestyle.

Production and distribution trends: New technologies enable lean production, such as Additive Manufacturing, and enable small-scale, rapid, local production and personalized products. For example, smartphone applications assist in the collection, transfer, and analysis of consumer physiological data. These trends change the value chain of products, and the need to mediate between producer and customer. Inventory costs related to forecasting and purchasing are reduced.

Product Characterization: The strategy focused on one main product that would offer personal value through 3D foot scanning and manufacturing of a footbed and 3D printed soles. This enabled a lean and uniform production process to be developed. Product development drew from a sustainable "design for disassembly" perspective. The market segment is unisex, everyday wear, and leisure. Distribution and marketing are online.

Figure 2: The shoe design – made from 3 materials that are attached to each other only by sewing. The insole - sole is a one-piece 3D printed according to a specific foot.

Product Value Chain Mapping*: Following the characterization of the product, a process of in-depth research was initiated. Meetings were held with experts[2] in fields related to the value chain of the product as a system. The experts helped map out the steps required for development[3].*

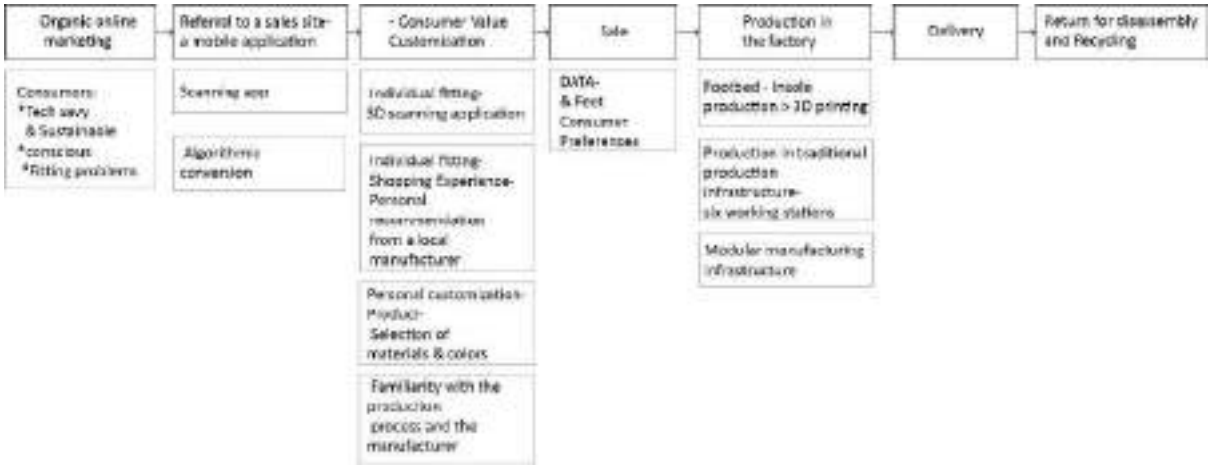

Figure 3: Value chain of the product as a system.

Sustainable product development: Recyclable materials are used. The shoe is connected by sewing, without adhesives. This allows for simple disassembly of the product at the end of its life cycle.

Development of the production process: Intervention in the existing production line with the assistance of the manufacturer has allowed for reduction of the number of workstations from 12 to 6. The manufacturing process allows for connecting shoe parts only by sewing.

3D scanning and printing technology enable employees to respond to new production capabilities and needs in planning the production line. This enables production of a single model with endless modes of expression adapted to the consumer's foot structure, style, and values. This model can be executed within a single, uniform, and continuous assembly line. It therefore reduces the production cost of the shoe.

Consumer Value Proposition - Product: Durable footwear customized to physiological data.

Consumer value proposition: purchasing experience: Personal recommendation from a professional, personal acquaintance. An illustration of the product and the consumers' shopping experience can be seen in the Know-Me Video. [4]

[2] *A senior development man in a large footwear factory, two entrepreneurs in the field of additive manufacturing, materials specialist, e-commerce, digital marketing, programmer of orthopedic software for three-dimensional.*

[3] *Some of the meetings with experts were conducted with the manufacturer and at his initiative, and the researcher mediated some meetings.*

[4] *https://youtu.be/YwVwDeEwhUk*

Second (following) outcome - Development of the Know-Me platform

Cost calculations of the value chain of the product introduced in the prior chapter revealed an economic barrier to manufacturers. Gaps were found between the shoe production costs at the plant and the costs of operating the digital site, marketing, and data analysis. This led to a shift from a system serving a single enterprise to one serving multiple enterprises and offering a variety of products to consumers.

The proposed solution, Know-Me, is a technological digital platform that designs:

- Direct contact between manufacturer and consumer
- Lean and modular production processes
- A database that can be converted into business opportunities

The platform model is based on an open platform linking online shopping opportunities to strengthen the connection between manufacturer and consumer. Three design values were defined as guiding principles for the platform value proposition to the end consumer: personalization, personal connection, and environmental impact (locally and globally).

Value proposition to consumers: Artisanal approach to a digital relationship

A review of the changes in production processes between pre-industrial craft production and global mass production identified values that could be leveraged as a new value proposition to consumers. These include the nature of the consumer-producer relationship, generic versus personalized products, and implications of the production process.

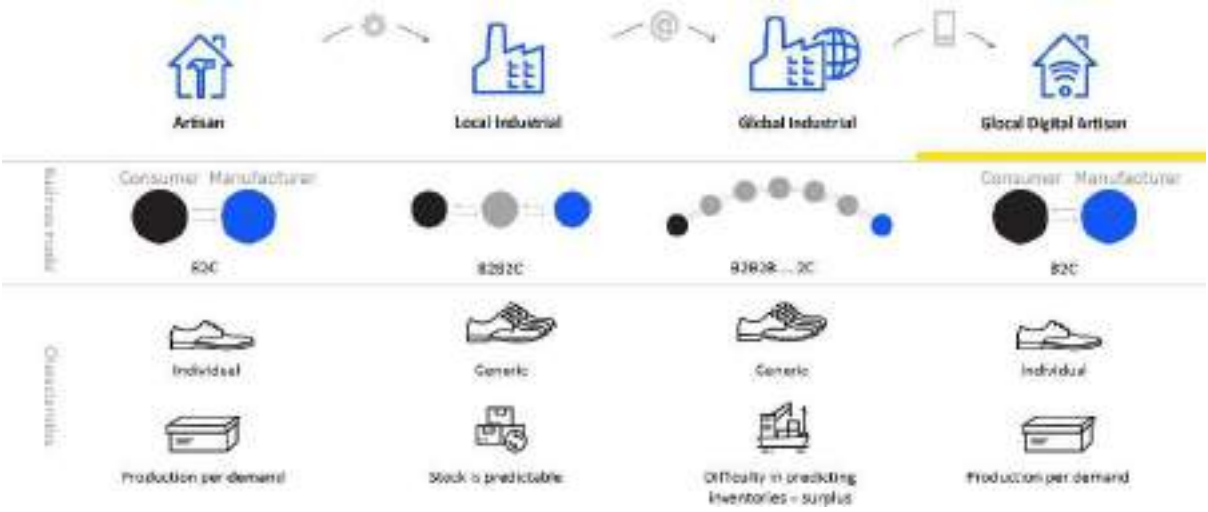

Figure 4: Production overview. New technologies facilitate the return to artisanal production values (craft) in a new digital configuration in the glocal (global/local) system.

The primary value offered and marketed to the consumer*: Personalized product and communication. The online selling site enables reception of physiological and other data from the consumer. In turn, the consumer receives personal and professional recommendations from the manufacturer.*

The added value to the consumer: The possibility of buying a product with sustainable value and responsibility for the end of the product's life. During the buying process, consumers can select the material, reflecting their worldview. Also, they have an opportunity to get acquainted with the manufacturing process and the manufacturer.

The value of sustainability is expressed in a product designed for disassembly. It can be collected from the customer at the end of its use, easily disassembled, and the materials recycled and/or reused. This enables the following sequence of production on demand: designing modules and production infrastructure > customer personalizes & customizes the design > purchase > manufacture.

Values to manufacturers

The platform offers the manufacturer accompaniment on three levels:

A. Product development process and production process

On-Boarding - The platform assists in co-developing a product and manufacturing process prior to the start of work. This is designed to adapt the product to a relevant target audience with a clear marketing value while maintaining an economically feasible production process and developing existing knowledge in the plant. The platform is used as a knowledge integrator.

Development of the production process - Development and design of the product takes place together with creation of a production infrastructure based on principles of minimal modules and workstations. This minimizes inventory of raw materials and eliminates excess stocks. It introduces technology to the plant that enables personal production on demand. This holistic process simultaneously considers product design, production, employee skills, and customer experience.

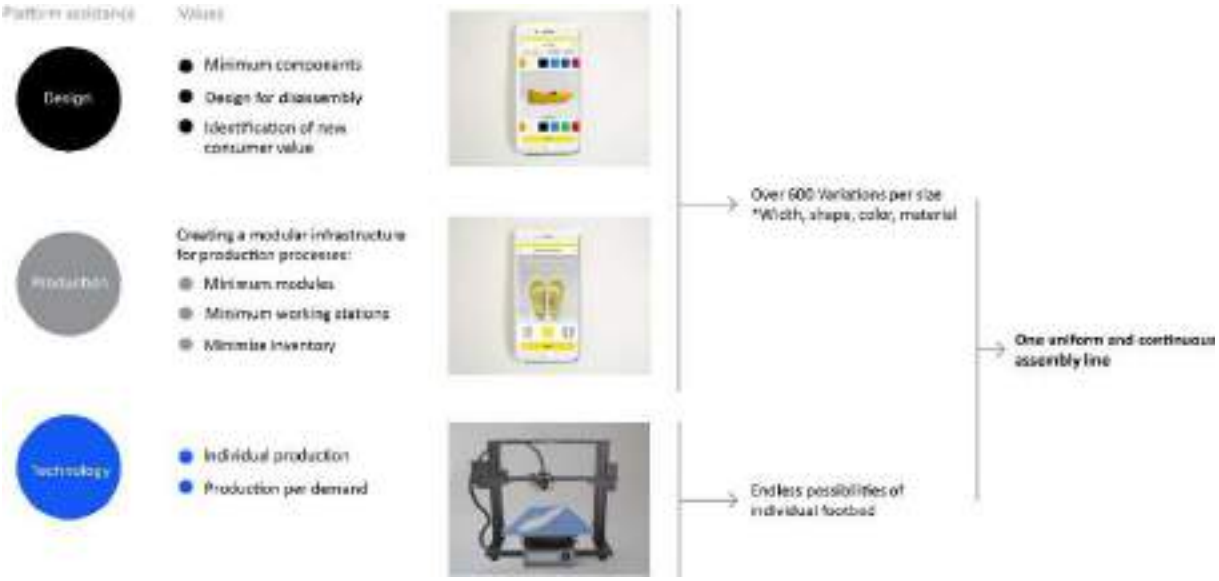

Figure 5: Product development and manufacturing process with a local manufacturer.

B. Support for ongoing activities

In daily operations, the platform manages the sale site, digital marketing, customer service, digital operation of the site and its applications, and transferring files needed for technological production (for instance 3D printing). The platform collects data and makes it accessible to the manufacturer. This is reflected in digital inventory management, production instructions for workstations, and communication with suppliers.

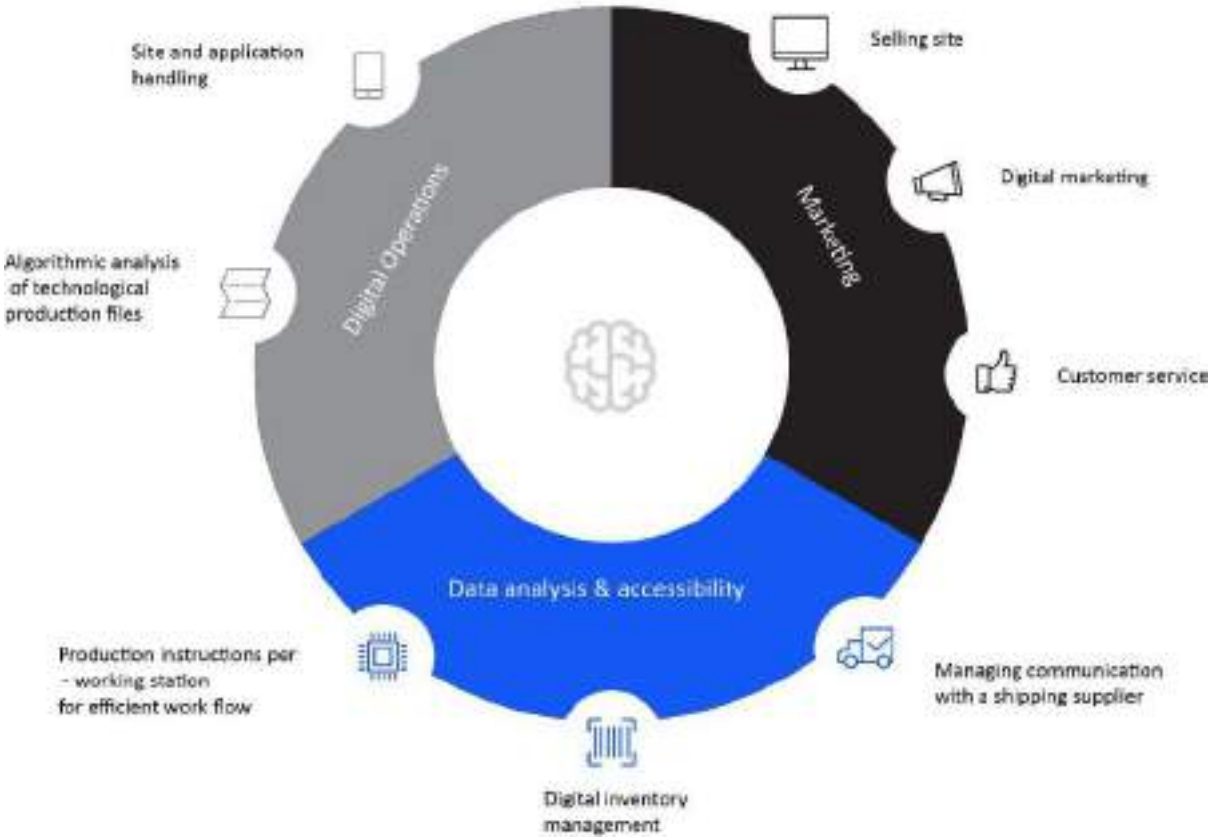

Figure 6: Platform support for ongoing activities.

C. Database and future R&D processes

Digitization can revitalize local production. New technology in the production process enables development of manufacturing capabilities. Data on customers' behavior and foot physiology will help identify opportunities for further development. This combination enables an interconnected and sustainable production process that can be continually updated and improved.

In the long term, the platform will enable creation of a unified network of an updatable and decentralized production process, which can be connected to additional workshops and industries to create new opportunities. The platform will unite plants in the collection and analysis of data, logistics, marketing, and distribution. It will allow for individualized production processes for different manufacturers, enabling a wide range of products for customers on the selling platform.

Environmental and ecological values

Short-term: Design for disassembly enables recycling or reusing materials. Eliminating final product inventory by producing on demand and reducing raw materials inventory.

Long term: Products will be offered to a local and global clientele. After identifying consumers outside the original production location, the platform will locate local producers in the new geographic location and initiate local production of the product near that customer.

Summary

The research presented in this paper finds that improving the connection between production and design within the footwear industry and with other industries may enable the creation of new knowledge regarding the product and the consumers. This can lead to a competitive advantage for the Israeli footwear industry and serve as a potential growth engine for local production.

The proposed solution is a platform used as a digital and technological platform for micro-small manufacturing plants. The platform mediates and shapes the connection between production, technology, and design. It

enables creation of a joint R&D system with the potential to develop strategies, production methods, and innovative products. It overcomes barriers of the global market and leverages the advantages of personal contact with the consumer.

The platform can serve as an infrastructure for developing a system that creates innovation. It could minimize the inherent risk of investing in innovation by creating a co-production and co-R&D network for manufacturers.

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Track 5.b Introduction: Strengthening the Design Capabilities of Professional Organisations in a Complex World

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Introduction

In Hong Kong of the year 2017, a new academic community convened to attend to pressing issues regarding design as source of innovation. The inaugural Academy for Design Innovation Management Conference (nee Design Management Academy) attended to a sense of urgency regarding the adoption of design capabilities within organisations as source of innovation. The title of the conference, *Research perspectives on creative intersections* was therefore pertinent, with papers exploring how design and designers were intersecting with new business challenges. Two years later in London (2019), rhetoric has notably shifted from matters of adoption to strengthening design capabilities within organisations, thereby enabling those organisations to unlock the possibilities and subsequent benefits of design. These possibilities include but are not limited to strategic and cultural renewal, design of new processes and meaningful engagement with hard-to-reach stakeholders.

To address the complex nature of today's societal and economic problems, professional organisations now recognize that traditional tools and approaches may not provide the required solutions. To address complex challenges, many managers and business leaders have consciously turned to design approaches over the past decade, including both public and private sectors (Bason, 2010; Dorst, 2015b; Irwin, 2015). To increase design capabilities, these organisations have established innovation labs with designers, have recruited designers in strategic positions, and/or have started building the design competence of existing staff through educational programs, often provided by design consultancies. Yet to date, describing the resultant impact of teaching. Individual design competencies on organisational design capabilities (Salvato & Rerup, 2010) has proven elusive.

There is limited evidence of the impact of design capability building within private and public sectors, although many seem to agree that workshops and short courses in design thinking do not lead to the required change. We identify that ubiquitous post-it-note workshops have become the associated image of designing shared by many practitioners. Yet this simplistic association reduces design to undisciplined brainstorming – an association that may be counterproductive to greater elevation of design as means to address complex societal challenges. Furthermore, capability building programs do not always build on contemporary educational and social theories of workplace learning which highlight the social and complex nature of how professionals learn (Hager, 2011; Orlikowski, 2002). This situation is further complicated by the fact that design for complex societal problems differs from traditional design practices, and should be *adapted* to the needs of this 'target field' (Buchanan, 2015; Dorst, 2015a; Smulders, Dorst & Vermaas, 2014; Van der Bijl-Brouwer, Kaldor, Watson, & Hillen, 2015). This means that design practices need to be adapted to deal with the complexity inherent to societal problems and organizations, and the political nature of dealing with divergent stakeholder needs. Happily, we observe that the scope of this Academic for Design Innovation Management

Conference in London (2019) has broadened to reflect the rich array of contexts in which designers now find themselves with contributions spanning across the public and private organisational spectrum.

Introducing the contributions to this session

The applications of design in complex contexts are diverse, as demonstrated by the wide variety of application areas represented in the papers that were submitted to this track session, ranging from the government, the financial sector, a supreme audit institution, an academic library, the science community to an airline. Each of these organisations has unique structures, processes, and histories which require customized adaptations of design and of the way it is introduced.

In the first paper of the session, Kim & Van der Bijl-Brouwer present an explorative study of the introduction of design practice within governments and conclude that embedding these practices is not just about developing skill-sets, but also requires organisational change. Rothkotter, Garner & Vanja present a literature review of the application of design in a science-based innovation context. Their results show a range of different types of design capabilities apparent in science-based innovation. They discuss the challenges at the creative intersection of science and design. Meijer-Wassenaar and Van Est work for the Netherlands Court of Audit and present a study of their work of introducing design practice to their organisation. They discuss how design practice needs to be adapted for use in supreme audit institutions. A second application of design in an academic context is presented by Gasparini who shows how design capabilities can be built within academic libraries, and how that brings (and requires) openness and dialogical spaces. Close-Debais & Matthews present an evaluation of the perceptions of design capability by staff from a financial service organisation. A critical discussion of what design competency is and how it can be built follows. Finally, Stoimenova, Stomph and de Lille present their action-research study in which they used design to develop 'organisational prototypes' for the ways of working, infrastructure and culture of an airline. Stoimenova and colleagues argue for continuous prototyping so organisations can adapt to a complex and dynamic context.

We have learned from our track that implementing design capabilities is not just a matter of exchanging one way of working for another. Design capabilities are novel and unprecedented in most of the present application areas we have witnessed in our track. Design capabilities in performative state could bring specific contributions that are believed to shed new light on existing (complex) challenges, unlocking solution spaces, in most cases unfamiliar to the actors involved. Based on the papers in our session we have identified three organisational subjects that are important to consider when building design capabilities. First, the topic of organisational learning that is undoubtedly related to implementing design capabilities must be more closely attended to. Second, developing design-rhetoric to better reflect organisational contexts in which capabilities are being built. Lastly, and very much interrelated to one and two, the need to acknowledge organisational changes that occur as collateral effects of implementing design capabilities.

Individual, collective and organisational learning

Two key questions to consider when approaching the task of strengthening design capability are; (1) how we learn, and (2) how we learn collectively in the context of professional organisations. From an individual learning perspective, theories such as experiential learning (Kolb, 1984; Moon, 2004) and practice-based or situated learning (Lave & Wenger, 1991) are commonly applied when teaching design skills in a professional context. Learning programs were proposed and/or discussed in five papers in this track session, all with an experiential 'learn-by-doing' element. Three of the papers showed cases of situated and practice-based learning where non-designers were actively engaged in 'design experiments' to introduce designerly approaches to their own organisation. For example, Stoimenova et al describe how airline staff were actively engaged in 'prototyping' ways of working and how that created noticeable change in the capability of the team. In this way design capabilities are built from 'within' the organisation with non-designers by demonstrating the possibilities of design, much akin to the work of Price, Wrigley and Matthews (2018).

While theories of individual learning have a long history, and organisational & team learning came up as a concept in the nineties (Argyris & Schon, 1996; Senge, 1990). More recent theories of professional learning focus on the complexity of organisations, and acknowledge that learning needed for successful performance in an occupation cannot be specified in advance or imparted in a formal course (Hager, 2011). Instead these theories conceive of knowledge as situated, negotiated, emergent, and embedded (Gherardi, 2009), and acknowledge that learning is not independent from context. Instead workplace learning and performance are

considered to be significantly shaped by social, organisational, cultural and other contextual factors (Hager, 2011). With the shift from collective and professional learning to a situated understanding of organisational learning, building design capability shifts from predefined context-independent design programs, to building learning spaces that allow design capability to evolve to allow adaptability of design practice (Elkjaer, 2004). A nice example of this is shown in the paper of Gasparini, who presents a range of different capability building interventions for public libraries, resulting in the design of 'dialogical spaces' where participants could feel safe, share knowledge, stances, and ideas freely.

A design language and vocabulary

A reoccurring topic that came up in the paper presentations was the language that was used to articulate what design is. The language impacts both the understanding of what design is (and what it is not), as well as the more emotional acceptance of new ways of working.

The first goal is about explaining to staff or colleagues how the act of designing has the potential to contribute to the purpose of the organisation in different ways. Gasparini described in this track session how building a design and project vocabulary are of paramount importance for building and sustaining design capability. For example, part of the design vocabulary discussed in the session was Buchanan's four orders model, which was used in both the Court of Audit study (Meijer-Wassenaar and Van Est) and the Science based innovation study (Rothkotter, Garner & Vanja) to explain the how and what can be designed (Buchanan, 2015).

The second goal of design language is related to the emotions involved in the discomfort that can often be experienced when new ideas presented that do not align with current views (Frese, Wegener & Smulders, 2018) and ways of working (Smulders, Dorst & Vermaas, 2014; Wegener & Smulders, 2019). The researchers from the Court of Audits for example explained how they developed a 'customised' language with terms that are related to elements of design, but are explained in terms of the language used within the organisation. The conference track session raised discussion of the 'Trojan horse' as a means to introduce design practice without explicitly calling it design. Applying design related activities like experimenting and visualising need not be referred to as 'design' as these activities are grounded in many disciplines. We see this distinction as a way to prevent entanglement in ambiguous discussions on what design is and what it can bring. An emphasis on action, demonstrating and experiencing design, is what engages stakeholders and overcomes hesitancies to a novel way of working (Price et al. 2018).

The development of a vocabulary and language are important elements of designing (Dong, 2007). Boland, Collopy, Lyytinen, and Yoo (2008) explain how "the design attitude includes an expectation that an organisation's familiar language will be subject to scrutiny" and, "that new vocabulary elements are expected as an emergent outcome of seeking to create a more desirable state of affairs" (p.22). They further argue that a critical awareness of vocabulary might also benefit organisation design. The discussions in this track session further contribute to this claim and suggest that building a new and customized vocabulary that draws on a linguistic perspective of designing as learning can strengthen design capabilities.

Organisational change

When addressing design capabilities in organisations, designers and design scholars are faced with an organisational-level phenomenon. Organisational capabilities are firm-level assemblages of lower-level routines (Nelson & Winter, 1982) and go beyond individual competencies (Salvato & Rerup, 2010). Therefore, to understand strengthening design capabilities of organisations, a sophisticated understanding of organisational change is needed for building organisational capabilities and underlying routines. The different papers within this track conceptualise organisational changes required to strengthen organisational capabilities for design as changing *practices*, changing *processes* and the *process of inquiry* inherent to organisational change.

Changing practices in organisations as a way to strengthen organisational design capabilities was a focus in several papers. For example, Meijer-Wassenaar et al. draw on Sparrow (2000) to conceptualize organisational change as requiring a change in practices instead of just changing regulations.

Changing processes, as bundle of practices, was another way of conceptualizing the organisational changes needed to strengthen organisational design capabilities. Close-Debais & Matthews highlight that building design capabilities in organisations requires changes in methodologies and practices (p.2). Similarly, Gasparini

conceptualized organisational change as “repeated interventions (each having a different design goal), and over time, led to integration of these ways of thinking and working with daily routines, transforming the work practices in the library” (p.2). Interestingly they link organisational change with organisational learning through referring to the process of inquiry by Dewey (1938) , as previous scholars in design have done (Junginger, 2008; Melles, 2008).

The process of inquiry inherent to organisational change is exemplified by Stoimenova et al. Their work highlighted the processual nature of organisational change as, "emergence of an adaptive organisational structure by tracing its evolution from the introduction of methods and tools to the full adoption of a new way of working" (p.2). Interestingly in their work they change organisational processes as stepping stones toward the process of organisational change. This reflects discussions in organisational change literature, highlighting that the changes of organisational processes (conceptualized as organisational routines) is an analytically fruitful way to study organisational change (Becker, Lazaric, Nelson & Winter, 2005; Feldman & Pentland, 2003). In line with this processual perspective on organisational change, Kim & van der Bijl-Brouwer problematize the very concept of 'embedding design'. Their discussion drawing on design and organisational development literature conceptualizes embedding design as "combined effort of introducing design practice and sustaining and amplifying design-led change energy until it transforms the public organisation" (p.3). Their work highlights the need to change practices, the processual nature and the requirement to transform the whole organisation toward a preferred state.

Together these studies highlight the required organisational changes when building a capability for design in an organization. Design often results in new concepts that not necessarily comply with existing ways of working (Smulders et al., 2014). An organisational design capability requires bringing new concepts from design to realisation, needing changes to existing practices, processes and engage in more fundamental organisational change (Junginger, 2008; Wegener & Smulders, 2019).

A research agenda for design capability building

When addressing design capabilities in organisations in a complex world, designers and design scholars increasingly are faced with pedagogical and organisational considerations. In this introductory paper we have highlighted topics such as educational models for individual learning and collective learning, the language and vocabulary used, and an understanding of organisational change. The different papers within this track reflect these different ways of conceptualising learning and the organisational changes required to strengthen capabilities for design. These discussions and papers are important stepping stones toward a fuller grasp of what it means to strengthen design capabilities in professional organisations in a complex world.

To further advance the field of design capability building, we propose a future research agenda that combines building a more expanded empirical base of effective capability building strategies, with a grounding of these strategies in relevant disciplines, including organisational learning and pedagogy, linguistics, and organisational management. Questions include for example:

- What does a ‘mature level’ of design capability in organisations look like to achieve their organisational purpose and goals? How can we measure that?
- How can we develop design and project vocabularies that strengthen design capability building?
- How can we ensure organisations are able to reap the benefits of deploying design capabilities?
- How do we build effective learning spaces to collectively reflect and organise dialogues that promote an ongoing practice of (organisational) learning?
- In line with the above, how do we organise for experiments based on these learnings that result in an evolving adaptive practice?

We argue that addressing these questions requires an interdisciplinary approach, bringing together theories and insights from design with those from for example learning, language and organisational studies. This requires us to move beyond our mono-disciplinary academic design community and engage with academics from these other fields. It also requires an engagement with practice, by actively experimenting with new approaches to strengthen design capabilities. Indeed, this diversity of disciplines and professional backgrounds was clearly represented in the audience and participants of the track session. We hope the session contributes to building a connected community of practitioners and academics to advance the body of knowledge on how we build, strengthen and sustain design capabilities in professional organisations in a complex world.

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Understanding the current practice of design in government: limitations and opportunities

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Design is today suggested as an alternative way of working in government contexts. Many developed nations are trying to embed design in their public organizations. Yet recent studies have shown that design is not easily permeating into everyday practice of public organizations. This research therefore aims to understand what the current practice of design-embedding in government is like and its limitations by interviewing six experts in the design for government field. The research findings reveal that the changes created by the current design-embedding practice in government are not being actively sustained or amplified. Based on an understanding of organisations as complex systems, we suggest a further practice of design-embedding in which designers steward and stimulate design-led change energy within public organizations. This study shows that embedding design capability in professional organizations is more about design-led organizational change than passing on a design skillset to the organizational members.

Keywords: Embedding design in government, design for policy, complex systems, design-led organizational change, design capability building

Introduction

We are living in a hyper-networked society that generates wicked problems – the ones defined as “complex, unpredictable, open-ended or intractable” (Head & Alford, 2015, p.712). As governments cannot properly handle these problems in their old ways, they are trying to make changes in their ways of working. Design in this situation has risen as an alternative way of working in government contexts. The experimental, human-centered and co-creating approach of design is praised as opposed to government’s bureaucratic, risk-averse, hierarchical and siloed ways of working (Bason, 2010). As a result, in recent years hundreds of public innovation labs using design as their core methodology have been created worldwide (Fuller & Lochard, 2016; Mortati, Christiansen, & Maffei, 2018).

Design has engaged in complex problems of business and service areas before, but in the unique context of government design is faced with many challenges. Firstly, designers are criticized for the lack of policy-relevant skillset and knowledge and the lack of commitment to implementation (Mulgan, 2014). Secondly, recent studies have revealed that the aforementioned design-led public innovation labs are having a hard time entering mainstream policy practice (McGann, Blomkamp, & Lewis, 2018; Mintrom & Luetjens, 2016). Lastly but not least, the closing of leading public innovation labs such as Helsinki Design Lab and Mindlab seems to suggest some challenges in the current approach of embedding design in government. Overall, despite its merits in government context, design is not easily permeating into the day to day practice of public

organizations. Designers and public leaders interested in the design-led public sector innovation have not yet fully grasped how to embed design in government.

Therefore, this research aims to understand the current practice of embedding design in government and its limitations, by interviewing six experts who are working inside and outside of governments in the design for government sector. This preliminary study for a doctoral thesis will serve as a starting point for further development of practical knowledges for design practitioners and public leaders who are interested in the design-led public innovation and especially those who are in the stage of scaling design-led change in public organizations.

* *Explanation of the term 'design/ designer' in this paper*

In this paper, the term 'design' refers to the design practice (or its approach) conducted in solving societal problems by the public sector. It is often used interchangeably with design thinking or designerly ways of working. Design as an approach to problem solving is characterized by abductive thinking and act of framing (Dorst, 2011). Design in the public sector deals with problematic situations where the desired values are known but what causes the situations and how to achieve the values are unknown. Thus, the design process involves co-evolution of the problem and the solution as well as the act of adopting certain "working principles" to describe the problematic situations (Ibid, p.525). This designerly way of problem solving is considered to be fundamentally different from the deductive thinking processes commonly preferred in public organizations. 'Designer' in this paper concerns both design-trained and non-design-trained people who practise design in the public sector.

Literature review

In this section we will briefly explain why design is desired in government contexts. Then, it is examined how design literature illustrates what 'embedding design in government' means and how to practise it. Lastly, we define the concept of embedding design in government based on the understanding of organizational change and development theories.

Why design is desired in government context

Policy can be defined as a course of actions that a government takes to solve societal problems while governing the state (Colebatch, 2009). If policy is the act of problem-solving, the making of a policy entails operations similar to designing such as defining the given problem, setting a preferred goal, and deliberately attempting to achieve the goal (Ibid). In fact, the concept of policy design has existed since 1950 in policy context (Clarke & Craft, 2017). However, today's policy design is more about co-designing a policy with multiple actors in open and networked systems as opposed to the closed and siloed ways of policy designing by a few actors in the past.

The reason why the co-designing ways of policymaking receive attention today has to do with a change in governance paradigm. In the current governments of developed countries, there are three paradigms of governance - traditional public administration, new public management, and networked governance. Hartley (2005, p.29) explains that all the three paradigms coexist as "layered realities," but it is reported that "significant elements of networked governance are seen in countries such as the UK, the USA and Australia" (Bason, 2010, p.10). Furthermore, it is known that the wicked societal problems of today are best dealt with in the networked and collaborative ways of policy-making, as involvement of multiple actors improves the understanding of a problem and ensures that needs of citizens are taken into consideration (Sørensen & Torfing, 2016). Thus, public servants and policymakers are asked to have the design capability that helps them understand the given problematic situation, find a real problem, and co-design its solution with other policy actors.

Design is also favoured for the sake of government innovation. Mulgan and Albury (2003, p.3) point out that current "practices, structures, cultures and modes of operation of public services, government departments and agencies" are shaped in the time when the needs of citizens were homogeneous. For the systems of public organizations are no longer suited for the diverse needs of citizens and wicked societal problems of today, the public sector is urged to change (Ibid; Hartley 2014). In this context, design is proposed as a major driver to the public sector transformation. Design is believed to help government not only design public service and policy but also "achieve wider long-term aims of growth and quality of life for its citizens" (Design Council, 2013, p.4).

What 'embedding design in government' means and how to practise it

Despite the increasing interest in 'embedding design in government,' what the concept means is not sufficiently discussed yet. How we define the concept is important since its definition can influence how to practise it. We firstly examine how current design literature explains what embedding design in government means and how to practice it, and secondly propose how the concept can be newly defined based on organizational change and development theories, as design in a government context is a change or innovation.

The British Design Council (2013, p.8) (BDC) made a model called the public sector design ladder to describe different levels of design used in public organizations. In this progressive three-step ladder model, embedding design is explained in the second step "design as capability," where, as BDC explains, design "becomes part of the culture of public bodies and the way they operate and make decisions." In this model, embedding design is a step below "design for policy," the stage where design is used by policymakers. However, in reality design can be used by policymakers before design becomes embedded in public organizations. This model is therefore rather confusing to explain the concept of embedding design in government properly.

The Scottish service design firm Snook and Design Managers Australia (2014) describe embedding design in government by three different embedding activities: embedding design capability and skillset, embedding design thinking, and embedding a lasting environment for design practice. This understanding seems to be more comprehensive than the design ladder model as it interprets embedding design as building not only design capability but also an environment for the sustainable practice of design. Nonetheless, a limitation of this explanation, as well as of the design ladder, is that it does not acknowledge the complexity in the design-led organizational change process in the design-embedding practice.

Design literature has paid less attention to the complex organizational change process also in explaining how to practise design-embedding in government, how public employees and organizations are transformed through design experiences. Sangiorgi (2011, p.29) claimed that the design process – the co-design process, precisely speaking, as co-designing is the norm in the public sector – "necessitates the concomitant development of staff, the public and the organization." It is also asserted that design process is not necessarily a change management process and "leaving the participants with the tools and capacity to continue to adapt and innovate means […] that organisational change will continue to happen" (Burns, Cottam, Vanstone, & Winhall, 2006).

However, such optimistic prospects about organizational change contrasts with the general opinion of organizational change experts. Roehrig, Schwendenwein and Bushe (2018) claim that "without an amplification strategy in place, chances are the energy and momentum [of a change] will dwindle." Only few design scholars such as Deserti and Rizzo (2014, p.86) criticized the pervasive idea that introducing design practice in public organizations will work "per se." They warned that designers' lack of concern for managing and fostering a design-led change process could "lead to the rejection of the new practices or confinement of them to a cosmetic role"(Ibid, p.87).

According to the theories of organizational change and development, 'embedding' of any change or innovation is the last stage of a change process (Hayes, 2018; Roehrig et al., 2018). It is a state where the change is sustained so that people in the organization no longer go back to their old ways of working. Behavioural changes are observed in leadership and people's roles, and cultural and structural changes are followed (Hayes, 2018). Most importantly, embedding design in this understanding means not only introducing and implementing design practices in government but also "encouraging and growing the energy, inspiration, and networks" of design-led change that will eventually make changes in every aspect of government- mindset, culture, practice, leadership, decision-making, and structure (Roehrig et al., 2018, p.325). In sum, embedding design in government based on the organizational theories can be defined as a combined effort of introducing design practice and sustaining and amplifying design-led change energy until it transforms the public organization.

Research methodology

Out of the literature study, we drew a preliminary conclusion that the current practice of embedding design in government may lack the practice of sustaining and amplifying design-led change within the public organization. To further explore this topic we set up a study that aimed to answer the following research questions:

1. What is the current practice of embedding design in government?
2. What kinds of changes are being made by the current design-embedding practice in government?
3. How are these design-led changes being managed (sustained or amplified)?

This research is based on the worldview of social constructionism. Social constructionism believes that the meaning of reality depends on social interactions and agreements between members of society, and thus communication and interaction shape the reality (Barrett, 2018). In this epistemological stance, this research aims to understand the practice of embedding design in government by interviewing six experts who are practicing design in the public sector.

Interview participants are recruited through networks of the researchers as well as using the snowball method. Out of the total six participants, three were experts working outside of government, and the rest were experts working inside government. Their work experience was limited to more than and equal to two years, and three of them were in senior positions in their organizations. Their geographic base varied such as Singapore, Australia, Finland, Canada, and the U.K. Please note that selecting participants from developed countries only limits the generalisability of this study, and we acknowledge that the results discussed in this paper might not apply to governments in other parts of the world.

The interviews lasted approximately thirty minutes to one hour in a semi-structured way through Skype. The interviews were recorded under the consent agreement of participants. We examined the data through thematic analysis and interpreted the results through the theoretical lens of complex systems. Interview questions included for example: Do you perceive change in terms of the adoption of design in the way government works? How do you ensure the change will be ongoing? In an ideal future, what would design in policy context look like?

Table 1: information about interview participants

Experts no.	*Type of organization they worked/ work for*	*Design training*	*Type of activities with government*	*Overarching view on design-embedding practice in gov.**
1	Senior designer in design research center of university	Yes	Design capability building, design projects for policy	It is a very slow process, but design-led change is happening in government.
2	Researcher in university	Yes	Design projects for policy	One big challenge for design to enter government is designers' tenure - how to make a team of permanent nature that can pull strings over the long period of policy projects.
3	Designer in social innovation lab	Yes	Design capability building, design projects for policy	Government is a significant lever in social change but should be regarded much like other stakeholder groups who are part of a system.
4	Senior public manager in ministry's innovation team	Yes	Design capability building, design projects for policy, strategic design for policy	If we develop design leaders who understand the matters and needs of senior leaders and policymakers, design-led change can scale.
5	Senior public manager in state government's innovation team	No	Design capability building, design projects for policy, strategic design for policy, innovation management	We're still figuring out how to scale but we think it is more of how you set off networks to work so that change and momentum become viral.
6	Public manager in central government's innovation team	No	Design capability building, design projects for policy, strategic design for policy	Bureaucratic funding model and governance (of a project) are big barriers of design practice in government.

* These are not direct quotes but edited by the authors.

Results

The interviews revealed some limitations of the current practice of design-embedding in government but also suggested possible directions to overcome them. The first and second themes answer the three research questions of this study: what the current practice of design-embedding is like, what changes are being made by the practice, and whether the changes are being managed. The third and fourth themes explain the directions that may improve the current practice of design-embedding in government. The last one is an ancillary theme about the design practice in government.

1 The current practice of embedding design in government

The aforementioned design ladder model divides the general activities of design-embedding practice in government into design capability building, design project for policy, and strategic design for policy (Design Council, 2013). Most experts interviewed were engaging in the two activities of design capability building and design project for policy. Three out of the six experts were involved in the policy designing at a strategic level. One interesting thing was that while other experts are practising these activities on their own, one expert reported that her team is outsourcing the practice of design capability building and design project for policy. Her team seemed to be more concerned with innovation management as she described below. As we will see later, this is a very rare practice in the current design-embedding in government.

> *Our goal isn't to do the innovation. We're not innovators per se. Our role is to try and bring the good things that are happening in and help leverage them and grow them in government. (expert no.5)*

2 No practice to sustain or amplify the design-led change

All the experts confirmed that design is creating some changes in government. The changes are of different levels - individual, team, or organizational – and in different features – awareness, skillset, attitude, mindset, practice, culture, leadership, or structure, though it is not always clear to classify them. The most observed changes were in individual or team level in awareness, skillset, attitude, or mindset. Changes in practice were also reported but they were in singular projects, not in everyday practice.

Changes were often better-observed in long term design projects. Experts emphasized the long term is an essential condition to make a substantial impact in the mindset of participating public officers, as well as in the project success.

> *over the course of eight months, the impact was felt there, where there was definitely buy-in from different levels and different parts of government. Once they saw the outcomes to invest more into it, you could see the team change and become the team who was actually working alongside of us change to be confident in the thinking and the mindsets and the implementation and the leadership. (expert no.3)*

> *[A] really exciting thing is that through the process all of the participants have been exposed to a different way of working and it created a relationship and appetite for ongoing working together around how it can have a continued development together. (expert no.5)*

However, many times changes were seen in individuals who participated in the projects, and most experts did not have clear strategies to sustain the individual changes or to amplify the individual changes to a group or organizational changes. Only one expert seemed to be explicitly engaging in change management practice in her organization. Experts working outside of government were not given the opportunities to steward the changes when their contracts with government ended.

> *I think that the main impact we can point to right now is more the one on one change like the first degree of change that we can see [with] the immediate people that we worked with. I think what will take a lot more time is to see how much further that change goes outside of the immediate team that we engaged with. (expert no.3)*

> *I guess you could say yes there is an influence. But how much they are prepared to let that influence to change all the ways they work, you know, I don't know. It's hard to know. (expert no.1)*

Besides, two experts reported some difficulties in design capability building practice. The challenges were that public organization's rather tokenistic approach to the design training – short term or one-off training – and new design knowledge not integrated within the organization after the training, the phenomenon expressed as "tissue rejection."

> *over 20 weeks we ran that program to help cycle people through and get experience of what was so kind of experience and that was good. The challenge was that the project … because it was built in our environment in terms of the space and the ways of working, they just simply couldn't reintegrate back into the department they come from because it was like tissue rejection. (expert no.6)*

Nonetheless, design capability building is considered important in terms of raising design awareness in government. Three experts expressed their concern that design being regarded as exogenous and inessential to policy context is a major barrier of design-embedding. The expert who experienced the tissue rejection also suggested not to underestimate the "creative energy smoke, even if there's no fire." Additionally, one expert emphasized that design capability training should be as much about attitude and mindset such as agility, resilience, action orientation, courage, and resilience as about skillset.

3 Understanding the organizational context of government

Government as an organization is unique and different from private organizations. Four out of the six experts had work experience in both private and public sectors, and we asked them how their design practice in public organizations was different from that in private organizations. One expert who had a long career history in diverse organizations replied that government is the most complex operating system that she has ever seen. She explained further as below. Her point was that government has its own system of "culture, rhythm, process, and structure."

> *Australian government lasted for how many… Westminster government as a form of organization for 300 years. The average corporates peak at 60 at max at the moment, and those are the exceptions. So, you know, there's something about it. (expert no.5)*

Other experts described the distinctive ways of working in government as political, risk-averse, and bureaucratic. One expert called it a paradox that governments are "bloody careful not to do anything wrong" despite desiring innovations so much. Another paradox seemed to be that despite the governments' risk-averse culture, some aspects of their system are prone to failure.

> *Government has tended always deliver software the way they deliver bridges in that you spec everything at front and you deliver it on a fixed schedule and you assume it's all going well as you planned. […] It means by all that is this cultural aversion to failure. People are scared to throw the hands up and say, hey- this didn't work. (expert no.6)*

> *They genuinely feel that they want to make change for the good. So, their hearts are in the right place. It's just the structure that doesn't allow them to be as positive and courageous. (expert no.1)*

While the bureaucracy of government was criticized the most, one person inside government showed a neutral opinion about it. She explained that "bureaucracy is all about standardization, compliance and risk management" that only contrasts with design, which is "all about exploration, iteration and change." It reminded us what policy scholars explain about the "ambidextrous" approach in public sector innovation – "running business as usual" at the same time as supporting innovation (Hartley, 2014, p.228). Another expert inside government made a similar comment,

> *if you were to build the government from scratch today and you had a completely blank slate starting fresh, you'd build it in the way that Google builds Google or Amazon builds Amazon. […] The challenge is when transitioning a huge behemoth machine to work that way while keeping the lights on because it [has]is a lot of moving parts. (expert no.6)*

Overall, embedding design in government is about transitioning large organizations with long history and their own distinctive systems of culture, rhythm, process and structure. To successfully work on this transition, as in the ambidextrous approach, designers should be able to understand the organizational context of government

well enough. Designers' understanding of the organizational context of government can influence the practice of design-embedding in government.

Understanding organizational change dynamics and nurturing design-led change energy

Then, how can we diffuse design practice and embed it in government? Three experts answered that we need more designers in government. One of them argued that we need a clear designer career track to encourage more designers to enter the public sector.

> *[The] Finnish public sector is big and that's what they call [the] Nordic model. The public sector produces a lot of GDP. And they do very much with little. […] compared to that, the number of designers they have and the number of design project they hire is miniscule. (expert no.2)*

> *designers have got to be infiltrated. They've got to be in there in the government as part of the hierarchy, part of the important… (expert no.1)*

> *I think maybe with things like a career pathway you signal to designers that it is a core specialization that is valued in government. Cause we have career pathways for things like economist or legal or engineering like that. But we don't have a career path for designer as yet. (expert no.4)*

However, it is to be careful that simply hiring more designers in government may not have as much impact as expected since organizational change in complex systems does not happen by few powerful individuals but emerges from multiple local interactions of organizational members (Stacey, 2018). In this respect, we were drawn to some other comments made by the three experts inside government describing internal organizational change dynamics. Consciously or not, they were talking about the local interactions in the design-led organizational change process.

> *When you're not inside government, I don't think you completely understand the tensions that the decision-makers face. (expert no.4)*

> *You need to change the way people work and interact and that's hard. You can't do that from outside. For it's own sake, it needs to be owned and lived by the participants in the culture and that's a self-reflecting change. […] It's not developed out of the great seething cauldron that we're working. (expert no.5)*

> *You could only slowly do that before we start [to] bang [our] head so much that you can't do anymore and that's really hard. (expert no.6)*

Another interesting remark was one expert talking about a 'burning platform'- the term used in change management literature arguing that a desperate need like setting a fire in a platform is required for people to change. She hypothesized that policymakers are not willing to adopt design because there is no absolute need for them as they for long had no trouble of making policies without the help of design. However, some scholars of complex systems theory disagree with the extremity of the burning platform idea and contend that encouraging the system's "creative and curative power" works better in changing the organization (Roehrig et al., 2018, p.327).

In conclusion, embedding design in government is about design-led public organizational change that needs to be owned and lived by the members of the organization. In this change process, the designer's role is to understand the organizational change dynamics and to nurture the system's creative change energy until the energy transforms the organization thoroughly.

It is often not clear what design practice in government means

During the interview, we found it interesting that four experts were hesitant to call their ways of working 'design.' One of them even told us that her team had been practising design principles for long without recognizing it as design.

> *It would have people with a process which is similar to design. Let's not say it's a design process but it's... it has many of the aspects of the way designers work… (expert no.1)*

> *do we actually have to call it design or can we just call it more integrative working, or can you call it more democratic way of involving participants or citizens into the process? (expert no.2)*

It is known that in public innovation sector, many non-design trained people are practicing design. Designers, on the contrary, are reflecting their own practices and questioning what other disciplines are needed to better comprehend complex societal problems. This ambiguous state of who to include as designers and what to include in design practice must be natural as design has expanded to a new territory of public innovation. Dorst (2015, p.31) claimed that "contradictions" in design field are what continuously "feed(s) discussion in the field" and what defines the culture of design.

What is clear though is that more experiments, reflections, and researches are required about the design practice in government context as one expert pointed out,

> *It's kind of like a method design exercise in the government contexts. Instead of going this is what design looks like and you should be doing this, it needs to go more to, this is the operating system that you're moving, how can we integrate as much of the good things and the good outcome of design […] how we can fit in it, how we can start to bring these principles and new ways of thinking. (expert no.5)*

Discussion

In the literature study we redefined the concept of 'embedding design in government' as a combined effort of introducing design practice and sustaining and amplifying the design-led change energy within public organizations. Based on this understanding, we concluded that the current practice of design-embedding in government may lack the practice to sustain and amplify the design-led change in public organizations.

In the interviews with six experts, these literature-based conclusions were further confirmed. The changes reported were mostly individual or team changes in skillset, awareness, attitude, or mindset, and no experts mentioned changes in everyday practice, culture, and structure on an organizational level. It showed that the 'concomitant development of participating individual and organization' in the co-design process is not always guaranteed. For the individual changes to become group or organizational changes or for the changes in skillset and mindset to become changes in everyday practice and culture, there should be some strategies and practices to amplify the change energies. However, five out of the six experts did not have such strategies and practices in place.

In addition, it was found that designers' understanding of the organizational context of government can influence the practice of design-embedding. It means that for designers who work with government as external consultants, their relatively low understanding of the culture, rhythm, process and structure of government can be a barrier to their practice of embedding design in government. Another finding in the interviews was that three experts inside government were more sensitive to internal organizational dynamics than other three experts outside of government. This also confirmed the disadvantage of being an external designer in the practice of design-embedding.

The common activities of current practice of embedding design in government are: design capability building, design project for policy, and strategic design for policy. If the goal of embedding design in government is the transformation of public organizations, the current activities may not be enough to make the transformation. Embedding design in government is about design-led public organizational change that needs to be owned and lived by the members of the organization. The designer's role in the change process is to understand the organizational change dynamics and to sustain and amplify the system's creative change energy. It might be a new role for designers, but we cannot confine the design practice in government as it is practiced now. This role, of course, will not apply only to designers inside government. Designers outside of government should be able to find ways to engage in the design-led organizational change process too.

More studies are required on how the designers can sustain or amplify the design-led change energy in practice. At this point, we find the clues in literature of complex systems theory. Stacey (2018, p.152) says that an organization is shaped by the "interplay of all the choices, intentions, and strategies of all the group and individuals both in organization and in all other organizations," and thus the organizational future is inherently unpredictable. Nonetheless, aggregated intentions of people in the organization make some patterns to emerge so that designer can plan certain "attractors" to stimulate or support certain activities (Hasan, 2014, p.51). Thus, there is a possibility that designers can stimulate design-led change energy using various attractors.

So-far-known attractor factors based on our literature study are conversation, power, and learning. Conversation is how we make sense of our experience and how we construct our social reality: in this sense, changing conversation in an organization could change the organizational reality (Marshak, Grant, & Floris, 2018). Power is itself an important part of organizational reality since everyone is interdependent and thus constrained and enabled by the relationships (Stacey, 2018). Lastly, learning is important in a workplace because to work means to learn practice as the "shared way of doing things" (Gherardi, 2009, p.356). For a new practice is always challenged to be institutionalized, it should be proactively facilitated and nurtured through "inter-organizational networks of sharing and comparing" by designers like gardeners (Hartley, 2016, p.101).

Summarising, designers might be able to sustain and amplify the design-led organizational change by following conversations of people in the organizations, understanding power dynamics in-between individuals and groups, paying attention to the learnings of people in the organization as well as those of themselves, and eventually figuring out what to design and what to expect to emerge in the design-led public organizational change process.

This research does not intend to provide any concrete answers to how to embed design in public organizations. However, we would like to propose that paying more attention to organizational change dynamics and attractor factors in the change process may provide designers with opportunities to sustain and amplify the design-led change energy and eventually succeed to embed design in public organizations. To further explore these opportunities, our future research will be aimed at investigating how the attractors may work in real contexts, what are known and unknown attractors, what are context-free and context-specific attractors, and how designers can monitor the organizational change.

Conclusion

This study aimed to understand the current practice of embedding design in government and its limitations. The study results showed that the current practice of design-embedding in government are generally the three activities of design capability building, design project for policy, and strategic design for policy, and change management is rarely practised. Thus, the changes created by the current design practice mostly remain on an individual level and do not touch the deeper parts such as everyday practice, culture, and structure of the public organizations. The practice of sustaining and amplifying the design-led changes in public organizations is largely missing.

Study findings also showed that embedding design in government is about design-led public organizational change, and the designer's role in the change process is to understand the organizational context and change dynamics and nurture design-led change energy within the organization. We therefore suggested a new practice of design-embedding in which designers steward and stimulate design-led change energy within public organizations as well as future research directions on design-led change amplification strategies.

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Research Perspectives IN THE ERA OF Transformations

Design Capability for Science-based Innovation

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In light of a growing research interest in the innovation potential that lies at the intersection of design, technology, and science, this paper offers a literature review of design initiatives centered on scientific discovery and invention. The focus of this paper is on evidence of design capabilities in the academic research environment. The results are structured along the Four Orders of Design, with examples of design-in-science initiatives ranging from (1) the design of scientific figures and (2) laboratory devices using new technology to (3) interactions in design workshops for scientists and (4) interdisciplinary design labs. While design capabilities have appeared in all four orders of design, there are barriers and cultural constraints that have to be taken into account for working at or researching these creative intersections. Modes of design integration and potentially necessary adaptations of design practice are therefore also highlighted.

Keywords: Design–technology–science, Four Orders of Design, interdisciplinarity, literature review

Introduction

Two parallel trends mark the research landscape on the future of design: in one lane of research, there is increasing recognition that design (in the sense of creating and modeling any kind of physical and virtual artefacts) plays an important role in innovation. In this lane, one finds studies on design-driven organizations and the value of design for business. In the parallel lane, the academic research environment is itself under study as a source of innovation: from the difficulties academic innovators face in translating discoveries from the laboratory bench to the user, to breakthrough technologies that could lead to solutions for global challenges such as climate change.

At the crossing of these two research streams, the design community is exploring the interplay between design, technology, and science in relation to the changing role of design in the context of innovation (Cautela, Dell'Era, Magistretti, Öberg, & Verganti, 2017). The design–technology–science (DTS) intersection is developing into a research field with an uptick in studies and published materials over the past years, including the launch of the Journal of Design and Science in 2016 (MIT Press, 2016).

This paper is a literature review centering on the DTS intersection and shows initiatives, collaborations, and studies that introduced design capability, either temporarily or permanently, into the academic research environment or strengthened existing capabilities. Collaborative work taking place between designers, scientists, design schools, study programs, and scientific laboratories is currently highly relevant, since both scientific studies (e.g., Acklin & Wanner, 2017) and government-issued reports (e.g., Sainsbury of Turville,

2007) have arrived at the conclusion that significant benefits can be expected from collaboration between design and science, although the specific contribution of the two aspects remains to be elucidated.

Before delving into the evidence from the literature, a brief definition of terms is warranted, as both of the key concepts in this paper, *design* and *science*, encompass vast areas of application and may differ in meaning depending on the exact context of usage. A detailed comparison of the similarities and differences between design and science can be found in a review on the subject by Peralta and Moultrie (2010).

Science is concerned with producing knowledge and testable assertions (Bonsiepe, 1995), with the generated knowledge from systematic study being expressed in a variety of forms such as models and theories, thus creating intellectual value (Simeone, 2016). These activities are typically, but not necessarily, based in scientific institutes. The focus of this review is the academic research environment at universities and research centers as opposed to commercial industrial operations. Scientific discoveries, inventions, and new technologies can form the basis of emerging business operations as shown in Figure 1.

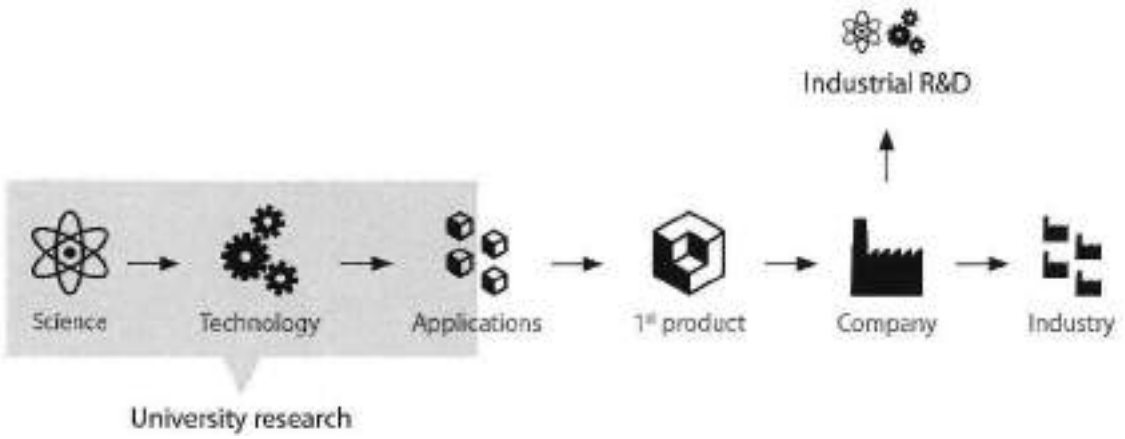

Figure 1: Positioning of the academic research environment (Driver, Peralta, & Moultrie, 2012, p. 20). Although this figure suitably shows the focus of this review (gray box), the original authors of the figure note that the true complexity of this process is not captured in a simplified linear depiction. Other authors echo this ecosystem view (Hudson & Khazragui, 2013).

In business, the value of design and designers is recognized (Hernandez, Cooper, Tether, & Murphy, 2017). Organizations are expanding their understanding of design beyond concerns of aesthetics and function, with investigations into the impact of design indicating that design-centric organizations show above-average economic performance (Westcott et al., 2013). This effect has been investigated especially in relation to the development of new products, where companies with a high design intensity, as expressed by their investment in industrial design, experience significantly better company performance (Gemser & Leenders, 2001). In contrast, the potential impact of design in academia has scarcely been explored (Moultrie, 2015).

Design itself is an ambiguous term with many definitions ranging from general to discipline-specific. In order to make sense of the various meanings under the umbrella of design, scholars have identified ways of grouping or classifying types of design. This paper follows Richard Buchanan's (1992, 2001) model of the Four Orders of Design (FOD) and uses it as a means of categorizing examples from the literature on design-in-science initiatives. The FOD model was selected because it offers definitions and a suitable number of design subtypes, unlike broader differentiations that are e.g. based on a goods-dominant vs. service-dominant logic of design (Eneberg & Holm, 2015). Additionally, the FOD model has already been employed by design scholars as the basis for design conceptualizations and as a tool for the analysis of design processes, as will be described in the following.

In the FOD model, design outcomes both by professional designers and those not necessarily considering themselves to be designers can be any of the following: (1) symbols, (2) material objects, (3) activities and services, and (4) systems and environments (Buchanan, 1992). Initially, the FOD were not called *orders*. Rather, Buchanan wrote about the placement of design in these four *areas* or *places of invention* and cautioned against equating one area with one major design field such as graphic design or product design (Buchanan, 1992). In practice, all orders are interconnected and have an impact on each other. For example, a system may be made up of objects that are connected through activities. In analyzing the history of design, Buchanan

argues that a progression through the FOD can be seen, with designers' focus appearing to shift from the first and second orders in the 20th century to the third and fourth orders in the 21st century (Buchanan, 2001). Eneberg and Holm (2015) highlight the immaterial aspect of the higher orders, where "Buchanan describes an offering that is becoming increasingly intangible" (Eneberg & Holm, 2015, p. 12).

The approach of looking through the lens of the four orders can be found, for instance, in the case study of a fashion magazine by Nylén, Holmström, and Lyytinen (2014), where the transformation from print to digital magazine design is described as *oscillating* between the FOD and posing challenges on several orders in parallel. The authors use a timeline of design decisions categorized into the FOD to trace the design process. This approach allows them to then analyze the relationships between the FOD in digital design and to identify co-dependencies between orders. In a design process spanning multiple orders, *ripple effects* can occur since a design decision in one order may set constraints and entail related design decisions in another higher or lower order (Nylén et al., 2014).

A second example of the FOD lens being used is a case study on improving the Australian Income Tax Act (Golsby-Smith, 1996), in which the author describes how third-order design was employed: in this case study, the design approach went beyond the delivery of the product, namely a redesigned, rewritten piece of tax legislation. Instead, the design team recognized that with complex, perpetually changing legislation "the value to be delivered […] is ongoing capability to handle the designing process" (Golsby-Smith, 1996, p. 12). The author additionally reflects on aspects that can be considered fourth-order design, for instance the design team's discussion of the wider purpose of the Tax Act project (Golsby-Smith, 1996). A further study focusing on the third and fourth orders is Breslin's (2008) perspective on the design of retail centers of a postal service.

Similar to the approach of the above-cited authors, this paper is centered on applying the FOD model to a specific area, in this case design-in-science initiatives, in order to address the question to what extent design capabilities are integrated into professional operations in the academic research environment.

The four orders of design in science

The previous section introduced the FOD and explained how they can be used as an analysis tool in studying design. In this section, examples are given of design-in-science initiatives as they can be found in the literature to date. One section is dedicated to each of the four orders. Some of the examples appear multiple times in different orders of design, underlining how several aspects of design can be found within one project and stressing Buchanan's point that each order is interconnected with the others (Buchanan, 1992).

First order

First-order design is firmly placed in a world of visual communication through signs and symbols. It is thus closely related to graphic design, yet it does not overlap fully with this design profession (Buchanan, 1992). Examples of the connection between visual design and science are numerous, often relating to the need to communicate the results of scientific research or to visualize and analyze data in the first place. As researchers produce an abundance of posters, figures, data plots, etc., many opportunities for graphic design are given. New symbols and other forms of expression have to be found for phenomena on micro and nano scales, inside living organisms or even on distant planets.

The importance of visual literacy in science has a long-standing tradition: more than three centuries ago, René Descartes declared that "[i]magination or visualization, and in particular the use of diagrams, has a crucial part to play in scientific investigation" (in: Trumbo, 1999, p. 409). Recent academic interest has resulted in a volume of work published throughout the 2010s, starting with a guide to designing scientific figures (Rolandi, Cheng, & Perez-Kriz, 2011) and continuing with studies of visual science communication (Chen, O'Mahony, Ostergren, Perez-Kriz, & Rolandi, 2014; Rodriguez Estrada & Davis, 2015). With the Design Help Desk, the University of Washington offered graphic design support to scientists and engineers. In parallel, a study by the same team found that a redesign of scientific figures according to graphic design principles had a positive impact on the reader's perception (Cheng & Rolandi, 2015).

Design drawings and renderings are useful tools to illustrate how new technologies developed in an academic environment could be used in products of the future. This application was explored in the Design in Science (Driver et al., 2012, 2011) and DesignSeed (Acklin & Wanner, 2016, 2017) initiatives, in which designers created materials such as renderings of potential applications for a biophotovoltaic device (Driver et al., 2012) and a gynecological measuring device (Acklin & Wanner, 2017), thus supporting the imagination of

stakeholders for these science-based products and creating means of engagement with audiences outside academia through symbolic depictions of the artificial.

Second order

Second-order design is the design of physical objects, which is often associated with product design and engineering design, but not exclusively so (Buchanan, 1992). Collaboration between scientists and designers has been carried out in the field of bio-design, which offers opportunities for designers to work with and create new materials and methods for manufacturing. An example of the outcome of such a collaboration is algal bio-ink, a liquid containing algal cells that can be printed using an inkjet printer, after which the cells will grow in the patterns in which they were deposited (Sawa, 2016).

Two major initiatives linking product design and science have been written about recently, namely the Design in Science and the DesignSeed studies (see section on first-order design above), in which teams of designers worked with academic inventors and groups. Design here is understood in the sense of what makes a product become tangible and usable. Many definitions have been attempted, and one that captures this meaning is "'Design' is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end" (Cox, 2005, p. 2).

On the practice side, the design teams of both initiatives produced tangible outcomes including models and fully functional prototypes of science-based new products such as a novel fluid handling device. In the Design in Science project, the researchers were motivated to explore how designers might contribute to early-stage scientific research (Driver et al., 2011). DesignSeed, on the other hand, laid focus on startup ventures based on technologies stemming from scientific research (Acklin & Wanner, 2017). On the research side of these studies, the authors created models of processes in design–science interaction that may give clues for third- and fourth-order integration, e.g. through an overview of stakeholders and their relationships (Acklin & Wanner, 2016).

Third order

Third-order design can be understood in different ways: in one sense, it is service design (Buchanan, 1992). This meaning was adopted in the DesignSeed study and touched upon in one of its practice cases, where a group of bio-technicians were trying to decide whether to use their technology of culturing cells in biopolymer scaffolds as the basis of a product or a service (Acklin & Wanner, 2016). Beyond the service design definition, the third order also spans other processes, activities, and actions as per Buchanan's (1992) original delineation. For instance, Cheng and Rolandi's (2015) Design Help Desk for graphic design resulted in first-order outcomes while additionally creating third-order opportunities for designer–scientist interaction.

The process of scientific research itself can become the subject of design activities: in a collaboration between design consultancy IDEO and a biology laboratory at the University of California – San Francisco, Design Thinking was used to generate new ideas for research avenues in synthetic biology and to create a "safe space for uncertainty" (Bernstein, 2011, p. 497) that supports scientific exploration. This collaboration was one out of several within the Synthetic Aesthetics project, in which short-term residencies shared between designers and synthetic biologists across the world were formed. For a duration of two weeks each, the designer would take up residence in the laboratory, and the biologist would later also spend time in the designer's studio while working on a joint project (Ginsberg, Calvert, Schyfter, Elfick, & Endy, 2014).

Golsby-Smith (1996) suggests that "[i]n the third order, the designer decides that the client will benefit from an earlier intervention of design thinking, at a more strategic and crucial time" (Golsby-Smith, 1996, p. 12). For instance, these early interventions take place in the United Kingdom as part of the Design Council's 'Design support for science and technology innovation' initiative, where scientists can benefit from support sessions through design associates, i.e. design management experts who coach academics on product design (Design Council, 2014). Participatory workshops on design were also among the collaboration formats facilitated by the DesignSeed initiative (Acklin & Wanner, 2017). These services touch upon the strategic aspect of design in science and additionally move towards the fourth order, which can be considered to apply once a transfer of skills is involved (Golsby-Smith, 1996).

Fourth order

Fourth-order design deals with systems and environments, and how human beings integrate into these (Buchanan, 1992). Design of this highest order is evident when skills are being transferred (Golsby-Smith, 1996), examples of which can be found in design and engineering education. Programs e.g. in the fields of human-centered product development (Vajna, 2014) and biomedical engineering (Yock et al., 2015) rely on multidisciplinary teams working together on current real-life challenges.

Design labs existing at several universities may also be considered to fall into the fourth order, since they are a lasting system or infrastructure connecting design and science. These labs are spaces for creative exploration connected to major universities such as Massachusetts Institute of Technology (MIT) with its long-running Media Lab (Simeone, 2016) and Harvard University with the Biodesign Lab, which has a multidisciplinary team of designers, engineers, and medical researchers working on wearable robotic devices, among others (Biodesign Lab, 2018). These labs and the translational activities undertaken by their participants provide a glimpse at the potential of interweaving design and science.

Similar to Bason (2010) calling for an *innovation ecosystem* in the public sector, the conceptual move from a design-in-science system to an ecosystem is easily made. The biological image is used by Sawa (2016), who refers to the interaction of designers and scientists by saying that "the role of a designer in scientific research should be more endosymbiotic with the designer physically located within the laboratory" (Sawa, 2016, p. 71). Analogously to endosymbiosis, where one organism lives within another with possible mutual benefits, win-win situations could be created with designers embedded in the scientific research environment. As Rust (2007) notes, designers' ideas can spring from simply being present and "dwelling in the situation" (Rust, 2007, p. 72). However, such a cultural shift depends on the building of a community that is interested in translating design practices to scientific applications (Yajima, 2015).

Placement of research activities

This section outlined initiatives at the DTS intersection from a variety of sources, including anecdotal reports of collaborative projects to account for the challenge that few studies have been conducted on the impact of design in academic research (Moultrie 2015). In the field of industrial design, Peralta and Moultrie (2010) stress that despite there being few literature sources, practice examples of design–science interaction can be found. However, information on these is not easily accessible (Peralta & Moultrie, 2010). Based on materials that are accessible, this section demonstrated that initiatives at the DTS intersection span all four orders of design. Out of the projects introduced in each section of the FOD, Table 1 summarizes initiatives that include a design research component, e.g. with respect to designer–scientist interaction.

Table 1: Overview of instances of designer–scientist collaboration with a contribution to design research. Personal perspectives and accounts of experience by individual designers are not included. Circles (●) indicate the corresponding orders of design, with larger circles for the focus of the study and smaller circles for further relevant areas.

Name of study (alphabetical order)	*Key publication*	*Scientific focus*	*Orders of design*			
			I	*II*	*III*	*IV*
Design Help Desk	Cheng and Rolandi (2015), University of Washington	Contribution of graphic design to science communication	●		●	
Design in Science	Driver et al. (2012), University of Cambridge	Contribution of industrial design to scientific research	●	●	●	
Design Moves	Simeone (2016), Malmö University	Contribution of design to academic entrepreneurship in design labs	●	●	●	●
DesignSeed	Acklin and Wanner (2016), Lucerne University of Applied Sciences and Arts	Contribution of design and design management to academic entrepreneurship	●	●	●	●

Synthetic Aesthetics	Ginsberg et al. (2014), University of Edinburgh and Stanford University	Contribution of design and designer–scientist interaction to synthetic biology	

As Table 1 shows, research on design in science covers the FOD spectrum. In addition, further results are to be expected from a pilot study on the impact of designers in academic high-tech startup teams, which was supported by the German Federal Ministry of Education and Research and concluded in 2018 (Fraunhofer IAO, 2019; Sinell, Brodack, & Denef, 2017). By observing Buchanan's theory of a progression through the four orders in the history of design, one may anticipate a trend for the design field to move more firmly towards the third and fourth orders not only in industrial organizations, but also within academia. This status quo gives the design community the opportunity of expanding this niche in the creation of an innovation ecosystem that draws upon the wealth of scientific discoveries, and to move towards a more strategic understanding of design in science. By translating approaches such as human centeredness (e.g., Vajna, 2014) and participatory design (e.g., Bogers & Horst, 2014) to scientific design applications, design management across the FOD can help break out discoveries and inventions to users inside and outside of academia.

Towards fourth-order integration of design in science

Design management "embeds design or design processes in companies in order to create added value in products, services, experiences, processes, and structures" (Acklin & Wanner, 2017, p. S471). In this section, directions for further design research and areas of interest for design management are outlined, including investigating designers' roles in the academic research environment and addressing prerequisites for collaboration at the DTS intersection. Some of these factors, being particular to the scientific enterprise, provide examples of contexts in which design integration starts touching organizational values. As Golsby-Smith (1996) explains, values and culture are an expression of the fourth order of design.

Opportunities for design integration in an academic innovation ecosystem

In their analysis of future avenues for design in science, Driver et al. (2012) suggest three options for creating design support: firstly, there could be a centralized design service at universities to match the centralized technology transfer office (TTO, also known as technology licensing or valorization office). Secondly, funding proposals could specifically include design work and be filed jointly by scientists and designers. Thirdly, research councils could provide allowances for design contractors to work on scientific research projects (Driver et al., 2012). Design thus has the potential to integrate both as a design service and as co-design.

An initial suggestion for designers' roles is the engagement as a *design supplier*, a *design consultant*, and a *team researcher*, where the design supplier has the lowest level of integration into scientific research, while on the opposite end of the spectrum, the team researcher is firmly integrated starting from a stage as early as the conception of research questions (Peralta, 2013). Future research could add new insights on this subject and consider additional roles such as the *individual researcher* who is motivated by an own research question.

An example of an individual researcher is bio-designer Sawa (2016), who explored the option of working from within a scientific team on an independent, long-term project of designing an application for printable algae (see section *Second order*). Conversations with the collaborating scientists allowed her to acquire biological and technical knowledge as well as advance her research work in unexpected directions (Sawa, 2016). Other options besides being embedded in the academic environment in a spatial sense could be discussed by the design community, e.g. a co-design approach around shared solutions. Such a systemic perspective could ultimately *catalyze* science-based innovation (Yajima, 2015).

At a level beyond designers and scientists as individuals, professional design and design management societies can facilitate the interaction. The Design Council demonstrated the feasibility of this pathway in its training program 'Design support for science and technology innovation' (see section *Third order*) by working with universities in the UK to coach scientific teams to apply divergent thinking approaches and to develop prototypes employing new technologies from their research (Design Council, 2014).

A strategic position for designers and design managers could be in technology transfer offices and the multitude of incubators, accelerators and mentoring programs helping to drive innovation stemming from academia. Currently, these programs offer support in entrepreneurial aspects such as financing, intellectual

property and project management (Gehr & Garner, 2016), but design is rarely found on the curriculum. Here, upstream design integration has the potential to enable easier interfacing with stakeholders, e.g. by making boundary objects available early on in entrepreneurial processes (Simeone, 2016), as well as pursuing a highly user-centric approach to technology transfer while still in the academic environment rather than an industrial environment. Another beneficial consequence of early design integration would be access to knowledge and knowledge transfer. For example, the design community can benefit from cutting-edge technologies, materials and methods for manufacturing, including nanotechnology and bio-printing. As designers get to know technological boundaries, they can start translating new technologies into use and pave the way for them to become more widely known.

Prerequisites for design integration

As the DTS intersection is a crossing of disciplines, perceptions both of oneself and of one another may stand in the way of collaboration. On the topic of self-perception, Driver, Peralta, and Moultrie (2010) find that scientists consider themselves to be doing certain types of design as their work routinely involves designing experiments, circuits, surveys, and clinical trials, among others. Regarding the topic of perception of the other, the view of designers as stylists may still be prevalent, with a low awareness on the science side of the added value that design can bring (Driver et al., 2010). While these observations are the result of an early exploratory study and require more detailed investigation on a quantitative basis, they highlight the importance of perceptions as a potential factor influencing collaboration. On the one hand, projects at the DTS intersection are at a risk of appearing to draw attention away from the dissemination of knowledge and may thus encounter an ethical challenge, especially if they are geared towards the commercialization of research (Hudson & Khazragui, 2013). On the other hand, a positive impact on scientific practice is possible, since the envisioning of research applications by designers can serve as a source of motivation for scientists (Sawa, 2016).

On the design side, designers may not yet be aware of the untapped potential for design work in the academic environment and for different levels of involvement that are possible as outlined above. Here, design education itself is a potential enabler of new ways of design integration. Besides having multidisciplinary teams and working on practice applications in the academic research environment, design programs could also benefit from communicating particular needs regarding the scientific publishing and funding system to future designers who may encounter these in their work.

Funding to enable collaborative projects and workspaces at the intersection between design and science is a key prerequisite and “the critical barrier to be overcome” (Driver et al., 2012, p. 127). Once design potential has been demonstrated e.g. through prototypes, these can help secure further funding and investment (Sinell et al., 2017). In the absence of joint funding, designers have to be prepared to be the drivers of the collaboration (Sawa, 2016).

In terms of adapting design practices for the DTS intersection, Driver et al. (2012) find that for projects conducted with the involvement of both designers and scientists, the design process should include a phase of clarifying technical scientific terms in advance of the definition of a design brief. This stage is introduced as a *translation* phase to develop a shared language and understand abstract concepts (Driver et al., 2012). It is debatable, however, whether this stage needs to be defined as an add-on to the design process or whether it is implied that any phase of design concerned with understanding the design problem requires a clarification of technical terms. The nature of the translation phase could thus be a subject of interest for further investigation. Design itself presents a solution to questions of communication in the academic research environment through prototypes and other forms of creating tangibility (Moultrie, 2015; Simeone, 2016; Sinell et al., 2017).

Conclusions

The important role of the DTS intersection in fostering innovation has been recognized by the design research community and has been the subject of various studies that formed the basis of this literature review (e.g., Acklin & Wanner, 2017; Simeone, Secundo, & Schiuma, 2017). This paper contributes to an overview of current activities at the DTS intersection by including new studies that took shape since the most recent literature review on collaboration between designers and scientists (Peralta & Moultrie, 2010). These new materials include a stronger focus on academic entrepreneurship and driving innovation through design

(Acklin & Wanner, 2017; Simeone et al., 2017) while spanning further design professions such as graphic and service design.

By linking existing initiatives to each of the four orders of design in the first part of this paper, it was shown that design is able to contribute to the scientific world on all four orders. The communication and materialization skills required in the first and second order can improve the understanding of highly technical scientific results and support user-centered development of new science-based products, while the higher orders may offer motivation to those studying elusive phenomena and build a creative environment supporting open-ended research.

Despite this evidence that the DTS intersection holds opportunities for designers and design researchers alike, reported initiatives are often exploratory and first-of-their-kind at a particular research institution. This status may reflect what Bason (2010) refers to as *random incrementalism* in public-sector innovation. For a more strategic and integrated view of design, further research is required on how to initiate and sustain collaboration on all four orders of design. Topics of interest include the roles of designers, awareness and perceptions, financing and institutional support as well as a design process based on mutual understanding. If there is a progression along Buchanan's orders as it is happening in the design field at large, then more widespread initiatives with respect to third- and fourth-order design should be expected in the future.

In order to gain knowledge on practice projects that are hidden from the outsider's view and currently inaccessible in the scientific literature, ethnographic and action-based research strategies can be used. For instance, Simeone et al. (2017) conducted an ethnography-inspired investigation of MIT's Senseable City Lab, one of the above-mentioned design labs, as part of the Design Moves study (see section *Fourth order*). Action research (e.g., Ottosson, Björk, Holmdahl, & Vajna, 2006), which was chosen as a research strategy in the DesignSeed project by Acklin and Wanner (2017) (see section *Second order*), is valuable in two ways: firstly, it enables the researcher to gather relevant information from within an organization to place design integration on solid foundations. Secondly, in the process, the action researcher may him- or herself act as a catalyst for design innovation (Price, Wrigley, & Matthews, 2018), leading to direct consequences in practice.

Certain prerequisites for successful DTS projects have already been identified, as outlined in the second part of this paper, resulting from designers' and scientists' endeavors to establish interdisciplinary projects. These insights pave the way to move from an ad-hoc use of design at an unmanaged level, which Westcott et al. (2013) call *heroic efforts*, to strategic integration of design capabilities supported by design management. In doing so, there is access to a multitude of design challenges that are highly relevant to society. These challenges include environmental sustainability, the development of novel therapeutics and other wicked problems (Yajima, 2015). In new collaborations, the design community can thus support scientists in making the impact of their work directly visible and envision symbols, products, interactions, and systems of the future based on academic discovery and invention.

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The adaptation of design thinking in auditing

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How can a supreme audit institution (SAI) use design thinking in auditing? SAIs audit the way taxpayers' money is collected and spent. Adding design thinking to their activities is not to be taken lightly. SAIs independently check whether public organizations have done the right things in the right way, but the organizations might not be willing to act upon a SAI's recommendations. Can you imagine the role of design in audits? In this paper we share our experiences of some design approaches in the work of one SAI: the Netherlands Court of Audit (NCA). Design thinking needs to be adapted (Dorst, 2015a) before it can be used by SAIs such as the NCA in order to reflect their independent, autonomous status. To dive deeper into design thinking, Buchanan's design framework (2015) and different ways of reasoning (Dorst, 2015b) are used to explore how design thinking can be adapted for audits.

Keywords: adaptation, Supreme Audit Institutions, design thinking, design research, co-creation

Introduction

Public organizations have to be accountable. As 'actors', they have to explain and justify their conduct to the 'forum', the forum judges (Bovens, 2007). In the end, it is about taxpayers' money. Supreme audit institutions help parliament – the 'forum' – understand how the government – the 'actor' – spends public money and how it performs. A minister, as a principal, has to be held accountable for the use of public funds.

The Netherlands Court of Audit (NCA) is a supreme audit institution. Based in the Netherlands, it checks whether the Dutch government spends public funds economically, efficiently and effectively. Its statutory task is to audit the revenue, expenditure and performance of central government and the institutions associated with it (NCA, 2016). Dutch law mandates the NCA to conduct audits using all the information it needs to check whether government did the right things in the right way. The NCA then reports to parliament and publishes its audit reports. The NCA is an independent and autonomous organization – no one can order it to audit a certain subject or to audit in a specific manner.

About 150 auditors work at the NCA; most of them are economists, chartered accountants, social scientists, data analysts or come from another academic background. Auditors 'form an opinion on a matter in an independent, expert and systematic way, based on acceptable criteria and sound evidence, within a certain institutional and accountability context', according to Dees's definition of public sector auditing (2010, p. 13, in Dutch). The audits are carried out systematically in an 'audit circle' designed by the NCA, in order to arrive at quality and impact. It comprises five compulsory phases the auditors have to follow: strategic audit proposal, audit design, collecting data, memorandum of findings and audit report.

The NCA's auditors inevitably have a preference for content-centred working environments, where people are expected to make improvements (positive change) based upon knowledge. This expectation that objective

knowledge will lead to changes can be understood as a particular style of change management. André Schaminée (2018) identifies five different styles of change management, based on management theory developed by Hans Vermaak and Leon de Caluwé, as summarized in table 1.

Table 1: Five styles of change management (Caluwé, 1998, p. 11), selection of characteristics from Schaminée (2018, pp. 46-47)

Change management style	*Things change when you*	*Focussed on*
1. Negotiation (yellow)	Align interests	Positions and context
2. Empirical understanding (blue)	First think and then act systematically	Knowledge and results
3. Learning (green)	Introduce people to a learning situation	Shared meaning, setting and communication
4. Motivating (red)	Stimulate people in the right way	Procedures, inspiration, atmosphere
5. Organic (white)	Make space for spontaneous evolution	Complexity and meanings

Auditors, though, are skilled in the second style of change management – empirical understanding. The first style of change management is based on negotiation. In the context of the NCA it is used mainly by parliament. Schaminée observes that the first two styles are dominant in the public sector (pp. 45 & 48). He proposes adding 'design thinking' as a new style. Design thinking is a combination of the third (learning) and fifth (organic) style 'where giving meaning is paramount' (p. 48). Design thinking 'refers to methods and techniques that designers use to achieve innovative solutions' (p. 22) and covers a wide range of design approaches. That is why this term is used in this paper.

Design thinking is a new concept in auditing

'Design thinking' is an interesting concept as a means for supreme audit institutions such as the NCA to stay relevant in a world of information overload. For an audit to have an impact, more needs to be done than simply writing down the findings in a report. Diny van Est and Linda Meijer-Wassenaar have been working at the NCA for more than ten years. In this paper they share their most recent experiences with the use of design thinking in the NCA's audits. Diny was audit manager of one of the two cases described in this paper and is an expert in innovative methods; Linda was involved in both cases as a design researcher.

Design thinking is a relatively new audit phenomenon. It can add value to audits and help auditors think more human-centred (Bijl, 2017), work iteratively and unravel complexity and abstract topics by making them tangible (visual, tactile) – and thus help create more impact. Yet, the first step to enable design to add value to an audit is to adapt the understanding of design (Dorst, 2015a). As Dorst explains, when adapting design principles in a new context it is important 'to delve deeply into the practices' (p. 23). In this paper we explore the different ways of reasoning between audit and design (Dorst, 2015b) and the design perspectives that can be used in audits (Buchanan, 2015).

One important distinction between auditing and design thinking is the way of reasoning. Most auditors start with deductive reasoning: they know the what (standards) and they compare this with the how (reality) to discover the unknown outcome (does reality comply with the standards?). When auditors want to know what patterns lead to the outcome (why doesn't reality comply with the standards?), they use inductive reasoning: they discover unknown patterns that, together with known elements, lead to a known outcome (Dorst, 2015b, p. 46). Designers, however, discover unknown elements and unknown patterns that lead to a known outcome: design abduction (p. 49). This is what makes the combination of designing and auditing quite challenging.

To explore the use of design in auditing the NCA carried out a series of experiments. The experiments can be put into perspective using Buchanan's framework (2015). Buchanan (pp. 13-14) differentiates between four

orders of design. They are derived from the evolution of design practices, as Buchanan explains (p. 11), and are 'an art comprised of four dialectical moments in the sequence of thought and action – moments of questioning and reflection as well as action', (p. 15). Figure 1 shows Buchanan's four orders.

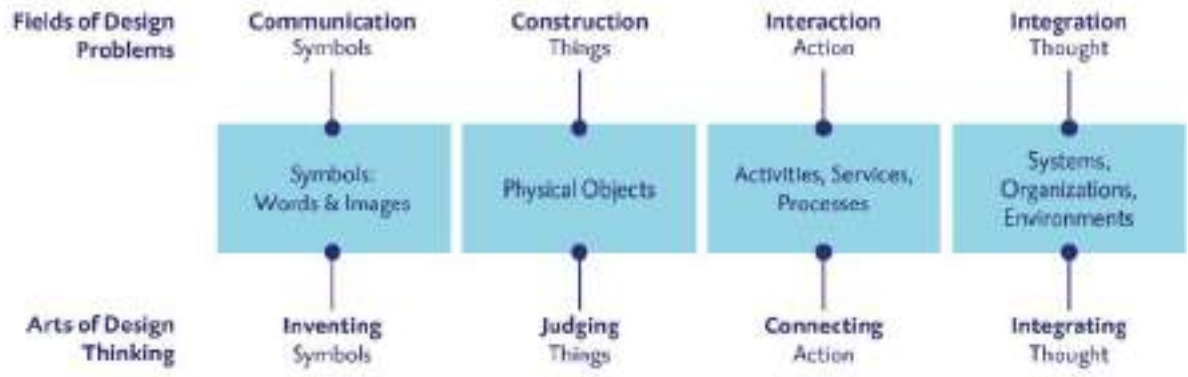

Figure 1. Based upon Buchanan's four orders of design (2015, p. 14).

We used this framework to reflect on our audit work and applied the four orders to understand what design can do for audits. The first order, 'symbols', can be found in our reports in the form of words and images. The second order, 'objects', is the report or publication as a whole, so this exceeds the individual words and images. The third order, 'interaction', is concerned with how we engage with our stakeholders. The fourth and final order is 'thought'. In this order all disciplines have to work together to improve the system. Yet various interests, values and methods stand in the way of improvement, especially in complex systems such as the examples we give in this paper.

Examples of design approaches in two audits

This paper describes two audits that we selected to explore and analyse how we applied design approaches using the different ways of reasoning identified by Dorst and Buchanan's framework. The first example is an audit of the EU system of CE marking. The audit asked: why is it that products that do not meet EU health, safety and environmental protection standards are nonetheless sold on the EU market? And what is the government doing about the problem? The audit commenced in autumn 2015 and the audit report was published in January 2017. The second example is an audit on the provision of information in the social domain. This audit started in January 2018 and publication followed in September of the same year. In this audit the NCA wanted to provide advice on how more coherent and more structured information could strengthen the information position of the House of Representatives.

First example: CE marking

Everyone in the European Economic Area, of which the Netherlands is a member, encounters products bearing a CE marking every day – at home or at work. Electrical appliances, toys, packaging, sticking plasters, supermarket scales, roadside petrol pumps, ladders used by window cleaners and bread slicers used by bakers are all examples of products that are subject to CE marking. Dozens of products in the EU are withdrawn from the market every month because they pose a grave risk to the users' health and safety. Curiously, many of these products carry a CE marking.

CE stands for 'Conformité Européenne', meaning 'in compliance with EU law'. By affixing a CE marking in the form of a logo to a product, the manufacturer declares that it complies with all applicable EU health, safety and environmental protection requirements. This logo is compulsory in all 33 countries of the European Economic Area.

Figure 2. CE marking as a logo (European Commission, n.d.)

The CE marking system is complex and hard to audit for several reasons. Firstly, as a system of the European Economic Area it involves many stakeholders. Secondly, it is a mixed public-private system in which both private sector parties (such as manufacturers) and public sector parties (such as market surveillance authorities) have their own responsibilities and need to interact with each other. Thirdly, it is a technical issue, specific expertise is needed to judge whether or not a product complies with the standards. And finally, the implementation of the CE system in the Netherlands involves a large number of public sector actors that are involved in policymaking for the CE system and its implementation: six ministers, five national inspectorates and a number of autonomous administrative authorities. This is probably also the case in the other EEA countries.

As an audit team we were challenged to 1) determine to whom we should address our recommendations, 2) formulate helpful recommendations for parliament in a transnational, public-private system and complete our audit knowing that we were stretching our mandate (the NCA may not audit the private sector), 3) command the same expertise as our stakeholders, and 4) make government 'care' when none of the six ministries felt responsible. The team consisted of three auditors (with legal and surveillance expertise), a data analyst and the two authors of this paper: a design researcher and an audit manager.

Our first goal was to provide the Dutch House of Representatives with an understanding of how the CE system works and the principles underlying it. By sharing this knowledge we wanted to focus on the opportunities available to the Dutch parliament to perform its role as a watchdog and thus help safeguard such interests as health, safety and environmental protection. We used inductive reasoning – finding patterns – to reach our first goal. The team carried out a statistical analysis of the database used by the inspectorates of the 33 European countries to inform the European Commission about dangerous products, analysed various documents and held a wide range of interviews. We then discussed our findings with Dutch stakeholders from both the public and the private sector. And finally, we discussed the most important challenges in an international EU workshop on market surveillance.

Our second goal was to 'make people care', but we did not know how to. So we experimented without knowing in advance whether or not we would succeed. The way we worked to reach our second goal can be classified as design abduction – searching for elements (what) that would work (how) to reach our desired outcome (making people care so they want to take over our recommendations). We experimented with various infographics (first order), methodologies to make our product more engaging (second order), approaches to interact with our stakeholders (third order) and searched for ways to improve and be meaningful as an SAI in a complex system (fourth order). To illustrate these experiments we will share a few of our experiences, presented in the same sequence as Buchanan's four orders of design.

Using 'symbols' (first order)

Since 2015 the NCA has used more infographics and data visualizations in its audit reports to tell stories visually. Yet the added value of using visuals *during* audits, in terms of new and different insights, was still being discovered at the time of this audit. The involvement of a design researcher helped the team discover a diverse range of visual stories which were used in the audit report to unravel the system and to get the message across (Meijer, 2018).

One of the elements the audit team wanted to explain visually concerned the 27 product groups that had to bear a CE logo. To produce the infographic (figure 3) the design researcher worked closely with a member of the audit team with a background in the law. Based upon the legal information on the product groups, 27 pictograms were selected to help readers better understand the audit subject. The process that led to the infographic helped the team sharpen its understanding of the product groups. The team also discovered that

the information about the product groups was not as clear as initially thought. The team did not realise this until it tried to present the information visually.

Figure 3. An infographic of 27 CE product groups (NCA, 2017)

In complex settings, such as the CE system, it is particularly important to start visualizing at an early stage in order to unravel the complexity and show it in an accessible way to laymen, such as members of parliament and journalists, without losing the nuances needed to understand the issues relating to the topic. The legal basis of the CE system can be found in a Blue Guide, a 122-page document on the implementation of EU products rules (European Commission, 2016). It took months for the team to understand its contents and produce an infographic that explains the system in a nutshell (see figure 4). It was used in various presentations as a framework to contextualize our recommendations.

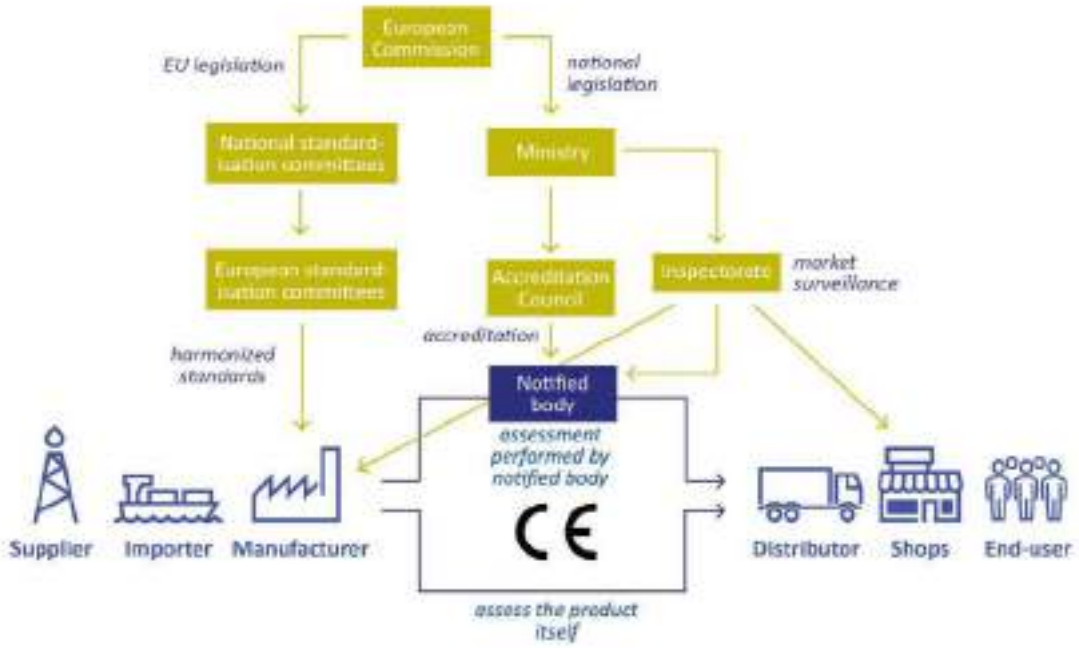

Figure 4. An infographic explaining the essence of the CE system (not published, NCA)

Using 'objects' (second order)

To deal with the complex environment, the audit team needed to think about how the audit report could make an impact. Publishing a thorough report with good infographics (first order) alone would not do the trick, they had to design the report as a whole, an entire story that would engage a broader audience. That meant that writing the story down and using good infographics would not be enough, we had to use methods that would form the building blocks of the audit story. In the team discussions we would talk about how the report could become more engaging, e.g. how CE marking affected our own lives and the lives of our children. As at least four of the auditors had young children and they had to admit that most of the time they noticed recalls of toys in newspapers. Simply visualizing the data was not enough to address the concerns of young parents, so how could the team catch that urgency without compromising the supreme audit institution's standing? How could they give the data more meaning?

The team decided to select one specific item in the 'toys' product group from the list of notifications and follow it from supplier to consumer. The reason they selected this product group was twofold: it was the product group with the most notifications in the Netherlands, and toys was a product group which the team felt the most concerned about in view of its impact on the lives of vulnerable users. The key question was: how can an item that does not comply with health and safety standards bear a CE mark and still be on sale in stores? The team started by looking for items in the data that were still available in shops, and bought one. They then asked the responsible inspectorate to provide the notification file. The file identified the stakeholders (supplier, distributor, manufacturer) and stated whether a notified body had been designated for the product group. The team contacted the manufacturer and asked it to help reconstruct the 'journey' taken by the item. The reconstruction of the journey was based on interviews with both private and public stakeholders and on desk research. During the interviews the item functioned as a conversation piece (Gaver, 1999) which sharpened the team's focus and prevented the conversation from getting bogged down in a discussion of the entire CE system.

The team experimented with many different ways to visualize the product journey and discovered that it was not possible to capture the journey in one visual alone. Based on the available information they discovered that the best way to visualize the journey was to show three journeys the product made: its first time on the market, the rejected product and the current product. Figure 5 shows the final infographic of the toy's three journeys.

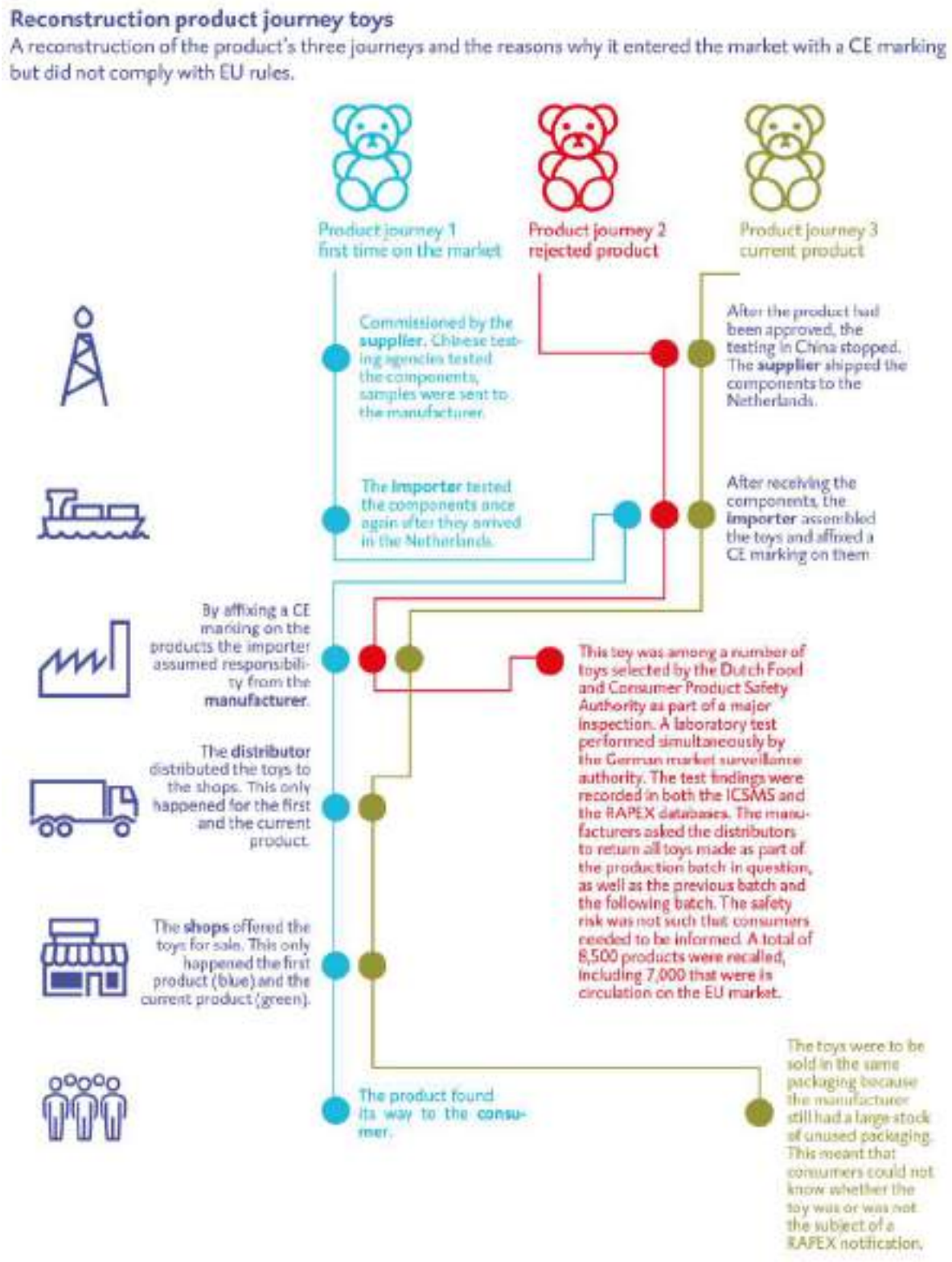

Figure 5. An infographic of a product journey (NCA, 2017)

After discovering which visual story could tell the story best, the team selected another product group. The top 3 notified product groups were: toys, pyrotechnics, and appliances burning gaseous fuels. Dutch law on the use of pyrotechnics is very different from laws in other countries in the European Economic Area, so the team decided to choose the third product group. Again they mapped out the selected item's journey, and again discovered insights about the system the team could use in the audit, e.g. the fact that ongoing technical

safety discussions could be the reason why items that were considered unsafe by the inspectorate were still on sale. These insights into the weaknesses of the system (and the infographics) were used in the final audit report.

The team named this self-developed design research method a 'product journey'. It not only helped the team gain more and different insights than data analysis and interviews would, it also helped design a more engaging product – our audit report. The data and the CE system were given more meaning, and it satisfied the team's personal wishes to have some pressing questions answered. Moreover, the audit was picked up by several journalists and their articles had many similarities with the way the audit story was presented in our report.

This approach differs from the first order because you have to look at the report as a whole: the report was 'directed' by the team. They added 'design abductive reasoning' to 'inductive reasoning', while they searched for ways to make people care (outcome – abductive reasoning) about the patterns they found in their audit (how – inductive reasoning).

Using 'interaction' (third order)

One of the complexities of the CE system is its transnational nature: 33 countries use CE marking as a passport for products to be sold in their markets. One of the audit report's recommendations was to improve the existing database and its use by the member states. But as the SAI of just one of the member states, the NCA was just a voice in the wind. In order to have an impact, the NCA needed to collaborate with other members of the audit community. It reached out to other SAIs in the 33 countries and hoped that they would pick up the same audit topic.

Knowing from experience that joint or collaborative audits would take a lot of time to coordinate, the NCA wanted to try something else. It came up with the idea of CODEA: COoperative Data Exchange and Analysis. The aim was to enable other auditors to audit CE marking in their own country, without coordination by or interference from the NCA in the form of data sharing. Four data visualisation students at Utrecht University of Applied Science were asked to design a tool that would help auditors from different SAIs understand and analyse CE marking data. The tool would address the problem that not all auditors were data experts, or were used to working with data. A two-day workshop in The Hague taught eight SAIs that were interested in carrying out a similar audit how to use the web-based tool. The team also presented six audit building blocks to help the other SAIs investigate the audit subject. Two SAIs that attended the CODEA workshop indicated that they would consider auditing this subject in their own country. In the end, you need one follower to bring these innovative plans further.

Again, this is an example of adding 'design abductive reasoning' to 'inductive reasoning'. We did not know what would work to find the collaboration that this audit needed. We tried to understand the needs of the CODEA participants (what do they need to execute the audit?), we designed a workshop and building blocks in order to get started with the results of the inductive part of the audit.

Using 'systems' (fourth order)

In 2000 Malcolm Sparrow argued to reform the practice of regulatory and law enforcement which, he wrote, "has more to do with changing the behaviour of regulators than with changing regulations" (p.1). It is not their job "to catch smugglers, it's to stop smuggling.", he said (2011). According to Aken and Andriessen (2011, p. 1, translated from Dutch) design-oriented research differs from explanatory research because it aims not only to describe and explain problems, but also to develop and test generic solutions to those problems. So, in order to find alternative strategies for inspectorates more attention should be devoted to problem- and risk-based solutions.

In our audit on CE marking we did not notice any problems in the regulations – the Blue Guide. The Blue Guide contained a well-defined system. But we also saw that unsafe products bearing a CE mark kept entering the market. That is why we recommended that the data and the database should prioritise *smarter* surveillance rather than *more* surveillance, and that 'the eyes of the consumer' should be used in that surveillance. It is important to notice that our recommendations asked for adding actions next to classical regulatory approaches.

Besides finding alternative strategies on CE marking, we tried to find alternative ways to increase our own impact. To strengthen our recommendations to make better use of the database, the team held workshops and presentations to share insights and data analysis methods. In face-to-face contacts with the inspectorates

they formed a DOE coalition (Dutch for a 'doing' coalition, in keeping with the inspectorates' aim of changing 'thinking about cooperation into cooperating' (Rijksoverheid, 2018, translated from Dutch)) in order to establish a smarter inspectorate for CE marking.

At the moment the inspectorates are improving their working methods by using data analysis and cooperating more frequently and more effectively with the various data owners. In their working plans they state that they want to change their way of inspection in accordance with our recommendations. This means that what we designed – an alternative strategy in a complex system – was picked up by the inspectorates. If we had just followed inductive reasoning, we probably would have recommended to improve the information position of parliament because the data was not adequate. Now we took it a step further: what would really work to improve the system? The data was not adequate but what could we do to convince the inspectorate that the solution was in the data? And in the end, we did everything to 'make people care': we made engaging infographics, we followed a product journey to give the data more meaning, we searched for collaboration on the topic and we added our report with workshops about our analysis of the data in order to help inspectorates learn.

Second example: Information provision in the social domain

In the Netherlands various tasks to provide care to people in need have been transferred from national and provincial government to local government. Examples of care that were decentralized include care for children and adolescents, care for the elderly and informal care. This transfer in the social domain took place in 2015, and since then parliament has struggled with the way it is informed about the provision of care by local government. Parliament asked the NCA for advice on how the information it receives about the social domain by law could be improved (Algemene Rekenkamer, 2018, in Dutch).

The team decided not only to honour this specific request but also to address a related problem. Parliament receives a lot of information via websites and databases that is not always accessible. The team engaged a design researcher (author of this paper) to investigate this unwritten question.

The audit's first goal was to explain to parliament what information it should receive by law, so this part of the audit was approached by means of deductive reasoning. The second audit goal was to show how the information could be presented in a more accessible and more useful way.

Using 'objects' (second order)

Besides sending the audit report to parliament, the team wanted to present a tool that would function as a signpost in the labyrinth of information. To design a tool that would meet parliament's needs, the design researcher made a prototype which she tested with the MPs' support staff. These staff members gather and analyse information to support the MPs' work. The tool was designed as an interface for the database containing government information produced for parliament.

The first prototype was tested with the MPs' support staff, and adjustments were made based on their feedback. The next iteration was tested with another part of the staff and the feedback was again incorporated in the interface. Finally, the tool, known as the Social Domain Signpost, was released together with the report. To offer other stakeholders a means to develop the tool, the NCA presented it as 'open design' and all the government information produced for parliament as 'open data', free for everyone to use and to design their own tool.

Using 'interaction' (third order)

The prototype developed by the audit team's design researcher was used to promote interaction among the stakeholders. The team didn't want to be the product owner but encouraged stakeholders to develop their own interface by integrating the tool into their own information services. The team deliberately focused more on the tool's design and testing than on its technical features. The prototype was used as a conversation piece in order to test its accessibility and raise awareness that parliament's problem involved more than just receiving enough information: it was also about the information's accessibility and presentation so that it met the users' needs.

Adapting design in the world of audits

The two examples described in the previous paragraph can be placed in Buchanan's framework as shown in table 2.

Table 2: Design approaches used in two NCA audits, placed in Buchanan's framework (2015).

Audits	*Symbols*	*Objects*	*Interaction*	*Thoughts*
Products sold on the European market: unravelling the CE marking system	X (discover and tell visual stories)	X (giving the data meaning, product journey)	X (design a tool from perspective of target groups (SAIs))	X (help inspectorates carry out data and risk-based surveillance)
Information provision social domain		X (tool, open design and open data)	X (interaction through the Social Domain Signpost)	

Table 2 suggests that the four orders of design are quite distinct from each other but in reality they are interdependent. A compilation of visual stories (first order) creates an engaging, directed publication (second order), and a tool to promote interaction between groups (third order) overcomes the groups' reluctance to cooperate and therefore challenges the system (fourth order). We also discovered that the results of the design approach used in an audit can both overlap each other and differ from each other. But the main characteristics of a design approach – human-centeredness, iterations, tangibility – are found in the examples. Human-centeredness was strongly represented in the product journey. The auditors wanted the data to have a stronger impact because dozens of products bearing a CE marking posed serious health and safety risks and were having to be withdrawn or recalled from the EU market every month. This was a very design-oriented approach to the issue. The iterative approach was most apparent in the prototyping of the Social Domain Signpost. This was an example of innovation, as auditors normally do not share information that still has to be signed off. Visualising the legal information on product groups helped the team understand the topic better and heightened their need to gain more information.

The NCA's first encounter with design thinking lies in the first order. The NCA was persuaded to use more infographics, data visualizations and animations to get our message across. We first hired designers to make infographics when the audit was completed, but the complexity of the audits was difficult to portray and the infographics would go through many revisions. As the auditors did not feel that they owned the visuals, this was a side issue. Fortunately, the auditors themselves began to use information design and visual design, and in 2017 a pool of external designers was set up to co-create infographics while reports were being written. Nowadays, every audit contains infographics made with input from the auditors to portray the complexity of the audits and explain the nuances. Auditors tell their stories in words and images, and designers work with auditors to co-create visual stories, not just to fulfil an engagement.

As noted above, the four orders of design are interdependent. An audit that does not address certain system values can have effective infographics, but it will have a low impact. Designers working at the NCA should understand this, and the importance of asking relevant questions. This is when the use of different kinds of reasoning (Dorst, 2015b) can help.

The audit process is based on auditors taking a deductive and/or inductive approach to objective knowledge. All steps in the NCA's audit process are geared to collecting data based on exacting standards of research. That is why the audit process contains many steps to safeguard quality, including fact checking with the auditee and internal and external quality control. A design process uses iteration to allow for new information and to understand the user's needs. Designers use a design abductive approach to strengthen audit significance and impact. For design thinking to add value to audits the NCA should integrate the audit process with the design process, the knowledge-centred approach with the impact-centred approach. Although concerned mainly with the use of visual and information design in audits, Meijer (2018) suggests how the NCA could integrate the two processes, as shown in figure 6.

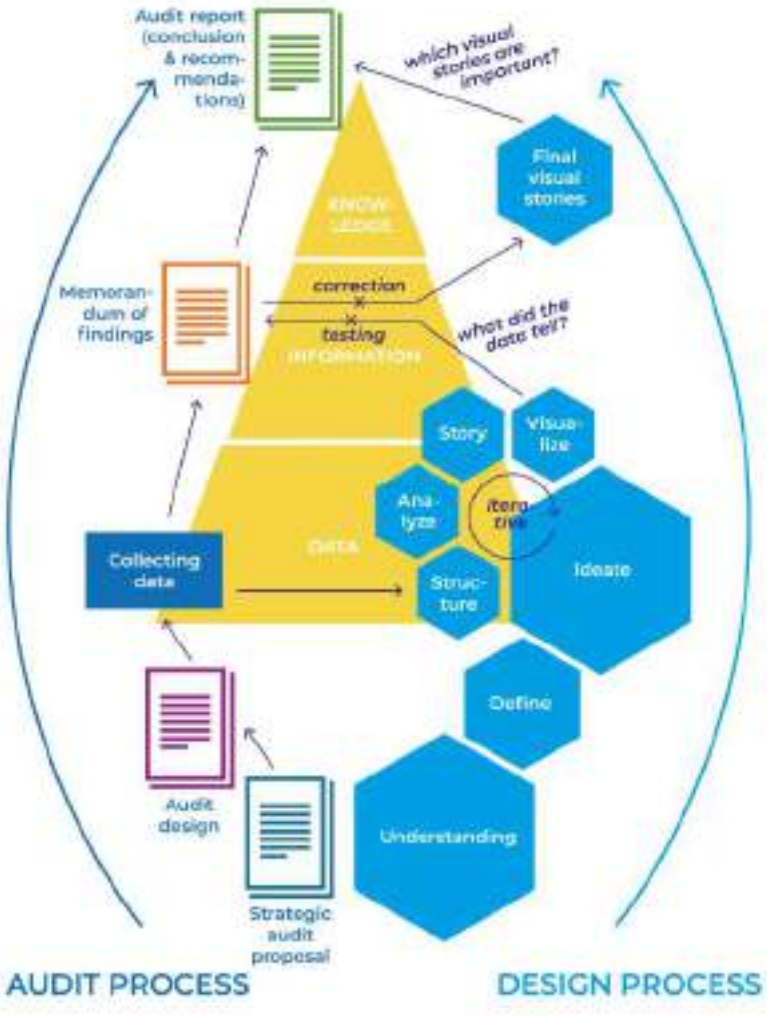

Figure 6. Suggested integration of the NCA's audit process and the design process (Meijer, 2018, p. 78)

These working strategies stimulate the adoption of design thinking in audits. Nevertheless, there is an important element in the world of audits that impedes the adoption of design thinking. The users of an audit are 'users' in a complex world. The users of the NCA's audits, the minister and House of Representatives, have different interests. Ministers want to prolong their political term and avoid any risks that challenge that term. The House of Representatives wants to put the screws on the minister in order to represent the interests of voters. INTOSAI (2018) warns SAIs about this risk:

> *When engaging with external stakeholders, a SAI needs to be mindful of potential risks such as being exploited for political purposes or being seen to be too dependent on international partners. Such risks need to be carefully managed, for example, through ensuring that the purposes of meetings are made clear to all involved in a transparent and accountable manner and the outcomes are documented and agreed. (INTOSAI, 2018, p. 18)*

That is why the independence and autonomy of SAIs is the highest good and also increases the impact of audits. As Van der Bijl (2017) notes, human-centred design is about 'how to gain and apply knowledge about human beings and their interaction with the environment, to design products or services that meet their needs and aspirations.' (p. 2). There is a thin line between 'being exploited for political purposes' and 'meeting needs and aspirations'. Auditors cannot just meet the needs of their auditees in order not to be exploited. Yet, stakeholder engagement is an emerging audit issue. The SAI of Estonia (Asari, 2019, pp. 18-21) recently took stock of the engagement of stakeholders by SAIs. As one might expect the most common way to engage with stakeholders is through 'consultation', which presents the least risk to the SAIs' independence. And SAIs, of course, are very risk averse.

In view of the environment in which auditors work – fundamental differences in reasoning, independence while engaging with users and co-creating with designers who understand the interdependency of design orders and embrace the complexity of the audit topics – adapting design thinking to auditing is quite challenging. But like regulatory agencies, auditors are beginning to realize 'that complex societal problems cannot be managed using traditional […] tools' (Malcolm & van der Bijl, 2016, p. 1). The NCA is convinced of the added value of the first order of design, but the other three orders of design are not yet daily practice. That is why the NCA is investing in a new community of practice: the Design Audit Studio. This community will aim on the further adaptation of design thinking in order to us it in the audit work and the audit process.

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Building Design Capabilities in Academic Libraries

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While design-led innovation may have huge potential to change both tangible outcomes of design, such as products and services, and the intangible ones such as values, mindsets and organizational cultures, the approach has not been broadly investigated in the organizational settings, especially when it comes to building in-house design capabilities. The paper reflects on both practical and theoretical concerns around building of design capabilities in academic libraries. The making and sustaining design capabilities was supported by design interventions in the form of design workshops and other design activities, and repeated re-enforcements of constructivist and experiential organizational learning leading to integration of design proto practices with daily routines and established work practices. The findings are articulated as a set of guidelines toward building design capabilities in academic libraries through design thinking. At the conceptual level, the work highlights the importance of openness, dialogical spaces and temporal aspects of such processes.

Keywords: Design capabilities, research through design, design thinking, knowledge brokers, design interventions

Introduction

In the past decade, we have witnessed extensive changes in the roles of libraries in general, and academic libraries in particular. Academic libraries have been challenged, on the one hand, by the emergence of new technologies and devices (e.g., e-book readers, smart phones), digitalization (e.g., Google Scholar) and new ways of research and knowledge management (e.g., Research Gate) (Saunders, L. 2015). On the other hand, academic library users are often competent and are early adopters of new technologies and digital tools. They also have ever increasing demands for good user experiences and services and solutions that support their dynamic work patterns, both in physical and digital environments (Sennyey, Ross, & Mills, 2009). This situation requires paying continuous attention to the role of the library in an academic community, including consideration of the services on offer. In other words, academic libraries must be ongoingly concerned with institutional visions and strategies for the future, and develop innovative practices that allow them to be active and agile forces within the academic communities they serve. One approach to tackle this challenge is based on adoption of designerly ways of thinking in an organization, and building design capabilities toward sustained innovation and strategic reflection efforts.

We make a distinction between designerly ways of thinking and working and design thinking as commonly appropriated in business management. The former has been tied to design research and understanding of how designers think, reflect and act, see for example, (Buchanan, 1992; Krippendorff, 2006; Margolin & Buchanan, 1996; Schön, 1983, 1992). The latter has been praised as one of the best approaches to innovation and organizational transformations, for both public and private sector. The literature here is extensive, but we

refer to early research such as (Brown, 2009; Brown & Wyatt, 2010; Kimbell, 2011; Martin, 2009; Stewart, 2011), emphasizing how design thinking creates opportunities for design to enter new fields like business management and strategy, or education. The main 'active' ingredient in design-led approaches is creativity (Kimbell, 2011). Design thinking in business has been criticized for suppressing this ingredient by streamlining the process into a procedure consisting of four main phases: empathize (with users), define (the problem), ideate (consider and rapidly prototype a broad range of ideas), prototype (one or two of the most promising ideas from the previous stage), and evaluate (to what extent the proposed solutions solve the problem and how well they work for users), see (Nussbaum, 2011, 2013). Even so, just how to implement and sustain design thinking efforts in organizations without the presence of professional designers or design consultancies becomes a crucial question, and represents an identified research gap (Carlgren, Elmquist, & Rauth, 2014, 2016). Furthermore, if an organization opts for hiring designers or consultancies for specific tasks, the issue of how to continue working on these tasks after the work of a professional design is done (ibid.), presents a continued challenge.

Later examples in entrepreneurial and managerial discourse around design in institutional settings (Malmberg & Wetter Etterman, 2016; Malmberg, 2017) point in the direction of building institutional design capabilities.

Given their need to innovate, libraries have also turned toward design thinking. Consultancies like IDEO (IDEO, 2014) developed a set of methods for working specifically with library's visions, strategies and responsiveness to external challenges. However, these tools were useful when professional designers guided the work. When their work was done, the design thinking and innovation efforts would often stop.

Thus, in this paper, we propose an approach that aims to provide for sustained (over time) abilities to work with design-led innovation by building *in-house design capabilities*, so that academic libraries can respond to both external and internal challenges more appropriately. This does not imply that professional designers and design consultancies cannot play a role in innovation any longer; it just scaffolds forces within the organization to understand design and be able to work with or without professional guidance more effectively.

The research presented in this paper is of an explorative and experimental nature, aiming to inquire into how to approach developing in-house design capabilities at an academic library. Research through Design (RtD), see (Bowers, 2012; Dalsgaard, 2010; Fallman, 2008; Gaver, 2012; Höök et al., 2015; Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011; P.J. Stappers & Giaccardi, 2012; Zimmerman & Forlizzi, 2014) was chosen, inspired particularly by the work of Fallman (2008), as it focuses on how design practice, design explorations and design studies combine to address the research positioning towards discovery of best practices, tools and methods that support emergence of design capabilities within an academic library. Other approaches, such as action research could have been a good alternative. However, experimental quality, flexibility and openness of RtD, as well as continued insistence on reflection, were characteristics that led to choosing the RtD for this work.

The library as an organization had no prior orientation towards design or design thinking. Methodologically, we use designerly ways of thinking and working to introduce design thinking processes and enable library employees to gain design capabilities that can, in turn, sustain the use of design-led organizational transformations and innovation of products and services. The research was carried out through design of a series of sixteen design interventions, in the form of design workshops or other design activities. The interpretation of the design practice, exploration and studies in the context is presented in detail in the methodology section of this paper. Constructivist and experiential organizational learning were used to gain design capabilities and establish designerly practices. This learning was re-enforced by repeated interventions (each having a different design goal), and over time, led to integration of these ways of thinking and working with daily routines, transforming the work practices in the library (Pandey, 2015). The contribution of this paper is a detailed presentation of how design capabilities were introduced and incorporated into everyday practices, with general guidelines as a starting point for knowledge transfer to other settings.

The paper is organized as follows: the next section presents a selection of literature focusing on design capabilities and tools for building them. We proceed by presenting sections on the methodology, the case, and the findings, which led to the set of guidelines.

Background

In this section, we first provide a brief reflection on previous work regarding building of design capabilities. Then frequently used tools that support design thinking, such as cards or mappings, are outlined.

Building design capabilities has been a recent topic of interest and described by, for example, Malmberg & Wetter Edman (2016) and Malmberg (2017). They put emphasis on how design capabilities are sustained within the organization, after project activities end. Malmberg (2017, p. 218) has observed that participants of design projects are often, after the project ends, not followed any further, and no attention is paid to strategies that enable them to spread design capabilities in the organization. This led to the conclusion that projects where skilled designers have learning-by-doing-based design workshops does not support "sustained innovation capability through design knowledge" (Wetter Edman & Malmberg, 2016). As pointed out in Malmberg & Wetter Etterman (2016), there is a gap to be addressed: "…and we see issues when it comes to structures that support diffusing and upholding new knowledge, for example, a lack of managerial activities that can support assimilation".

Service designers, along the same lines, found that the design tools and methods they try to use in organizations do not produce "the kind-of high-level transformational thinking in managers" they hoped for (Junginger, 2015). These findings were also true for libraries as organizations, and some researchers, e.g., Bell (Bell, 2011) argues in favor of including design thinking as a subject in librarianship education, and a way to gain design competence. In (Booth, Schofield, & Tiffen, 2012; Tiffen & England, 2011), the authors propose inclusion of design activities within the library through cooperation with the School of Design, which facilitated the use of design thinking approach on a more continuous basis. In (Luca & Narayan, 2016), design activities within the library were supported by an artist-in-residence, and in-house designers. A design thinking project at an academic library, described in Whang et al. (2017), explores its concrete applications to specific services, such as support of transfer students. The service focus is the one that is the most frequently reported on regarding library services innovation, see (Scupola & Nicolajsen, 2010), or (Trischler & Kelly, 2016). The latter used co-design with users at three different academic libraries in Australia. However, in line with findings from Malmberg & Wetter Edman (2016), when co-design activities stopped, so did the projects.

One of the largest design consultancies, IDEO (2014), focused on tools and methods for innovation in libraries. The toolset has been developed through a large project concerned with design for a Danish public library. The project is described in Dindler et al. (2016). Others have built on this work, e.g., (Zbiejczuk Suchá et al., 2015) or (Modern Human, 2017), both providing card sets inspired by those of IDEO, specifically to facilitate design thinking for libraries. However, it is difficult to use toolsets without the basic design knowledge, and it is easy to underestimate the importance of designer's tacit knowledge and sensibility for the positive outcomes of processes supported by the toolkits.

Diverse forms of mapping are also frequently used in conjunction with design thinking. We find Giga-mapping (Sevaldson, 2011) to be particularly useful. It aims to facilitate thinking and communication by visualization, inviting participation and collective negotiation of understandings related to the design context, usually by providing a large physical work space for these efforts. Furthermore, it allows for mapping out the context in layers (e.g., from the perspectives of different stakeholders), fostering further understanding of complexity and relatedness of problems.

From this background work, we find that in order to sustain design capabilities, diverse tools can be effectively employed, but also, attention needs to be paid to develop structures that support diffusing and upholding new designerly knowledge.

Methodological approach

Research through Design (RtD)

Research and design have been long regarded as separate endeavors, in particular within interaction design and human-computer interaction. Research through design (RtD) is a recent effort within those fields to merge the two, building on designerly ways of thinking and working (see Bowers, 2012; Dalsgaard, 2010; W. Gaver, 2012; Höök, Dalsgaard et al., 2015; Koskinen, Zimmerman, Binder, Redstrom & Wensveen, 2011; P.J. Stappers & Giaccardi, 2012; Zimmerman & Forlizzi, 2014), using design research, its theories and practices, as the main vehicle to generate new knowledge, often engaging users to validate, evolve and evaluate the work.
As articulated in Höök et al. (2015, p. 2), one of the main issues that RtD faces is how to articulate the gained design knowledge, and allow design researchers to engage with, and build on, one another's contributions. There are several proposals aiming to establish connections between theory, and practice, e.g. (Fallman, 2008; Gaver, 2012; Höök & Löwgren, 2012; Odom et al., 2016) and others. One of these approaches is Fallman's interaction design research triangle (Fallman, 2008), a tool to guide and describe research and design efforts.

The triangle frames the work by three main activities: design practice, design studies and design exploration. Each one of these "*has its own purpose and intended outcome and the rigor and relevance have to be defined and measured in relation to what the intention and outcome of the activity is"* (Fallman & Stolterman, 2010). Recognizing that research practices do not normally fall neatly into one of the three activities, but exists in the space between them, the triangle (see Figure 1) provides a way to address the research practice through *drifting* trajectories, looping or shifting dimensions, etc.

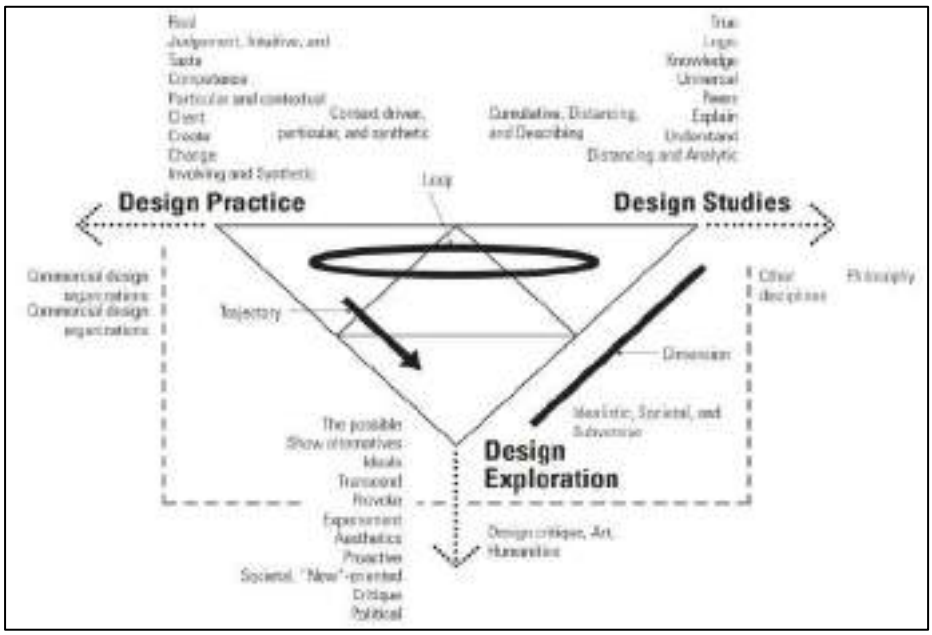

Figure 1: Design Research Triangle connects design practice, exploration and studies as researcher drifts in various ways (loops, trajectories, dimensions) through these activities. Figure adapted from Fallman (2008).

The main three activities are now briefly described.

Design practice can be described as a generative and synthetic research practice where the researcher becomes an integral part of a multidisciplinary design team working on a real-life library project, not primarily as a researcher or observer, but as a designer. This is to say, the researcher takes an active part in the hands-on design work of sketching, constructing and building artifacts and prototypes, dealing with time constraints and communicating and negotiating with fellow team members. Thus, the researcher, alongside library employees can build an appreciation and understanding of the tacit knowledge and competences involved in a professional design practice. However, unlike a professional designer, the researcher approaches the process "*with an explicit design research question in mind, or with the clear intent of forming such a question from their activities"* (Fallman, 2008, p. 6). It is important to mention that the research question does not have to align with the direction and goal of the design interventions, but can be formulated to focus on particular issues or themes that are relevant from a research perspective. In this case, for example, the intervention's goal may be to create a new service, but the research aim is to inquire into tools, meaning creation, ways of thinking etc., which support gain of design capabilities and understanding of design thinking.

Design exploration is synthetic and proactive, involving the researcher in a reflective, hands-on process of exploring designs and constructions of prototypes. These activities revolve around the researcher's own research interests, where "*the most important question is: What if?"* (Fallman, 2008, p. 7) Design exploration intends to experiment, question and provoke critical reflection on the current state of the world, and to imagine possible, alternative and preferred futures. "*[D]esign exploration is a way to comment on a phenomenon by bringing forth an artifact that often in itself, without overhead explanation, becomes a statement or a contribution to an ongoing societal discussion"* (Fallman, 2008, p. 8). In the context of this paper, the research explorations were centered on how design interventions should be designed so that the learning is re-enforced by tackling different real-life issues. Each intervention outcome was intended to serve as a road to becoming aware of larger, more complex issues, values and notions that the library can engage in through gained skills and understandings.

Design studies is the type of design research activity "that most closely resembles traditional academic disciplines" (Fallman, 2008, p. 9), where the goal is to build upon and contribute to a cumulative body of knowledge. This requires an analytical engagement with design theory, methods, history and philosophy, as well as theories and approaches from a variety of other disciplines. It also involves presenting and publishing research outcomes in academic conferences and journals. "*[U]nlike design practice, [design studies] seeks the general rather than the particular, aims to describe and understand rather than create and change, and because of that often appears as distancing to its character rather than involving."* (Fallman, 2008, p. 9) Design studies, in the context of this paper, highlight concepts that emerged through the process of implementing the interventions as the most important ones for gaining and maintaining design capabilities.

The role of the triangle is not so much about the positioning of a particular activity, but the way in which it enables reflection and discussion about how RtD researcher moves in between the three activity areas, thus providing concepts that describe movements, such as *trajectories*, *loops*, and *dimensions*. *Trajectories* are either intentional or unwanted drifting between research activities. They enable discussions about the perspectives and directions of a particular research activity, how the outcome of the activity may feed into another activity and *"what kind of quality measures, guarantors, and stakeholders we will face when moving in between different activity areas",* (Fallman, 2008, p. 11). *Loops* are trajectories without start and endpoints, signifying an ability to freely move back and forth between the two, and in some cases all three, activity areas. Thus, activities in different activity areas feed into each other, iteratively driving the research forward. Finally, *dimensions* infuse the triangle with meaning by creating conceptual continuums and tensions between the activity areas.

All these concepts have been useful in describing the research process regarding design capabilities within an academic library through interventions. The interventions were made with a clear intent of performing designerly work and allowing the challenges, both the learning ones and the ones related to appropriateness of methods and tools to emerge from activities and engagement of participants in any given intervention. Each intervention required engagement in design practice prior to the intervention (for example, designing and making context specific card sets, worksheets, or other objects to be used during the intervention to engage the participants in rapid prototyping), during the interventions (by participating in whatever design activities were a part of the intervention). Design explorations required a focus on research intent and exploring different ways in which design capabilities and practices could be supported through an intervention, as well as performing explorations under each intervention together with other participants. Design studies, in line with traditional understanding, served the purpose of generalizing findings from individual interventions and framing of research contribution to the body of knowledge that addresses how an organization, such as an academic library, develops design capabilities over time. Epistemologically, the triangle postulates that concepts and ideas have to be tried and explored to demonstrate their validity, in line with Dewey's position that knowledge and theories are active phenomena "that are formed and reformed" during an inquiry (Biskjaer & Dalsgaard, 2012).

Constructivist learning

Building design competences by applying design thinking in the library context had to do with ways of organizational learning. The approach to learning that was implemented in the context of the library was based on real-life problem solving, through an experiential and constructivist approach (Jonassen, 1999; Kolb, 1983). In fact, while articulating how learning was implemented, the Beckman & Barry's (2007) model that combines design thinking, innovation and learning styles (see Figure 2) was re-discovered.

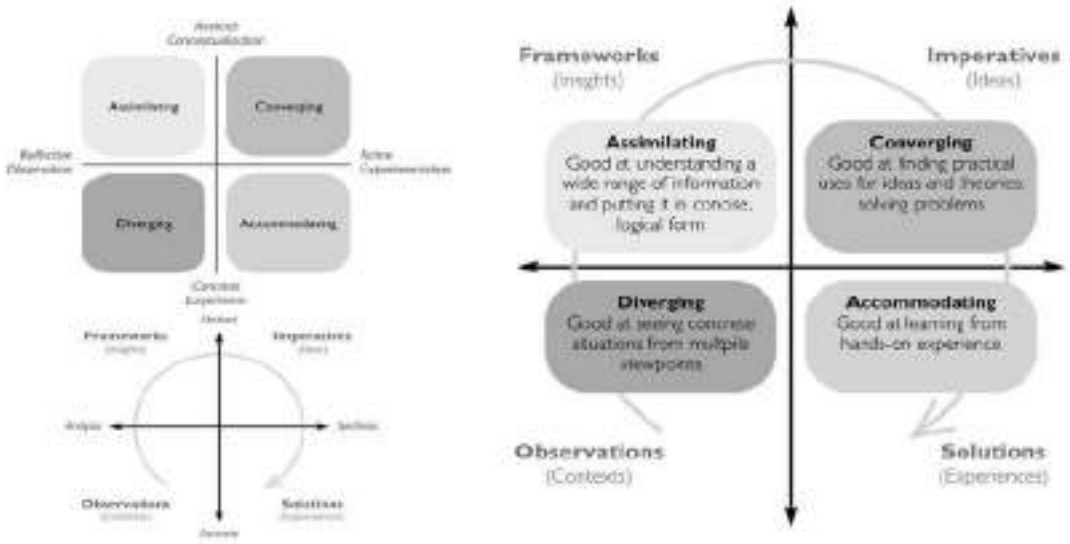

Figure 2 - Beckman and Barry's model that integrates design thinking, innovation and learning styles. Figure: from (Beckman&Barry, 2007).

Figure 2 is rather self-explanatory. Design thinking process is shown in the left bottom image, iterating between the synthesis and the analysis, the concrete and the abstract when moving from understanding the context towards solutions. The top image on the left shows different thinking styles. These are explained in relation to design thinking phases in the large image on the right, which depicts the integrated model.

While engaging participants in intervention activities in the library context, attention was paid to shift between divergent and convergent thinking, concrete and abstract, allowing the time for dialogues and assimilations, synthesis and learning from concrete experiences.

The case: design interventions in an academic library

During the course of this research, 16 design interventions were carried out. They grew increasingly complex over the period of four years that this research took. Interventions can be divided into three groups in accordance with what research aims were. The first set interventions (4) all focused on service design as the aim of the intervention (innovative services, or improvement of the old ones), as well as organizational learning (vocabulary for service design and design thinking) through experiential engagement in the intervention, exposing participants to different thinking styles and thinking through rapid prototyping. The mid-period interventions (9) also focused on services, but were tackling more complex issues that were of importance for the library at the time when they were performed. During this period, some library employees already got engaged with the approach, and it could be said that became knowledge-brokers for design thinking in the library (Pandey & Srivastava, 2016). The last set of interventions (3) was related to three large projects, two of which are still going on. These interventions were strategic, deeply engaged in envisioning of the role of the library in the future. To provide flavor of these workshops, one representative intervention from each group is presented.

An example of early interventions

The intervention presented here was a workshop with 25 participants. Seventeen participants were library employees, including leaders, librarians, digital service employees, and open access consultants. Four participants were graduate students in interaction design and four were researchers. The participants were divided into four multi-disciplinary groups to discuss searching for e-books, which was a real life issue at the library. The activities were hands-on. Each team got their deck of service design cards, and other typical workshop items, such as colored pens, dots, and a large sheet of paper (see Figure 3, left and center). The participants took some time to become familiar with service design concepts and tools, especially cards. Cards were quickly recognized as an excellent tool, facilitating the building of common understanding of the problem space. Soon, all groups started also using arrows and dots to reason by assigning importance to specific cards or processes, and mapping out present and future customer journeys while searching for e-books. Design

thinking was an approach, at least in the simplified format in which it was presented, that all could easily understand and use to solve the problem at hand.

Figure 3 - The images show some of the cards that were made to depict the local library spaces, use of cards during a workshop and a Giga-mapping session (Photo: Gasparini).

The outcome of the workshop was, for the library employees, the understanding that service design uses a design thinking approach and tools such as customer journeys and touch points between library users and the library. Alternative customer journeys (prototypes of future services) were easy to visualize using service design cards (touch points cards). One of the lessons was related to the understanding that through synthesis of experiences from diverse suggestions of future customer journeys, inferring and discussing the best solutions may lead to design of better services.

The research aim was how to best introduce design thinking and build interest, motivation, engagement among the library employees by considering the selection of the intervention aim (a small, manageable one at first, such as e-books search, yet related to the real organizational need) and the use of tools that are appropriate for the purpose. The team work facilitated fast learning and constructive dialogues. Attention was paid to the number of participants within the team (in this case, 6-7 per team) in relation to the engagement and equal opportunities for all to actively take part in the process. The level of openness of tools emerged also as central (Culén & Gasparini, 2016; Culén et al., 2016) already during this first intervention.

In the subsequent three interventions in this first group, we used different sets of cards, to explore the different effects on participants when tools were directing behaviors, were too open, somewhat structured, or fully structured. Other layers of *openness* also became visible, establishing openness in tools, processes and mindset and a main theoretical concept to be explored.

An example of mid-period interventions

This example is an intervention concerned with the use design thinking in order to improve web services for the library, as well as the coordination between different departments maintaining the web pages. The goal was also to envision a common strategy for dealing with web-services across all departments. The intervention comprised several workshops and was organized in collaboration with the Communication Department at the University of Oslo Library. All participants were web-editors and different workshops had different number of participants, ranging from 7 to 10, most participants took part in more than one workshop. Since participants by now were familiar with design thinking processes, the tools changed. Communication exercises, design thinking exercises, mind-mapping and Giga-mapping (see Figure 3, right image) became central, and were based on real library needs (apart from the communication exercises such as writing a break-up letter, and others that were picked up to support the processes). Materials such as large paper sheets, post-it notes and colored pens were provided.

The outcome of these web-service workshops (constituting a single intervention to improve processes around web-page maintenance) for the library was a draft of the common strategy that all could agree to. In the aftermath of the workshops, it became evident that the participants in this intervention managed to integrate the design thinking approach in their daily work practices, implying that they have indeed succeeded in developing some design capabilities. They demonstrated this this indeed is a case by using the new gained skills and ways of thinking to organize different events and services entirely on their own.

From the research perspective, exploration of how to support dialogues continued. This now became conceptualized as *dialogical spaces* and is described in more details in the discussion. The emergence of these spaces was fostered by using and shifting between different tools (again, in accordance to constructivist and experiential learning, Figure 2). The participants showed routinized behaviors when using tools, that is, familiarity with both processes and tools. Temporal aspects were now brought to the foreground of research inquiry into integration of design capabilities and designerly practice with everyday work in the library.

An example of the most recent interventions

A new department at the university, and the physical space to house it, was under planning since 2016. In the initial plans, the library was given only a small place to perform the traditional library functions. The intervention, comprised of two workshops was carried out to change this outcome strategically. The workshops were initiated by one of the library leaders, along line with other knowledge-brokers in the process of organizing the intervention. The first workshop had the aim to discover opportunities for the library that could be fronted, and through which the library could support the needs of the new department in new ways. The second workshop focused on an even broader question: "*What should the University do to be known as a place for convergence and innovation? How to create room for innovation, and innovative thinking in the new department?"*

Eleven participants took part in the first workshop, from different departments of the University, and one architect. The second one had 14 participants, all with different backgrounds, aiming to create truly multidisciplinary teams. Participants were in research leadership positions (6, in charge of research groups), a dean, a student representative, employees from different departments, interaction-design students and two library employees.

During the first workshop, people used ethnographic methods and tools (walking tours with photo-documenting). The second one used a whole range of tools – cards to make newcomers comfortable and open for dialogue, customer journeys and touch points to understand the approach to service design, Giga-mapping and other mappings to discuss the complexities and layers of needs in the new building, see Figure 4.

Figure 4 - Wall from the second workshop showing different design tools used, such as the affinity mapping, and customer journeys (Photo: Gasparini).

The outcomes for the library could be summarized by what the leader of the library who initiated the workshops said: design capabilities, skills and understandings of the processes gained during earlier design thinking interventions allowed her to envision how to use different design methods to position, in the difficult arena of political negotiations for the space and presence in the new department, the new values of the library. The design approach used during the two workshops helped the participants understand that the library could be a much larger stakeholder in the building than they previously realized. Using the design thinking approach in these two meetings, the library managed to change its position from being almost marginalized to be the party responsible for innovation and creative thinking spaces in the new department.

For the research, this represented the point at which the interventions could be stopped naturally. It confirmed very clearly that the understanding of design thinking at the organizational level was now deep enough and powerful enough to serve also the strategic purposes. The leadership and the knowledge-brokers have gained competences that they could use in complex contexts, and to meet new challenges. Temporal

aspects of the processes became of central interest, whilst different aspects of openness could not be clearly seen, as well as how it influenced creation of dialogical spaces that last within the organization.

Discussion

As common when engaged in research through design, the basic way of gaining new knowledge was through reflections in actions during each intervention, and reflections on actions post intervention. In practical terms, after careful planning, possibly design of cards or other tools, piloting the intervention, in action, every step was evaluated anew. For example, even if tasks were carefully timed, interesting processes and discussions were allowed to continue even if the allocated time was over. Also, many different aspects, such as team work, quality and quantity of ideas etc. were always ongoingly evaluated during interventions. Reflections on action allowed for establishment of new explorative pathways that were deemed optimal towards continuing to build in-house design capabilities. They also helped in recognizing important theoretical concepts that facilitate processes of adoption and integration of new practices in everyday work.

The three core concepts (openness, dialogical spaces and temporalities) that emerged as central through the research efforts are now discussed.

Openness

Several layers of openness became visible in these processes. *Openness to change* implies willingness to observe and identify opportunities for design in everyday work. It also requires the willingness to *periodically evaluate* the effects of using design thinking, as well as consider other ways in which it can be used, towards building of design capabilities. *Openness to learn* and acquire design skills and competences was also important, but did not necessarily apply to all employees. As long as some library employees were willing to become knowledge brokers, in-house competences could be maintained, and built further. However, it was remarkable that nearly all employees wanted to learn, and participated in at least one of the interventions to gain the understanding of design thinking processes. Keeping in mind Beckman & Barry's (2007) constructivist and experiential learning model, oscillation between the concrete and the abstract, as well as reflections and actions, was important to keep people engaged and open to learning. *Openness to proto-practices* relates to the willingness to integrate new ways of thinking and working with already established practices and processes. *Openness to be a part of a multidisciplinary team work*, where dialogical spaces and creation of truly shared knowledge, was important. It is directly related to individual's behavior and experiences in team-work settings and people's willingness to adjust personal behaviors and expectations from personal to project based ones, to take the full advantage of the diversity of competencies.

At a different level, *openness to research collaborations,* that is work with other researchers and designers engaged in similar research and practices, fostering positive collaboration to explore building of design competences, was of importance to increase competences of knowledge brokers and understanding of tools used to communicate design thinking processes.

When discussing tools, the understanding of *openness of tools* emerged as a very important one. Most of the tools, such as diverse card sets available on the market, have structured approaches so that novices can use them with some gain. Alternatively, they are open for interpretation and require facilitation by professional designers, to address their tacit knowledge and sensibility. One of the main findings from having been involved in the processes of building in-house competences has been that semi-open structure work best. In other words, using tools that allow creativity instead of limiting it, but that support well both divergent and convergent thinking and enable broader research and wider inquiries into the problem space were the best to use. In addition, such *semi-structured design tools* were found to support various forms of communication and emergence of dialogical spaces well.

Dialogical spaces

Developing dialogical spaces, design vocabulary, and the project vocabulary, in line with findings from (Krippendorff, 2006) and (Boland, Collopy, Lyytinen, & Yoo, 2008, p. 14), were shown through this work to be of paramount importance for building and sustaining design capabilities and understanding of design thinking processes in an organization such as the academic library. What we have seen is that the design thinking approach and the tools, different at different stages of assimilation and capabilities building, supports the creation of a dialogical space where a common understanding is created. The real-life solution-aimed activities supported well the reflective learning (Beckman & Barry, 2007; Schön, 1983). However, dialogical

spaces, both the physical ones (created for each intervention so that people could easily engage in creative activities, move and talk in different constellations was always facilitated) and the mental spaces in which participants could feel safe, and share knowledge, stances, and ideas freely were essential property of the process. Next, we found that playfulness was important in the dialogical space, as it supports team interaction and invites people to a more relaxed communication with each other. Often, tools to be used in an intervention were selected just for their power to support dialogues, speculations and criticism (where relevant) but through playfulness.

Regarding the physical aspects of dialogical spaces, the territory where they take place id important. Places chosen for interventions mediate the character of the event (for example formal or informal), level of care for the event (careful preparations, availability of all needed materials, preparation of cases to work on and more), level of intimacy (the size, coziness and other properties) and so on. In the dialogical space physical proximity of participants, as well as activity spaces are both important and some personal routines may be challenged. To be in the same space for duration of the intervention is important for dialogical spaces. When appropriate, informal spaces for dialogues could also be created, such as during lunch or coffee breaks.

In summary, the term "*dialogical spaces*", reflects the concept of both physical and mental spaces (supporting possibly multiple dialogues within the same space) in which a cross-disciplinary design projects take place. Dialogical spaces shape the project language and introduce the design vocabulary to newcomers to design processes. Through careful choice of physical spaces, using constructivist and experiential learning (sharing of concrete experiences, abstracting together, etc.), supported by adequate design tools, like Giga mapping (see Figure 3, right image), learning is speeded up, and new understandings of project-relevant knowledge emerge.

It is also important to note that, when concerned with building of design capabilities, knowledge brokers continue these dialogues by integrating them into their regular work-practices. They are thus always available to others, to engage in dialogues around possible new projects or areas of application for their design capabilities.

Temporal aspects of building design capabilities

As noted above, this part is rather mundane and part of the common practice when planning interventions, workshops or other activities involving people who dedicate their time to come to the activity. During the entire project, no participants were paid for their work extra (the library employees did the activities during the normal working hours, and had their regular pay, all others volunteered their time). Thus, the return on time investment needed to be thought of. It turned out that most participants, if novice, were happy with the learning process, and if experts, with sharing knowledge in a real-life and meaningful setting, usually with people who were quite engaged. Making sure that each intervention had some form of concrete outcome, even if not immediate, was an important return on time investment.

It can be said that the first group of interventions was an orientation phase, using the term as in Karapanos et al. (2009) that describe temporal aspects of processes, becoming familiar with design thinking and the ways of using it. The second group of interventions was corresponding to the incorporation phase, through prolonged use of the new practices. Finally, the last interventions can be said to represent the identification phase, demonstrating how designerly ways of thinking and working have become meaningful within the library.

Between interventions, especially the more complex ones, integration of gained knowledge, changes in the mindset, or in practices, needed to be allowed some time. This kind of temporal perspective are really little understood, because they can be subtle and unnoticeable for those who are not a part of the organization (connecting back to the importance of insiders and knowledge brokers for the development of design capabilities). How to support and how much time to dedicate to these processes? If new participants attend different events within an intervention, as was the case with later ones, how to save time related to establishing dialogical spaces, and the orientation phase? The findings here indicate that selecting knowledge brokers here too, is necessary (or, at the minimum, there should be some overlapping participants who can speed up the learning processes for the newcomers). Equally important, deciding what ideas and possible solutions should be discussed further, what solution trajectories to choose when implementing, was also interesting from the time perspective.

Remarks on learning and participation

Although the portfolio of interventions was diverse, they all focused on integrating design thinking and building of design capabilities in the library. Some have taken concrete, simple projects that, seen in isolation, are not of a large significance. However, seen jointly, as re-enforcements of learning how to act in designerly ways, they do address macro management of time. Distributing these smaller, manageable and possibly inspirational projects across the timeline of the overall project kept re-enforcing the learning.

In the light of previous research, especially the poor ability to sustain design capabilities (Malmberg, 2017), the creation of a design language based on the vocabulary used during projects was of paramount importance. There are many examples of how the library staff used their design capabilities. For instance, one subject librarian, long after this research was done, when working together with the faculty from another department at the university, used design methods to engage with the following questions: *What makes a research paper a good one?* and *What does a PhD student need to do to get to have a good one?* After mapping the problem area, they created a number of different user journeys, charting the territory from an assignment to a successful paper. This example shows that the subject librarian continued to be open to design methods, successfully remembered design vocabulary and explained the user journeys to others, creating a common dialogical space along the way. The subject librarian also could articulate the time perspective more clearly, leading to the better understanding and implementation of the collaboration on this particular case.

Since projects were diverse, people were always open for new learning and participation. As mentioned earlier, many library employees have participated in multiple interventions. Repetition and diversity of interventions were hugely important factors for building capabilities over time. There was no prescribed number of interventions that had to be done. Instead, the momentum built by one intervention and the interest it generated were used to organize the next one. In this process, the attention was paid to not have them too close to each other so that they do not become burdensome, but close enough that they can build on the outcomes of the previous ones. Between these, the library leadership could use the time to evaluate and appropriate the skills. With time, they developed the ability to notice the design opportunities. As described in the most recent intervention example, it was the leader who was the initiator of the intervention. This was a marker that incorporation has indeed taken place.

In summary: a practice-oriented approach, research through design, utilizing experiential learning, and a pragmatic approach and especially the Dewey's notion of *inquiry*, aiming to approach a non-defined situation and try make it *thinkable* (Dewey, 1909, p. 108), has been a suitable way of introducing design thinking and building of design competences for the academic library. Real-life problems, solved through design thinking and in the context of experiential and hands-on learning, were crucial. In addition to repetition, as a learning strategy, what motivated people to engage, and keep them engaged in design thinking processes, were dialogical spaces and openness. Allowing time for assimilation, integration, evaluation and emergence of proto-practices, also played an important role.

I close this section by providing guidelines, rather than recipes, on how to work with capability building and design thinking in complex organizational settings of academic libraries.

Guidelines

Based on the outcomes of this study, some simple guidelines are provided on how to work with design capability building and design thinking in complex organizational settings of academic libraries.

1) Start by providing introduction to design thinking and service design, using compelling examples of real-life library issues, to the leadership (have in the back of your mind the ways in which people learn (Kolb, 1983) and use concrete real-life library problems to so that people can relate them to experiences that they already have).
2) Systematically work on increasing and building design competences. This can be accomplished by using knowledge brokers, someone who has design competences to start with, or is willing to learn in order to facilitate systematic building of competences.
3) Use, at the very start, simple activation tools, such as cards. Then increase the complexity of both problems and tools used gradually. Changing tools, and choosing ones that are suitable for the issue at hand is important. Tools like cards, Giga-mapping, semi-open templates and workbooks are very helpful.
4) Use a lot of thought on how to facilitate emergence of proto-practices, but allow this organic process to unfold by itself. It may take time. After some time, people (as a collective) either pick up new practices and add to the old, or do not.
5) Pay attention to dialogical spaces, and keep them active even between interventions. When someone in the organization shows interest for the approach, take time to help (or design a help service for the approach).

6) Repeat and refresh whenever possible. Be very pragmatic about this. Nothing should be imposed, overdone, but also not underdone.
7) When engaging others in multidisciplinary process, pay attention to the choice of people that make up the team. Having positive and competent participants, who are communicating easily, is good. However, paying attention to thinking styles, the knowledge and competences that participants have is also important.
8) Knowledge brokers need to keep developing their own competences (exploring, experimenting and reading about the approach, tools, teams, practices, etc.). It is an advantage if someone in the leadership evolves into a knowledge broker.

Conclusion

Concluding, RtD offered a good, hands-on, exploratory, and reflective way to engage with the inquiry regarding development of design capabilities in the academic library. Engaging in a series of sixteen design interventions through practice – oriented approach that utilized real-life problems and experiential learning, gave insights into how design competences can be developed in an academic library. Some of these insights were articulated as guidelines that can be explored and followed when building design competencies is desired. At the more abstract level, concepts of openness, temporality and dialogical spaces emerged as foundational to understanding competence building.

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Applying design thinking in a hierarchical organisation

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Many large financial services organisations are seeking to develop their employees' design capability to develop innovative customer solutions. Yet, there appears limited understanding on how individual employees (without a background in design) view the relationship of design thinking to innovation. This study investigates how employees perceive design thinking and its potential link to drive innovative practices within a large Australian multinational financial services organisation. An exploratory qualitative approach used face-to face semi-structured interviews with diverse participants from across the organisation. A modified existing design capability framework was used to map each individual's perspectives and illustrate the organisation's current DT and innovation capacity. Findings from this study contribute new insights regarding employee perceptions and design capability requirements.

Keywords: Design Thinking, Innovation, Financial Services Industry, Large Organisations

Introduction

As Design thinking (DT) has grown in popularity, organisations experiment with programs using DT principles to drive innovative practices (Bucolo & Matthews, 2011; Bucolo & Wrigley, 2013; Carlgren, Elmquist, & Rauth, 2011; Liedtka, King, & Bennett, 2013; Matthews, Bucolo & Wrigley, 2012). Large organisations generally recognise the need to innovate to achieve sustainable growth in today's economic marketplace (KPMG, 2015). Adopting design, DT, and design led approaches to innovation have been known to assist in this process (Brown, 2008; Brown & Martin, 2015; Johannsson-Skoldberg et all, 2013; Kolko, 2015;Liedtka, 2010; Liedtka and Ogilvie, 2011; Verganti, 2008 and Verganti, 2009). Hence, organisations are seeking to up-skill employees to develop their DT capabilities with the view to improve innovation processes and outputs.

With increasing numbers of people and organisations exploring DT methods, this empirical study presents findings from an investigation of how employees perceive the current DT capacity of their organisation and its ability to generate transformative innovation. Specifically, capturing and illustrating how employees of a large Australian financial services organisation recognise the possibilities of DT and its potential link to drive innovative practices. Applying a case study approach, the researcher interviewed 31 employees across various organisational levels, roles, geographical locations and departments within one large organisation, MFSCo. An existing design capability framework was modified for this context and used to map the participants' thoughts and views about DT and their capacity to drive innovation in current work contexts.

The aim is to investigate, discover and understand how employees without a background in design value and apply DT practices and the relationship to innovative outcomes. Building capability requires both knowledge and the ability to apply the learnings to provide real value generation.

The findings contribute practical evidence of the complexities associated with how individual employees understand and transfer DT learnings to innovative workable applications.

Current Understandings

Understanding what DT expertise actually is and how to establish it is crucial, in order to determine how to build DT capability. Despite the many views, definitions and interpretations of DT capability found in the literature, there is no single agreed consistent explanation of DT competency and how it can be acquired.

DT competency has multiple meanings (Barry & Beckman, 2008; Beverland and Farrelly 2007; Brown, 2008; Howard, 2012; Johansson et al. 2013; Kolko 2010; Lawson & Dorst, 2009; Liedtka & Bennett, 2013; Martin 2009; Martin 2010; Melles, Howard, & Thompson-Whiteside 2012; Sobel and Groeger, 2012). Melles, Howard, & Thompson-Whiteside (2012) discuss DT capability as the capacity to co-design and work together with end users at an organisational level in conjunction with developing skills and knowledge at the individual level, while Sobel & Groeger (2012) describe DT as effectively applying diversity of thought amongst users and internal stakeholders to uncover insights, identify the real problem and be adaptable whilst developing and testing prototypes to reveal the solution. According to Lawson & Dorst (2009) DT expertise is not defined as one way of thinking, it is a mixture of rational, analytical thinking and creativity. Barry & Beckman (2008) concur with this view, contending that the inherent capabilities differ within each DT cycle, where understanding and applying the right skill for the required element will produce better outcomes overall. Diversity of input across multidisciplinary stakeholders can enhance design, assist to define the problem and determine appropriate solutions, and is highly relevant in the context of a complex multidimensional organisation.

DT capabilities are much more than knowledge and skills and include intrinsic characteristics that accompany the application of DT. Martin (2009) stated 'the essential core capacity for designers is abductive reasoning, 'the logic of what might be' (Martin, 2009: p27). The ability to make 'a logical leap of the mind' without proof from past events or supporting validated data, differentiates the designer from the non-designer. This explanation offers further insight into what capabilities make up a designer, particularly in a business context and for employees without a background in design, where inductive and deductive reasoning is the norm (Kolko 2010). Martin (2010) proposed that consideration should be given to finding balance between analytical management and intuitive thinking, between 'exploration and exploitation.' Hence the necessary characteristics to apply a DT approach contain a mixture of feelings, empathy and intuition as well as systematic, rational expertise. These additional skills are often seen as foreign in a business context.

DT capabilities range from the tools and techniques required to follow the design methodology and the appropriate logical mindset or ability to apply abductive reasoning. By understanding what DT capabilities are, the next focus considers the integration of DT in large organisations.

Integration of DT in large organisations

Large, established organisations comprised of multifaceted frameworks contain traditional hierarchical structures and well-established management practices. Overcoming these obstacles to drive innovation through a design-led approach is challenging (Brown & Martin, 2015; Bucolo, Wrigley & Matthews, 2012; Carlgren, 2013; Carlgren, Elmquist, & Rauth, 2015; Howard, 2015; Liedtka, 2010; Liedtka, 2014; Martin, 2009; Sobel & Groeger, 2012). Large businesses today face a whole new level of challenges with rapid changes in the external environment and decreasing asymmetry between organisations and consumers (Kloeckner, 2018).

A study by (Carlgren, Elmquist, & Rauth, 2013) examined how employees perceive DT and its application across four industries (including software, product, services and healthcare). Findings note that many employees perceived design to be a mind set or culture rather than a practice or method, and the utilisation of design varied from early adoption in projects to alignment with strategic initiatives (Carlgren et al., 2013). In comparison, research conducted by Darden University examining the effect and impact of DT in large organisations, revealed difficulties and challenge in the application of DT. The challenges included complex structures; separate business departments; management ability and expertise and the language barrier between designers and non- designers (Carr, Halliday, King, Liedtka, & Lockwood, 2010). Both Carlgren et al. (2013) and Carr et al. (2010) noted that shifting individual and organisational existing competences to incorporate new and unfamiliar methodologies and practices, such as DT, requires considerable time, effort

and know-how, where both the environment and culture play a key role in applying the new learnings in an existing traditional organisational setting.

In contrast, large organisations such as Apple, Google Ventures and Nike have successfully applied DT to drive innovation (Berger, 2010) largely incorporating designers' skills successfully to solve problems and innovate. Developing core competences to understand your customers, build prototypes and iterate fast is essential to all designers and organisations (Kolko, 2015). This view supports Michlewski, (2008) who argues that the right design attitude is important to a designer's toolkit. Schweitzer, Groeger & Sobel (2016) suggest in order to build a design led approach to innovation, focusing on developing the mind-set is integral, as employees can adopt new processes quickly (Schweitzer et al., 2016). These studies indicate that developing the mind-set and learning how to think differently form an important part of a designer's core capability to transform solutions.

Understanding the operational environment and all the elements and characteristics of an effective designer will support large organisations to develop the design capability required to successful DT outputs.

Design thinking in the financial services industry

Many Australian businesses remain tied to traditional workplace practices and expertise that have successfully delivered predictable positive results (Bucolo et al., 2012). Financial services is a highly regulated industry comprising multiple sectors including banking, insurance, investment, superannuation and other financial services activities, where the support for DT as a lever for innovation is still in its early stages (Sobel & Groeger, 2012). Largely conservative in nature, the ability of these organisations to remain competitive in an environment of constant disruptive change is more important than ever (KPMG, 2015).

A study of an Australian division of a professional financial services firm providing consulting services, acknowledged the complexities associated with non-design trained employees learning DT (Howard, 2012). Both capability building and the practice of design were difficult due to the complexity surrounding highly analytical and logical environmental surroundings. Howard (2012) recommended the support of trained DT professionals to improve the quality and development of the employees. This research emphasises the complexity associated with transferring DT theory into practice, particularly to staff who are not trained designers, in the financial services industry.

Measuring and mapping application of design thinking

Understanding how design is understood, applied and delivered provides opportunity for further improvements. The Danish Design Ladder (Kretzschmar, 2003) was developed by the Danish Design Council, illustrates four steps towards design maturity, showing that the further up the ladder the more design is integrated into the strategic landscape of a company. The Danish Design Ladder represents the levels of design integration can have within a business and provides a basis for design integration, beginning with the absence of design in the organisation across projects or product development, through to design incorporated into the strategic arena of an organisation (Kretzschmar, 2003). The Design Management Staircase (DMS) (Best, Kootstra, & Murphy, 2010), an extension of Kretzschmar (2003) model, considers five factors: awareness of benefits; planning for design; resources for design; design management expertise and design management process. DMS provides for further consideration of design elements within an organisation and assumes a level of maturity within the establishment.

The Design Capacity Model (DCM), defined as 'a framework for companies' design management capacity' (Storvang et al., 2014) builds on the two previous design frameworks. Inspired by the model established for the Chinese industry (Heskett and Liu, 2012), the DCM was designed for small to medium sized companies in a Danish context. The visual representation consisting of five (5) levers, is a spider web formation, focuses on design capability factors including: who is design valued by; how are customers engaged; who the design thinkers are; what are the innovation drivers, and design capabilities in the organisation as shown in Figure 1.

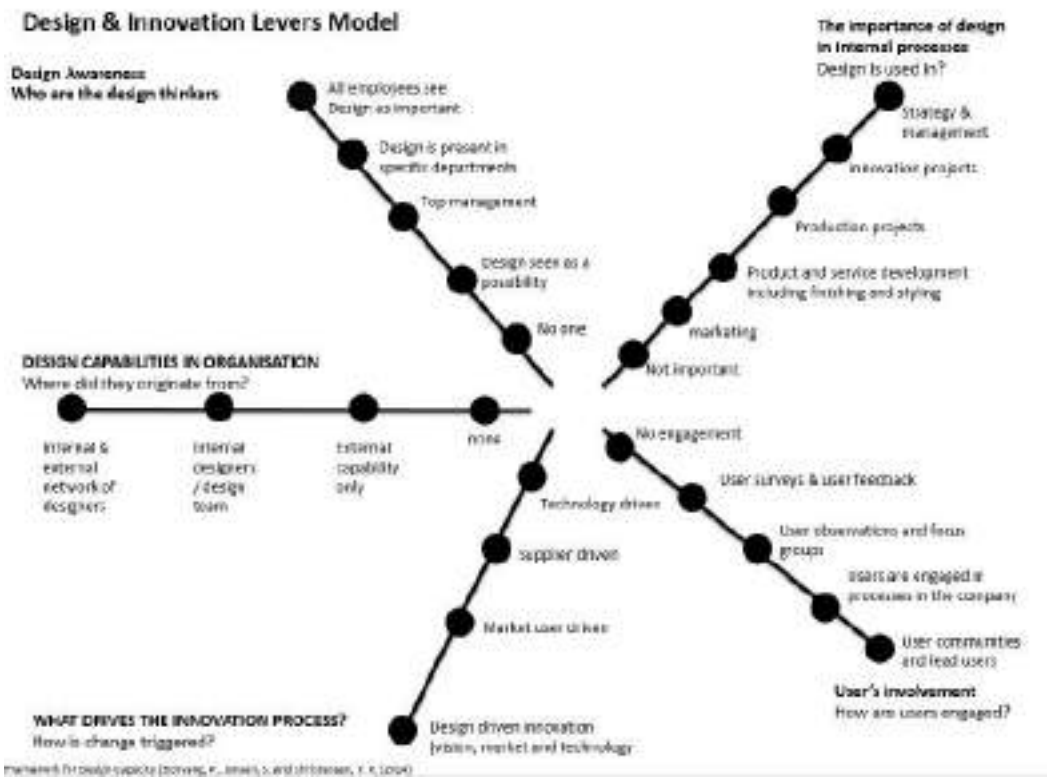


Figure 1: Design Capacity Model (DCM) (Storvang et al., 2014)

The DCM provides a practical tool for mapping an organisation's engagement with design and its design capacity, providing a basis for comparison over time and across organisations and provides the framework for this study. The next section considers the definition of innovation in the context of this study.

Defining innovation

While innovation has been defined in a range of ways (Amabile, 1988; Damanpour, 1991; Damanpour and Schneider, 2006; Frambach & Schillewaert, 2002; Rogers, 2010; Souto, 2015; Wisdom et al., 2014; Wolfe, 1994). For the purposes of this study, innovation is defined as the acceptance and adoptions of an idea or behaviour regarding a system, policy, program, device, process, product or service (Damanpour, 1991), with the focus on the perception of DT and its relationship to innovation.

Participating company

A large Australian publicly listed multifaceted multinational financial services organisation named 'MFSCo', was selected for the research project. The sheer size, complexity and the desire to utilise DT to deliver innovative outputs, is the motivating factor for selecting this firm as the case study for this research. While the company has over 10,000 employees, this case study examines employees within one sector within the Group, comprising 2000 employees, distributed in multiple geographical locations across Australia.

MFSCo's commitment to innovation exhibited an innovation framework incorporating varied DT based education and training programmes, ranging from a one-hour introductory workshop through to a tailored programme centering on knowledge based experimental DT practices aimed to drive innovation refer Table 1.

Program	*Purpose/Objective*	*Time*	*Program Content*
Program A	An introduction to design thinking	60 mins	High level overview of design thinking using D school model
Program B	Learn end to end Design Thinking through experimental application Introductory Course. Very fast, efficient course in busy business environment	90 mins	D School Model More emphasis on each step
Program C	Learners will describe the purpose, technique and skills used to generate creative ideas and demonstrate delivery of improved business results	90 mins	D school model in greater detail
Program D	Tailored individual program. Experiential learning through practical application of real problems or ideas	Timeframe is at the discretion of the team	The D school model was introduced and participants worked through each step to address an organisational problem

Table 1: Overview of internal design innovation training programs

Research Design

This exploratory qualitative approach applies a case study method (Yin, 2009), and provides deep exploration and understanding of an individual entity for the purpose of gathering insight into a larger group of similar types (Gerring, 2004). The study of MFSCo aims to provide greater comprehension of the dissemination and practical application of design capability to derive innovative results, considering the nuances of a complex multinational. The main purpose for selecting a qualitative case study method was to gain empirical data from individual participants regarding their experiences and the ability to contextualise employees' perceptions and applications regarding DT and innovation (Denzin & Lincoln, 2011).

To prevent any misgivings and demonstrate academic rigor, the researcher applied the six stage case study process developed by Yin (2009) and deepened guidelines outlined by Baškarada, (2014). The use of multiple approaches and data sources constructs validity in the research through data triangulation, as it utilises differing sources of information in contrast to investigative or environmental triangulation (Guion, Diehl, & McDonald, 2011).

Data collection and analysis featured the model inspired by the Design Capacity Model (DCM) (Storvang et al., 2014) in Figure 1 above. The original DCM was reframed and customised to reflect a large company structure and current organisational vernacular but the essence of the model remained unchanged. The majority of the customisations were name changes to existing nodes or removing /adding new nodes along the levers. Figure 2 illustrates the amendments.

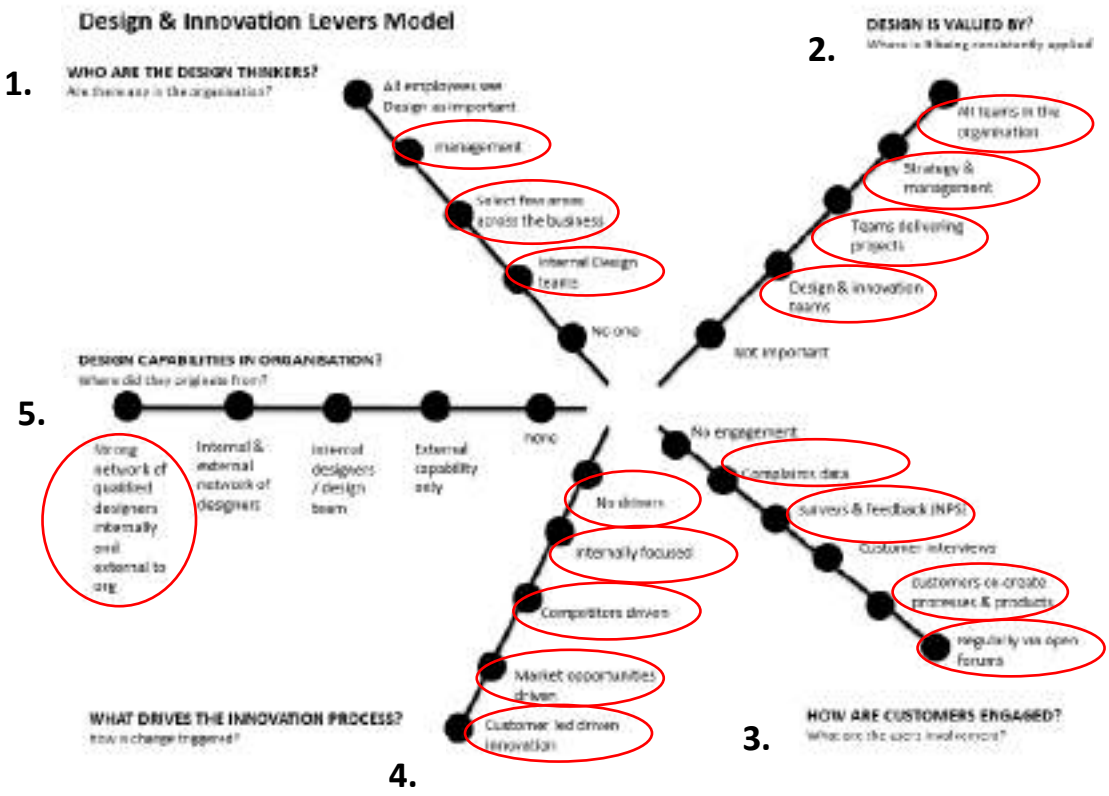


Figure 2: Modified Design Capacity Model (DCM) (Storvang et al., 2014)

Participating employees

Participating employees were selected from a range of diverse roles, primarily those in project, marketing, strategy and business improvement, rather than the functional or operational roles, where design capability may not be required. A diversity of participants were selected to acquire a broad appreciation of the dissemination of DT expertise from both bottom up and top down positions, incorporating both strategic and operational lenses. Participant sampling is shown in Table 2 and Table 3. Coding of responses referenced the role, location, and position of participants to identify patterns of responses and also ensured anonymity of the participants. An example of the coding is represented as (D-BNE-EGM).

Table 2: Participant selection (Departmental)

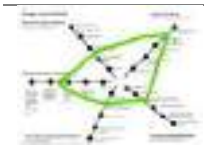
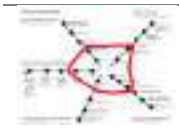
Department	***Distribution (D)***	***Claims (C)***	***Portfolio(P)***	***Operations (O)***	***Human Resources (HR)***	***Statutory (S)***
Participants	5	4	4	11	1	6

Table 3: Participant selection (Geographic and Managerial)

Location and Position	***Executive General Manager (EGM)***	***Manager (M)***	***Team Leader (TL)***	***Team member (TM)***
Sydney (SYD)	1	3	1	2
Brisbane (BNE)	2	4	7	8
Melbourne (MEL)	-	2	-	1

The researcher mapped the participant's beliefs about the organisation's position with regards to DT capability and its ability to deliver innovation, for each of the 31 participants. The five levers represent: who values design; customer engagement; drivers for innovation; design capabilities and design awareness. An example of the mapping and results is provided below in Table 4.

Table 4: Example of mapping the results in the modified DCM

	Who Values Design	***Customer engagement***	***Drivers for innovation***	***Design Capabilities***	***Design Awareness***
	Almost all of the organisation	Net promotor score (survey)	Internally focused	Mostly internal with help from design consultants	The design team with a few employees across firm
	Design & innovation team	Net promotor score (survey)	Internally focused	Mainly external consultants	The design team with a few employees across firm

Findings and Analysis

Individual maps were completed for each participant, collated in a table as demonstrated in Table 4, then each completed diagram compared, noting the key differences and similarities. The diagrams were divided into participants who did not attend any internal design innovation training programmes and participants who attended at least one of the programmes. This section provides a synopsis of the findings and then outlines three (3) broader themes identified from the findings: responsibility vs accountability; business centricity; and lack of integration and application.

Participants who did not attend any of the four-internal design innovation programmes

Six (6) of the thirty one (31) interviewee participants, who did not attend any of the four-internal design innovation programmes, were predominately senior strategic executives and managers. Two (2) of this 6 believed that all teams across the organisation valued design. 50% of participants highlighted 'employees delivering projects' valued DT more highly and one (1) participant stated *'a few outside of the design and innovation team'* valued DT. With regards to customer engagement, five (5) out of the six (6) participants focused on the long-standing net promotor survey (NPS) and feedback mechanisms as the primary way customers were engaged. The NPS is a national survey completed by a third party (such as a broker) on behalf of the customer, as the avenue for customer insights and engagement.

The innovation drivers for the organisation were evenly divided between external markets, internally focused or competitor driven. Perceptions regarding design capabilities currently in the organisation focused on the internal design and innovation team in conjunction with engaging external consultants to bring in design capability to the organisation. Lastly, design awareness was noted to be 50% 'a select few across the businesses' with two (2), of the participants highlighting design awareness is mostly contained to the internal design team with one (1) participant believing that management are aware of DT.

Participants who attended at least one internal design innovation programme

The remaining twenty-five (25) participants who attended at least one internal design innovation programme were predominantly front-line employees, first line leaders and managers from MFSCo. Many employees indicated that DT capability was concentrated in a few select areas across the business, and there was not a recognised DT capability in the management arena. Once again customer surveys were identified as the measure of customer's engagement.

16% of these program participants believed almost all of the organisation valued DT. 16% stated that the design and innovation team and those delivering projects valued DT and 12% of participants believed teams delivering projects valued DT. 52% participants nominated only the design and innovation team as the area that valued DT the most in the organisation. One (1) participant selected the node '*employees delivering projects with a positive shift towards a strategic focus*'. Employee (C-BNE-TL)

For Customer engagement, 13 of the 25 (52% of these participants) also selected the net promoter survey (NPS) as the main method for engaging with their customers.

Only eight (8) participants indicated that customer interviews had been undertaken to understand more about customers. Of those 8 participants, 6 had attended Program D of the internal design innovation programmes (See Table 1.), which promotes observations and conversations with customers to capture insights and identify patterns and themes based on the interview content.

With regards to the organisation's drivers for innovation, 17/25 (68%) stated the organisation was internally focused, primarily on internal efficiencies and improvements. One participant did select 'customer is the main driver' for innovation, outlining '*the customer is the primary reason we are in business and should be at the centre of everything we do*' Employee (O-BNE-TL).

For the dimensions of design capabilities recognised across the organisation, perhaps not surprisingly, the majority (13) of participants indicated that the design and innovation team, with assistance from external consultants held the design capabilities in the organisation. Five (5) participants noted that external consultants were brought in when design capabilities were required, for specific projects or needs. Interestingly, three (3) participants stated there was no DT capability in the organisation, adding that the design and innovation team were compiled of '*non-technically trained'* designers and "*they were the only ones who valued DT*" Employee (D-BNE-TM). This finding implies the employee may not require DT in their day to day role or has yet to see valid DT capability demonstrated across the organisation.

Lastly, 9/25 (36%) of participants believed design awareness was contained to mostly the internal design and innovation team with a select few across the organisation. 12/25 (48%) of participants noted that a 'few select teams' had an awareness of DT, indicating these employees were primarily related to those participating in projects, the design and innovation team and select managers responsible for change. Two (2) participants selected they believed only a 'few in the design team' held an awareness of design. Finally, one (1) participant selected that 'no-one' was aware of DT in the organisation.

Comparisons from all the completed participant diagrams

The overall participant diagrams were then compared and a thematic analysis applied to the data. The sub-themes identified in the data are represented as: responsibility vs accountability; business centricity and lack of integration and application.

Responsibility vs Accountability

The results show that senior management responsible for managing strategic decisions believed DT was valuable and important to delivering innovation. In addition, the notion that the design and innovation team contained design capability and were largely responsible for building and applying design capability was a popular view across the organisation. Unfortunately, there also appeared to be a distinct lack of investment in building these capabilities, or in encouraging wider application of any learnings undertaken.

One strategic leader expressed the value of DT at a strategic level, *"however we are not there yet".* Nevertheless, they did state *"there is an openness at that level to exploring possibilities and to challenge…."* Employee (C-BNE-EGM). This comment may imply that dialogue at the strategic level contains the notion of exploration and new possibilities, challenging existing approaches to solving problems. The concept of DT was acknowledged as a valuable tool for the organisation, and further education may be required to inform how strategic leaders can apply and drive design led innovation outcomes, without relying on one team to drive the expertise required to deliver change across the organisation. Describing their own limited investment in nurturing the DT capability required to enable innovative outcomes, also indicates an absence of responsibility and hence accountability for such outcomes.

Business centricity

An overwhelming emphasis on business centric thinking, in terms of the business forming a solution irrespective of customer insights was found. This distinct focus on internal drivers for innovation, with limited external inputs, particularly direct involvement from the customer or other external environmental factors, was a strong feature. This is not to say the employees were not aware of the importance of understanding the customer, however the ability to transfer those insights into tangible solutions was the challenge.

Harnessing and applying new concepts based on customer insights are difficult, particularly when they are in contrast to existing organisational methods, ways of working and tightly focused goals and objectives. Often in a business context, organisations develop a solution they believe a customer wants, based on their own projections, rather than capturing and applying the insights from the customer and developing solutions based on the wants and often unarticulated needs of the customer.

One participant stated that *"even going through the process (DT) the output didn't change…."* Employee (D-BNE-TM). This comment may indicate that the solution was developed before applying what they perceived as the DT process. Thus, customer insights were disregarded, and the solution was not necessarily based on what the customer was telling the organisation, but what met the immediate business needs and objectives.

Lack of integration and application

A disconnection between applying all the components of DT and the ability to generate the collective benefit of what design can bring, was found. For example, while design was valued highly by participants, limited customer insights were collected, mainly by front line staff in Claims and Operations. In addition, the drivers for innovation were often limited to internal drivers or exploring competitors' performance. The findings also noted that DT training was often brought in by external consultants, for often one teams requirement and not shared across the business. This team-based focus may indicate pockets where DT can be purposely applied throughout a team and extend beyond individual knowledge and skills.

One participant asked, *"how can you be innovative and add the design thinkers to a problem without the threat of slowing it down?"* Employee (D-BNE-M). This comment suggests their perception of DT as an activity carried out outside of the existing process to innovate, and perhaps a recognition that DT requires an added investment of time to achieve new value.

Discussion

The results reveal the difficulty encountered by the employees of MFSCo with regards to merging the mindset, skills and tools attributable to DT, with the celebrated structured analytical competence and the traditional, cultural environment found in a large established financial services organisation.

DT was valued most by the innovation and design team as well as with a few teams undertaking projects. The strategic leaders stated they valued DT as a method to deliver innovation. However there appears to be a distinct lack of investment in DT outside of the internal programmes which focused on foundational DT practices. The organisational change literature indicates that many developmental programmes build in ongoing projects, encouragement and support, mentoring and coaching to assist the implementation of new behaviours. These notions were not identified as present in the research interviews. In addition, limited time was allocated to practicing DT after attending the programmes. One consequence of limiting time for employees to properly apply or use the newly acquired DT capability is the restrained opportunity for integrating design with other practices performed across the organisation and generating new innovations. Many possible reasons why the value of DT and the relevant capabilities are not being valued and harnessed in entirety.

One possible reason for the absence of progress with design thinking capability is linked to the new knowledge and skill capabilities directly associated with DT. Consider Martin's (2010) description of DT as the balance of analytical excellence and intuitive ingenuity when applying design capabilities in a business context. Where DT takes the best of both traditional analytical thinking, including deductive and inductive logic, in conjunction with abductive reasoning. Kolko (2010) describes abduction as intuitive thinking or using gut instinct and allows for new ideas (innovation) to flourish, whereas inductive and deductive reasoning cannot deliver any new knowledge or discoveries, limiting innovative opportunities (Dorst, 2010; Kolko, 2010; Martin, 2009). In a highly conservative industry structured frameworks, technical expertise and analytical skills are often highly valued. These competences frequently utilise deductive, inductive logic and quantitative methods for problem solving not abduction, intuition or creative pursuits. Training employees to apply and adopt creative, messy techniques that encourage observed insights, an experimental mindset and iterative processes that include failure in order to learn, may require more significant time and expertise than was observed. Given tight timeframes, high expectations of financial benefits from invested projects, and hierarchical complex structures the ability to apply intuitive, creative solutions that may fail is challenging to traditional organisational management.

Traditionally for new projects to be funded, proposals for novel ideas require demonstrable evidence, substantiated by quantifiable and measurable metrics, often in the form of a business plan. This business approach seldom aligns to DT, where insights arise from abductive reasoning in the form of hypotheses and suggested solutions may be outside the organisational financial objective. Therefore, to improve the connection of DT to innovative outputs and establish value, MFSCo should focus on integrating new capabilities through implementing DT via experimentation, through minimal cost and resource as maturity and skills grows across the organisation (Dorst, 2010). Harnessing differing views and mindsets that allow for creative transformative innovations, will show the way design can integrate into the current knowledge and skills within the organisation by way of proven examples and applied techniques.

Through application of DT in small projects and building capability through experimentation, the value of DT could be enhanced and the shifts in management perspectives may embrace the designer's skill sets. As stories and case studies that demonstrate the usefulness of DT in this organisation and its context are developed and collected, the appetite for further engagement with DT mindset and methods is more likely to progress. In addition, longer and more extensive experience with DT in relevant, related projects, perhaps with ongoing coaching and mentoring may be more beneficial.

Limitations

The exploratory modification of the DCM used to extend this framework to large organisations is an experimental approach and has not yet been validated with further studies. However, such identification of levels and mapping changes for comparison over time may lead to new research on DT capability for improved performance in large corporations.

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Research Perspectives IN THE ERA OF Transformations

The Organization as a Prototype

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Some of the most valuable companies in the world accumulated their fortunes as a result of a business model innovation built upon matured technologies. Now the majority of them are investing and shifting their focus to the development of new technologies such as AI, blockchain and genetic editing. If an organization is to remain profitable, it needs to be able to quickly adjust its structure to the rapidly changing context. We contend that a way to do so is to build an organizational structure that is conductive to both generative and evaluative prototypes. We report on our action research with a leading European airline following the transformation of a team of four into a new department, through the lenses of continuous prototyping. We then propose an initial framework that conceptualises organizational prototypes and provides a rational and systematic way of approaching the devising of such. Finally, we outline several directions for further research.

Keywords: prototypes, ways of working, emerging technologies, organizational design, generative prototyping

Introduction

The past 25 years brought us some of the most valuable companies in the world today – Google, Amazon, Uber, Facebook. Their rise became synonymous to unprecedented growth and business model innovations built upon matured technologies. However, we're entering a new era of technological development that becomes so enmeshed in users' everyday lives that it is difficult to judge the extend and kind of impact it will have on them. In the past few years we have witnessed the exponential investment and developments in new technologies such as Artificial Intelligence (AI), blockchain and genetic editing, largely due to the unprecedented computational abilities and the amounts of generated data daily. In fact, it is not uncommon to see all these companies who made their money off long-established technologies heavily investing in new ones. For instance, in their 2018 product launch, "Made by Google", Google announced its focus to be "software + hardware + AI" (Made by Google, 2018). Amazon, the most valuable company in the world that started as an online retailer, owns the biggest cloud service – Amazon Web Services (AWS). Historically Microsoft has been largely dependent on Windows. Yet in 2018 the product Windows ceased to be a separate business unit, so the focus could be shifted to cloud services that can provide other companies with the infrastructure on which they can run their data (Warren, 2018). Furthermore, the infamous startup unicorn Uber is investing billions in the development of self-driving technology (Somerville, 2018), competing with Tesla and Alphabet's Waymo.

The current pace of development of emergent technologies is defined by high degrees of uncertainty and companies built on agile principles that continuously adapt and work in fast iterations. It is precisely the desire

to reduce the adverse feelings of uncertainty caused by the rapidly changing context that serves as a strong motivator guiding organizational adaptation (Beckman et al., 2004; Akgün et al., 2012). Yet some organizations continue to be more agile than others (Panditi, (2018). However, if an organization is to not only survive but become/remain profitable, it needs to be able to rapidly deal with uncertainty by thoroughly understanding the different contexts in which such technologies can be implemented. Moreover, they need to have the capabilities to develop solutions employing them. This notion necessitates the establishing of methods and consequent organisational structures that allow for rapid development (also termed as organizational adaptiveness (Gibson & Birkinshaw, 2004) or ambidexterity (Tushman & O'Reilly, 1996)).

This paper presents our attempts to reduce the abstraction associated with theories on how such organizational structures are created and sustained by utilizing the design practice of prototyping. Prototyping is widely recognized as a means to deal with high levels of uncertainty (Buxton, 2007). Furthermore, it accelerates the learning by serving as a means of communication and validating hypotheses early in the development process. As such, we will present the emergence of an adaptive organizational structure by tracing its evolution from the introduction of methods and tools to the full adoption of a new way of working (WoW). While the notion of organizational WoW certainly does not exhaust the entirety of what constitutes an organization, it is our contention that it can serve as a first step in building a new organizational structure (Stoimenova & De Lille, 2017;2018).

This article is structured as follows. First, we elaborate on the nature of prototypes in design. Then we explicate the methodology behind the study and the generated insights as a result. We will report on our attempts in transforming a 4-person team within the operational department of a European airline, Air, into a division that is continuously re-inventing itself. Initially created to check ideas' feasibility and desirability early in the NPD and eventually accelerate the firm's pace of innovation, the team's new approach has grown to almost the entire operation of the airline. Based on principles of Lean Startup (Ries, 2011), Scrum (Schwaber & Beedle, 2002) and Design Thinking (Brown, 2008), its premise is to create ideas, prototype them in a matter of days (using MVPs) and test as soon as possible with real passengers and employees either at the Departure hall, one of the three dedicated gates at the airport or during flights. As such we helped them to establish a new WoW tailored to their context. This allowed them to involve internal and external stakeholders early in the process and then create, test and implement new ideas in live environments with real passengers, employees and flights. The generated insights are used as a foundation for the creation of an initial framework on how to conceptualise organizational prototypes that could be conductive to rapid exploration and development of emerging technologies and continuous re-invention of the firm itself. We conclude the paper with recommendations for further research.

The nature of prototypes in design

Prototypes are widely recognised as an important means to explore and communicate what it will be like to interact with future products, systems and services (Buxton, 2007; Lim, et al., 2008). As such, they can play different roles– evoke a focused discussion in a team, test hypotheses, confront theories, allow users to experience their world differently (Sanders & Stappers, 2014) and minimize design errors that may otherwise occur late in the process (Deininger et al., 2017). Many definitions of what constitutes a prototype exist complemented by a plethora of methods and tools serving each sub-field of design. Some of the most widely adopted types are summarized in Table1.

Table 1: An overview of the most popular types of prototypes

Type	*Description*
Minimum Viable Product (MVP)	*Contains the minimum number of features that allow companies to gain the maximum amount of insights and test their fundamental hypotheses on value and growth. As such, "an MVP is designed not just to answer product design or technical questions. Its goal is to test fundamental business hypotheses" (Reis, 2011).*
Experience prototype	*Aims to understand, explore or communicate what the experience of a solution might be. Its value lies in the prototyping attitude that requires the blending of multiple disciplines and a low-technology mindset (Buchenau & Suri, 2000).*
Boundary object	*Both designated (prototypes) or emergent objects can be used (Levina & Vaast 2005). It exhibits different meanings in different social/professional contexts. Yet, it has a structure that*

	is common enough to more than one community and thus it's able to transform knowledge in new product development (Carlile, 2002). This makes it a recognizable means of translation (Star & Griesemer, 1989; Eppler & Pfister, 2011).
Conscription device	*Enlists and engages participation of those who will later employ and/or build on it (Henderson, 1991; Roth & McGinn, 1998) to shape knowledge (Bendixen & Koch, 2007). It facilitates linkages between the meaning of the object and the knowledge of the network around it (Hölttä, 2013). It also aids with reasoning, reflection, and the linking of items in new ways to enable discoveries (Karsten et al. 2001).*

Prototypes are primarily seen as a tool to evaluate design's failure or success (Lim et al., 2008). For instance, to Sanders & Stappers, (2014), prototypes are usually put into action once the "design opportunity has been established". This view is complemented, among others, by Dong and colleagues (2016), Eekles and Roozenburg (1991) and Takeda (1994) to whom prototypes are to be used for evaluation and testing of hypotheses and requirements. This is in line with widely adopted approaches such as Agile, Lean Startup and Design Sprint (Knapp et al., 2016).

However, using prototypes in their evaluation capacity has its limitations due to the flexible, reflective and problem-setting nature of design (Schön, 1982). A design solution can never guarantee it is the best since there are many possible ways to tackle a (wicked) problem (Buchanan, 1992). Moreover, an examination of design practices shows that evaluative prototypes (i.e. during usability testing) are a relatively small part of the entire design process (Lim et al., 2008). Prototypes are also oftentimes used to help designers learn, discover, generate, and refine designs (Buxton, 2007) by stimulating framing, and discovering possibilities in a design space (Lim et al., 2008). In effect, becoming the means of a generative discovery that could play a pivotal role when new technologies and their impact on societies should be understood, as is the case with AI, for instance. The notion of externalisation of thought as an impetus for creativity (Clark, 2001; Magnani, 2007), a means to finding new aspects of a problem and generating new ideas to solve it is widely recognised in design (Suwa et al., 2000). By giving rise to new perceptual and cognitive operations that allow for reflection, critique, and iteration (Clark, 2001), externalisation helps designers develop and communicate their ideas through "physical" manifestations (Zucconi et al., 1990). These can take any form, shape, and appearance, based on the choice of material (Lim at al., 2008; Deininger et al., 2017) and provide help with the invention of important design requirements of a given problem (Schön & Wiggins, 1992).

To our knowledge, there are several attempts to define a taxonomy of prototypes (i.e. Lichter et al., 1993; Gutierrez, 1989) – all primarily based on different ways of using prototypes in a development and design process. However, developing generally applicable prototyping methods is not viable when faced with the complex variety of design (Lim et al., 2008). To understand how prototypes could be used in an organizational context, we will review the insights gleaned from our work with Air.

Methodology

This paper reports the result of an action research in Air. It was carried out in the span of 3 years and followed the transformation of a 4-person team into a new department. The first author carried out participant observations, complemented by more than 20 sessions and 10 semi-structured interviews with the growing team during the first year. Furthermore, she was involved in the creation, shaping and initial implementation of their new way of working (WoW). The study also followed the way the team tried to involve internal and external stakeholders and grow to the entire operational side of the firm. She was supported by a design MSc student, who helped her to facilitate some of the sessions. Subsequently 5 more interviews were carried out to gauge new developments in the last two years. All interviews were transcribed and cross-referenced with the accounts of participant observations and extensive literature review stemming from the areas of design cognition and methodology, and Participatory, Engineering and HCI design. As such, both inductive (Patton, 2014) and deductive (Crabtree & Miller, 1992) coding was used. The second author initiated and oversaw the transformation. The third author was regularly involved in the research through three MSc students performing research for the team.

The initial research is discussed in our previous work on implementing design principles and establishing the foundations for a new organizational structure in Air (Stoimenova et al., 2016; Stoimenova & De Lille, 2017) and cross-referenced with a study in a technology B2B company implementing the generated insights as discussed in (Stoimenova & De Lille, 2018). However, this research adopts a different frame of looking at the results – that of the role prototypes played in the change of the organizational design.

Results

In this section we will explicate the initial stages of how the team grew to an entire department through the lens of the different prototypes we used. The starting point was the new WoW the first author helped the team develop. As already mentioned, it's based on well-established principles from Lean Startup, Scrum and Design Thinking manifested in six main phases. Each new project starts with formulating a clear ambition (a purpose). This is followed by understanding of the problem using qualitative and quantitative data. Once such understanding is obtained, the team starts ideating on possible solutions. They then build an MVP (prototype) and test it in a live environment part of the airline's operations. The project ends with a thorough reflection and the making of a decision whether to adjust, kill or scale the solution. The WoW is carried out in increments of 2-week sprints.

The research employed a nested principle, in which MVPs and experience prototypes devised for user testing and hypotheses validation were used as a foundation around which prototypes of sessions, tools, templates and methods can be built. We started by understanding how the new WoW can be implemented in the Air's context. Such necessitated a better grasp on how to enable the team of non-designers to understand their context by using design principles and tools. The first step was to create a way to elicit insights from passengers waiting to board their planes quickly. To do so we used more than 10 sessions at the gates to prototype and test different tools, approaches and templates. This triggered the need to enable the team to work with such insights and involve stakeholders throughout their process. Thus, optimal ways to involve stakeholders had to be discovered by prototyping different sessions around on-going projects. These sessions were used as conscription devices, as not only stakeholders but also team members were involved to understand how to facilitate and organise such. They were also used as boundary objects allowing for the communication of the importance of such to other departments and new additions to the team.

These prototypes helped us reflect on the WoW and detail it for the context the team was in. This was enabled by vicarious learning and creating a shared understanding of the rationale behind each used method. The multiple sessions complemented by templates, explanations and modified to the context tools and methods created a noticeable change in the capabilities of the team. They also provided the foundation for a new (shared) mental model (Rouse & Morris, 1986) on how the WoW could be carried out. We label the changes in capability and mental model as culture. Finally, we observed changes in the infrastructure of team and subsequently the department regarding the needed resources (both human and monetary) and the extent of involvement of stakeholders. As such, our definition of infrastructure is similar to the one of Star and Ruhleder (1996). These three elements – WoW, culture and infrastructure – coincide with the factors crucial to design adoption discussed in Stoimenova and De Lille (2017; 2018).

In Table 2, an overview of the purpose of the prototypes we used, and their descriptions can be found. These initial attempts are also described in detail in Stoimenova and colleagues (2016; 2017; 2018). The table is structured as follows: the purpose of the used prototypes is stated paired with a short description. Then the form in which the prototype manifested itself is noted.

Table 2: An overview of the different types of prototypes used in building up a department

Purpose	*Description*	*Prototypes of*
Understand how to gain insights from passengers at the airport (in less than 15 minutes)	*Used over 10 sessions at the gates of the local airports to gauge how to involve passengers who are waiting to board their plane and usually have less than 15 minutes to spare. We went through several iterations of what set up to use, how much time should be spent per passenger, find tools and methods that are effective and efficient in the environment, how to elicit tacit insights and latent knowledge and overcome language barriers. In the process we worked with tools such as context mapping (Sleeswijk Visser et al., 2007), Lego, Brainwriting and Journey mapping. The sessions are described in detail in Stoimenova and colleagues (2016) and were later used as boundary objects to communicate the importance of involving passengers to the team.*	*Templates* *Generative methods* *Method setup* *Tools* *Passenger communication* *Sensitization*
Increase the amount of time team spends on exploring the	*Initially the team spent on average 2 hours during every 2-week sprint on exploring the context and coming up with new ideas. To increase the time spent, first the results from the passenger sessions were used as a boundary objects, then two four-hour ideation sessions were carried out*	*Templates* *Tools*

context and generating multiple solutions	*with the team and a few stakeholders. The duration of the sessions grew to 2 days of context exploration and ideation with stakeholders as part of a Design Sprint. The sessions were used as conscription devices.*	*Methods* *Sessions (duration)*
Create capabilities in non-designers to facilitate ideation sessions	*We carried out 6 different sessions to first understand the needed level of capability. Then, to create such, explanatory materials, templates and new methods were introduced to the team and used as conscription devices. The sessions were also used to train the team in facilitating such by sharing the process and creating a template and guidelines. These were paired with vicarious learning and explanation of the basic principles behind each activity. All prototypes were used as conscription devices.*	*Explanatory materials* *Templates* *Methods and tools* *Guidelines*
Understand how to create a sense of ownership among stakeholders	*Used the different sessions to involve operational employees in the ideation sessions, paired with regular involvement of operational employees in testing of on-going MVPs. Also, a dedicated moment in which stakeholders come together to ask difficult questions, called a "roast" became a standard procedure.*	*Team composition* *Involvement structure* *Tools* *Templates*
Understand how to test in live environments	*All MVPs during the first year of the research were used to gauge how to test and collect information from the users (both passengers and employees).*	*Solutions* *Test setup* *Communication* *Interviewing methods* *Result analysis* *Adjusting solutions in the field*
Understand how to prototype services in live environments	*A Design Sprint was carried out with the core team (6 people at the time) to prototype the structure of the sprint itself and adapt it to the context of Air. Further, ways to prototype a service in a live environment, the necessary time allocated for each day and the level of detail of a service MVP were explored. The sprint was used as a conscription device which was later further elaborated upon.*	*Team composition* *Design Sprint structure* *Test setup*
Understand how to involve a different department	*Prepared and facilitated a design sprint with another department of Air to understand who and when to involve, manage expectations, share insights, how elements of the way of working can be translated to the department and determine a possible way of communication. The sprint was used as a boundary object.*	*Communication* *Inter-departmental collaboration* *Method setup* *Test setup*
Understand when, how and what employees to involve	*A Design Sprint and the aforementioned sessions were used to understand what type of people need to be involved, when and in which manner to involve them. They were later used as a boundary object to communicate the importance of the WoW and ultimately help it spread to the entire operational side of the firm.*	*Employee involvement* *Team composition*
Understand how to combine and communicate qualitative and quantitative data	*Initial attempts were based on the research done with passengers. They were used during the design sprints and the sessions. However, they were mainly qualitative-oriented. This research is currently ongoing as the first author is involved in establishing a deeper understanding of how to combine and communicate thick and thin data.*	*Method* *Communication* *Templates*
Understand how to structure the newly-established department	*Two 1-day events were carried out once the newly department was established to understand the future of the department, the topics it needs to tackle, the culture and communication it needs to have through the means of multiple break-out sessions*	*Methods* *Communication* *Templates* *Tools*

The use of prototypes helped us explore the unusual context of the team and rapidly define an initial version of a WoW through the use of conscription devices, boundary objects, MVPs and experience prototypes.

However, using these generally applicable prototyping methods is not always viable when faced with the complex variety of design (Lim et al., 2008). Therefore, the creation of a rational and systematic way to approach the devising of prototypes in an organizational context is necessitated. A way that will provide the guidelines on how prototypes with evaluative and generative purposes can be devised on both project and organizational level.

Framework for Organisational Prototypes

To our knowledge, one of the most prominent works on conceptualising prototypes' dual nature by providing a systematic and rational way of devising them comes from Lim and colleagues (2008). Developed for the field of Human-Computer Interaction (HCI), their anatomy of prototypes is based on two dimensions that are interconnected and influenced by each other – filters and manifestations. The former identifies an initial set of design aspects a prototype might exhibit such as appearance (i.e. size, color, shape), data (i.e. size, type, privacy), functionality (i.e. system function), interactivity (i.e. input and output behavior), and spatial structure (i.e. arrangement of interface). The decision of what to filter is always based on the purpose of prototyping. Once a filtering dimension has been selected, choices should be made about the way the idea will be manifested. Lim and colleagues identify three manifestation dimensions – prototype's material, the resolution of its details (corresponding to the notion of fidelity), and the scope (whether the prototype covers one or several aspect of the design idea). These dimensions can be determined, they claim, by following the economic principle of prototyping: "the best prototype is one that, in the simplest and most efficient way, makes the possibilities and limitations of a design idea visible and measurable.".

Combining their anatomy with the gathered insights from Air on how a WoW is prototyped, we propose the following framework that can assist organizations in creating organizational prototypes. First, we start with the filtering dimensions. As already suggested in the Result section, the WoW influenced the culture and infrastructure of the department. Therefore, we contend that the dimensions through which to filter could be **way of working**, **culture** and **infrastructure**. However, although the filtering dimensions could provide an initial direction for prototype formation, knowing only what to filter can neither fully determine how to form a prototype nor provide strategies for devising it. Therefore, once the purpose of the prototype is filtered, the proper manifestation should be selected. To do so, all of its three dimensions must be considered: material, fidelity and scope, as they all inform and impact the way a prototype is being devised. We stayed close to the dimensions provided by Lim et al. (2008) by substituting only resolution with fidelity as the term is more regularly used both in design and software development literature. However, the majority of the example variables we provide stem from our research in Air. The dimensions and their corresponding sub-dimensions can be found in Table 3. These dimensions and their variables are not exhaustive, however. They simply provide a general guideline of factors that might be considered. However, this framework requires further research and elaboration.

Table 3: An overview of the manifestation dimensions

Manifestation	*Description*	*Example variables*
Material	*Different types of physical and digital materials that can be used when prototyping products and services*	*Physical material (e.g. paper, plastic, wood, Lego)* *Methodology* *Data* *Sessions*
Fidelity	*Fidelity refers to how closely the prototypes resemble the final product in terms of visual appearance, interaction style, and level of detail (Petrie & Schneider, 2007).*	*Low* *Medium* *High* *Mixed (Petrie & Schneider, 2007)*
Scope	*The number of aspects of the design solution a prototype covers*	*e.g. Template* *Tool* *Method*

We believe using such framework will assist in creating a common understanding of the nature of prototypes used in similar contexts. Further, it will help to design an organization that can further develop new technologies, explore contextual implications and generate profitable business models. It will also provide a language for articulating the characteristics of a particular prototype that could be used to prototype organizations.

Conclusion

This article started with the contention that in order for an organization to continue being relevant and profitable, it needs to create an organizational structure that will allow it to rapidly and iteratively develop emergent technologies and understand how they impact its context. Then to exemplify how this could be done we reported on our initial efforts of growing a small team into a department, whose purpose is to rapidly develop, test and implement new ideas. The transformation was achieved largely by the extensive use of both generative (boundary objects and conscription devices) and evaluative (MVPs and experience) prototypes. This allowed us to outline a framework that can explicate and systematise the conceptualisation of organizational prototypes in a rational way. As such, this research provides an ample ground for further investigation in two directions – understanding the way both generative and evaluative prototypes can be used to further develop and implement emerging technologies and discerning the role a department that continuously prototype its parts could play within an organization.

Discerning possible ways to further develop emerging technologies

The first direction stems from the fact that we are still in the early stages of development of technologies such as AI (what Vinge (1993) terms narrow AI) and their potential impact and implications are still largely unknown. The discernment of the possible implementation areas and their business value is also in its infancy stages. While the presented here WoW's build-up does not directly specify how to deal with such emergent technologies, it provides a solid foundation for such due to its iterative and adaptive nature. Therefore, more research is needed to determine how to work with a technology that continuously changes the value it delivers as it interacts with data and the users, as AI does. We contend a viable initial direction to be the use of prototypes due to their ability to make the abstract future effects of a solution tangible (Lim et al., 2008).

However, to do so attention has to be paid to both generative and evaluative prototypes. Based on our action and literature research, we argue the former to be suitable for the exploration of the problems connected to emerging technologies and their implications on society. Evaluative prototypes such as MVPs are already largely recognised for their ability to test assumptions and validate business hypotheses (Reis, 2011). Both types are of equal importance and should be continuously employed throughout the development process of a solution to ensure its successful deployment/implementation.

More research is needed in this area, however, to identify the ways such prototypes can be created and built upon. It is our contention that the structure we developed in Air provides a solid foundation for doing so. Moreover, it is conductive and favourable to both generative and evaluative prototypes since the department's organizational structure was largely a result of multiple prototypes. Last but not least, further research is needed to understand the ways such prototypes can be implemented within existing ways of working, cultures and infrastructures and the implications they will have on organizational structures. We are currently carrying an action research to gain initial insights on the topic.

The role of the department-prototype

In the process of this research we continuously prototyped every single element of what later became a newly-formed department. This led to a department built upon an amalgamation of several layers of prototypes serving different purposes. Therefore, we argue that the department itself could be seen as a big prototype geared towards the continuous exploration of its changing context and validation of its ongoing hypotheses. Seeing the Air's department as a prototype is not far removed from the way the most successful startups in the past two decades have made the development of an MVP central to the way they grow and

structure themselves. The definition of a startup is a "temporary organisation whose goal is to search for a sustainable and profitable business model" (Livingston, 2007). The ability to be flexible and continuously pivot in terms of market or product strategy is another marker of what being a successful startup entails (Hoque, 2012). These definitions are well-aligned and complementary to the transformation of the Air's four-person team. However, the development of the department we described needs to be further researched to explore the roles such organizational unit can play within a bigger organizational structure and how it can contribute to the profitability of the firm. Moreover, additional insights are needed to discern how such a department can continuously prototype itself and foster both generative and evaluative prototypes.

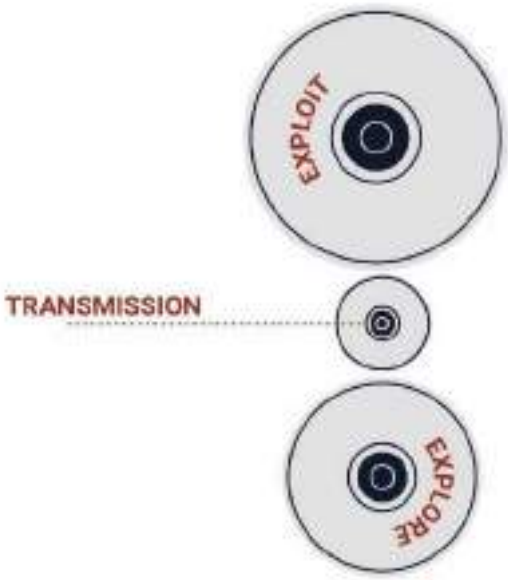

Figure 1: the three wheels of DLA (Stoimenova & De Lille, 2016).

A concept that can point at initial search directions is that of design-led ambidexterity (DLA) introduced by Stoimenova and De Lille (2017; 2018). DLA is based on the notion of ambidexterity defined as "the ability to simultaneously pursue both incremental and discontinuous innovation… hosting multiple contradictory structures, processes, and cultures within the same firm" (Tushman & O'Reilly, 1996). As such, implementing organizational ambidexterity allows companies to simultaneously manage current business demands and adapt to environmental changes (Mom et al., 2015). It constitutes of three elements, employing the metaphor of three constantly rotating wheels. Exploitation allows the firm to improve the efficiency of implementation and production of its already existing capabilities and knowledge. Exploration is characterized by search, experimentation, play, flexibility and investigation, and can result in new knowledge (Tabeau et al., 2016). However, many challenges exist when trying to make the collaboration between exploration and exploitation wheels smooth (i.e. rotate in the same direction) (Oehmichen et al., 2016) due to their distinct nature, roles and influence they have on innovation outcomes (Tabeau et al., 2016).

The Transmission is designated with the task of ensuring the smooth and profitable collaboration between the other two wheels. As its name suggest, it transmits and adapts the signals from Exploration, so the Exploitation can pick them up easily. Moreover, it gives signals back to each wheel to ensure their corresponding structures, processes and cultures could be adjusted accordingly. It is also in its nature to continuously adjust its size and rotation pace to ensure the smooth collaboration of the exploration and exploitation wheels. From the three elements depicted in Figure 1, we argue the structure and role of the transmission can provide a fertile ground for a department that continuously prototype itself. However, further research is needed to understand how to fully build a department that acts like a Transmission and its implications on a firm's structure and profitability. As such we are continuing our investigation of the department through the means of action research.

We are entering a new innovation era of multiple emerging technologies. Organizations are faced with three options: don't adopt new technologies, rely on companies such as Microsoft, Amazon and Google to provide them with the infrastructure that can run (or provide) data, or further develop and understand how the technology can be applied to their specific context. It is the latter two options that offer multiple benefits to firms, if employed well. The impact and potential of such technologies are still largely unknown, so are their business models. Therefore, both cases require companies to create the necessary capabilities to quickly adapt and respond to such changes. We are too early in the technology development cycle to fully understand and predict its implications. However, an organizational structure that can continuously and rapidly adapt to its changing social and technological environment is of paramount importance.

Despite the plethora of innovation frameworks such new developments can instigate, they will always need to be adapted to a context. However, due to the unexplored implications and changes such new era will entail, it

is difficult, if not pointless, to attempt to create such. This, in fact, is the epitome of a wicked problem to which we cannot find the best answer. However, we need an approach to deal with it. Our work with Air leads us to believe that a viable way to tackle such a problem is through continuous prototyping that essentially turns the organization into a prototype. However, we intentionally did not specify how such structure should look like. Instead we introduced the initial stages of a framework that allows organizations to rapidly discern which way of working, culture and infrastructure are most suitable for their context and fit with their ambitions. We believe establishing such capabilities in a firm can prove invaluable for its sustained profitability and relevance.

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Track 5.g Introduction: Design with Foresight: Strategic Anticipation in Design Research

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Introduction

Global changes in the 21st century appear intractable as social, technological and environmental trends force the contemporary organization to address these uncertainties in vision and strategic direction (Vecchiato, 2012). Enterprises across nearly all sectors of the globalized economy must adapt competitive strategies to anticipate specific political, resource, and market uncertainties that could impact expected growth and broader social benefits (Buehring & Liedtka, 2018; Wilkinson, Mayer, & Ringler, 2014). Yet the inclusion of strategic foresight within system, product and service design projects has yet to reach its potential in business enterprises.

Given the uncertainties these often-cited global trends impose, why are decision makers not relying on strategic foresight to inform design decisions and strategic product service development? The most popular business design processes continue to be decidedly short-term reasoning practices: Agile, Lean, and Design Thinking are at least three problematic methodologies that might repel or constrain the uptake of serious futures anticipation. Business foresight practices are commonly relegated to strategy development, thereby informing business models and competitive strategy, but not necessarily the productive design capacity of the enterprise.

While design often addresses complex business problems for today's world and the immediate future, strategic foresight develops alternative scenarios for the futures in which these solutions will exist. Scholars and educators in these core fields are devoting increased attention to the question the most effective organizational process or fit for successful, actionable long-horizon strategies (Bishop, Hines, & Collins, 2007; Heskett, 2009; Rohrbeck, Battistella, & Huizingh, 2015; Slaughter, 2002).

The themed track features 4 submissions from nine authors who share important insights, new knowledge, and research outputs relevant to design and innovation management practice and the integration or effective processes of strategic foresight applied to decision-making.

In the paper titled "The Role of Horizon Scanning in Innovation and Design Practice", Isabel Meythaler and Elies Dekoninck focus their investigation on how horizon scanning (HS) is used by practitioners to create foresight for design and innovation. They address two questions: first, how do innovation practitioners spot and act on changes in the business environment, consumer and technological landscape? Second, what methods, tools, and approaches are used? Key insights from sixteen in-depth expert interviews are reported. The authors make three contributions. First, they discuss the role and importance of horizon scanning for innovation and design. Second, they identify dominant methods and approaches used within horizon scanning. Third, they compare the methods typically used by different types of innovation practitioners. The authors report that HS in conjunction with creative and lateral thinking, technology scouting as well as human-centred

thinking have two outcomes: first, it facilitates the early detection of emerging trends and technologies and (b) it facilitates turning insights into actionable ideas, increasing the likelihood of more successful product development, meaningful innovations, and sustainable competitiveness. These findings are insights and guidance for managing horizon scanning and incorporating it into innovation and technology management strategies.

Challenging predetermined frameworks and biases to planning the future, Timothy Stock and Marie Lena Tupot put forward an argument for designers practicing foresight to overcome their inherent bias toward a world informed by the known and experienced. It is proposed that exploring and planning for the future requires a deeper understanding of a cultural system and language that represents the dynamics between the concrete (known) and abstract worlds, thus needing a mapping system that could help designers to think on multiple abstract levels to anticipate change and make sense of signals, signs, and cultural meaning relevant to their future designs decision-making. This paper is bringing to our attention the need for new design foresight relevant research approaches needed to deal with uncertainty, and the causality of sustainability, and ethical futures considerations. The authors draw on fundamental research design considerations relevant in futures studies, providing relevant examples and case studies in support of the argument that the prevailing design ideology and vocabulary is informed by one of materiality and technology.

In the paper titled “Bringing futures scenarios to life with video animation: A case of disseminating research to non-expert audiences”, Jörn Bühring and Nury Vittachi draw attention to research disseminating practices expanding beyond traditional media of publication. That is, research findings in the social sciences, including scenarios produced in futures research, are typically reported in client reports, monographs, white papers and journal articles. The purpose of this paper is to investigate video animation as a way to communicate futures scenarios to nonexpert audiences, corporate decision-makers, and their staff. The process presented in this paper is based on a case study in which academics and designers at a design school took the findings of a financial services futures study and applied storytelling and visualization techniques to bring futures scenarios to life with video animation. The study outlines the four-step process of developing a video animation – the challenge, the exploration, the interactions, and the delivery. Each stage in this process involved techniques and choices to realize the objective, to bring the future to life and make it real for a general audience. The paper concludes with ten recommendations for producing quality videos based on future scenarios.

Finally, Eliana Ferrulli, Caroline Nohra, and Silvia Barbero’s RETRACE project cites a systemic design study connecting the functions and methods of strategic foresight to regional planning and development strategies. The challenges her team engages involve the creation of a policy and economy learning network across five regional enterprise communities, with eight partners coordinated by a systemic designer team in the EU-based project. Here the formation of a foresight-based strategy is driven by the necessity to conceive coordinated actions for multi-sectoral transitions to circular economy programs. Coordinated regional engagements such as RETRACE are fairly rare in other parts of the world. Their application of advanced systems-oriented design and foresight as cross-cutting (generalized) approaches in regional development policy provides appropriate methodological pluralism for a creative learning strategy. Many aspects of such a high-complexity engagement might be forbidding to other policy making or design thinking approaches –Such bio-socio-economic transition planning is certainly complex enough of a program. With the project engaging over 70 stakeholders from different countries and regions, touching dozens of companies and planning actors, totally different local economies, it is clear to see the requirement for a systemic approach.

With this eclectic mix of ideas and contributions, the Design with Foresight track explored the value of strategic and creative foresight in design and innovation, together improving the designer’s and the organization’s learning to adopt new methods in their innovation practices.

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The Role of Horizon Scanning in Innovation and Design Practice

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This paper aims to investigate how horizon scanning (HS) is used by practitioners to create foresight for design and innovation and which methods, tools and approaches innovation practitioners use for spotting and acting upon changes in the business environment as well as in the consumer and technological landscape. Thus, this study contributes to the field of horizon scanning and innovation management by presenting the results from 16 in-depths expert interviews with innovation practitioners. Specifically, the aim of this research was to: discuss the role and importance of horizon scanning for innovation and design; identify dominant methods and approaches used within horizon scanning; and compare the methods typically used by different types of innovation practitioners. This study discovered that HS in conjunction with creative and lateral thinking, technology scouting as well as human-centred thinking not only facilitates the early detection of emerging trends and technologies but also facilitates turning insights into actionable ideas, increasing the likelihood of more successful product development, meaningful innovations and sustainable competitiveness.

Keywords: horizon scanning, practitioners, interviews, dominant methods, comparison

Introduction

Ever-increasing consumer expectations, the subsequent launch of products with new, more convenient and improved features, and the emergence of technological advances create highly-competitive and fast-changing business environments. Therefore, the need for businesses to place innovation at the core of their business operations is intensified, as innovation is widely regarded as being key to success and a vital element for ensuring future growth and survival (Tohidi & Jabbari, 2012).

Companies' inability to foresee and react to new technologies, new customer demands or competitors with new products, services and business models is one of the main reasons why they cease to exist (Watson, 2017; Brown, 2007). It is argued that companies adopt future-oriented approaches to proactively equip themselves with methods and tools that enable them to anticipate and act upon signals of change and emerging trends and technologies in order to operate more sustainably and competitively in today's complex economic and volatile environment. In fact, a survey of 91 executives discovered that 24% classified "lack of coherent vision for the future" as one of the biggest obstacles to transform in response to market change and disruption (Anthony et al. , 2016). Another report confirms the prior findings as 42% of 270 innovation, strategy, and R&D executives regard the "inability to act on signals of change or developments critical to the future of the

business" as a major obstacle to innovation (IL & KPMG, 2018). This paper set out to investigate how Horizon Scanning (HS) tools and methods used in innovation and design practice might help address these challenges.

Horizon scanning: Terminology & Definition

Although the practice of HS has received increasing attention in academia and industry in the past few years, no consensus concerning a universal definition has been reached yet.

One of the most cited and prominent definitions originates from the UK Government's Chief Scientific Advisor's Committee, defining HS as "the systematic examination of potential threats, opportunities and likely future developments including – but not restricted to – those that are at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems or trends'' (van Rij, V., 2010a). Other authors have diversely described horizon scanning as an: ability (Williams, 2018), process (Könnölä et al., 2012) or technique (Brown, 2007). Table 1 provides an overview of more specific definitions which also includes some information on practical implementation and benefits proposed by the selected authors.

Table 1: Overview of definitions of horizon scanning

Definitions	*Source*
"Horizon scanning is the practice of **monitoring the business environment** and tracking the **changes** in the environment that could have an impact on individual businesses"	(Brown,2007).
"Horizon Scanning can be completely **explorative and open** or be a **limited search** for information in a **specific field** based on the objectives of the respective projects or tasks. It seeks to determine **what is constant, what may change, and what is constantly changing in the time horizon under analysis**. The time horizon can be short-, medium- or long-term"	(European Commission.,2015).
"Horizon Scanning eschews the attempt to create projections of the future; it instead **aims to continuously and objectively explore, monitor and assess current developments and their potential implications for the future"** "The use of Horizon Scanning is intended to develop an organization's capability for **identifying subtle environmental changes, allowing organizations to cultivate a high awareness and understanding of their environment, leading to a quick and effective response to changes and events"**	(Rowe, Wright and Derbyshire,2017)
"Effective horizon scanning involves **systematically tracking and analysing trends**, alongside anticipating what might 'disrupt' these trends in the future. It is not about 'making predictions' but rather **looking at what might possibly happen, and what will probably happen in the future, based upon available data"**	(Beers,2016)
"Horizon scanning aims to **spot changes** in the world around us before they become 'old news', so that **decision makers can plan on how to exploit or mitigate these changes,** securing the most positive outcome for their organisation. This means **systematically monitoring a wide range of information sources and indicators**, with the intent of identifying patterns and 'weak signals' of coming disruptions that could have a severe or a transforming impact on our world"	(Marteaux, n.d.)

To understand the concept of HS, it is elementary to look at environmental scanning, which entails the examination of the current macro-level environment, consisting of political, economic, social, technological, legal and environmental (PESTLE) factors. Whereas environmental scanning is primarily concerned with present and known trends, HS focuses on monitoring the environment on a longer-term scale to spot, track and assess changes and their potential implications for the future (van Rij, 2010a; Rowe et al. ,2017). Classifying HS as a foresight tool, Van Rij (2010b) acknowledges the uncertainty that any future entails and

states that HS is “neither about forecasting nor fortune telling” but rather the development of actionable insights and solutions, which contribute to informed decision-making by seeing the bigger picture.

The process of Horizon Scanning

HS consists of data collection and data analysis including a mixture of quantitative and qualitative methods. Depending on its objective, HS can be either conducted in a completely open form (exploratory scanning) or a more limited manner focused on a specific area (issue-centred scanning) (Amanatidou et al. ,2012; European Commission, 2015). As there is no standard process for HS and literature concerning its practical application is rather vague, Rowe et al. (2017) developed a framework for guiding the process of HS, illustrated in Figure 1.

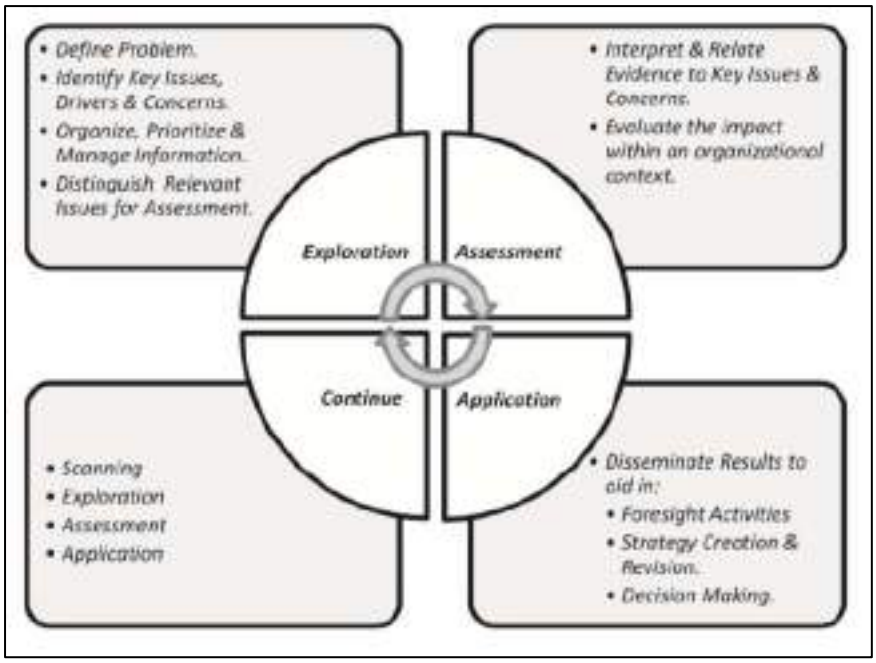

Figure 1: Horizon scanning process (Rowe et al. ,2017)

Exploration represents the starting point and spans throughout the whole process as it incorporates the continuous gathering of information, monitoring and scanning of the external environment which can be undertaken manually, automated or web-based. Furthermore, Palomino, et al. (2012) distinguish between network-based HS and web-based HS, arguing that web-based HS complements rather than substitutes network-based HS. However, Rowe et al. (2017) underline that due to the vast amount of available information, HS may lead to information overload and paralysis. They emphasize the importance of identifying patterns and sifting out valuable signals from meaningless noise which requires a developed set of skills, knowledge and expertise based on intuition and individual judgment.

Regarding HS as a strategic foresight tool, Rohrbeck and Schwarz (2013) link HS to innovation management and argue that it is crucial for new product development as it enhances the exploration and identification of promising new innovations. Having studied 77 companies, they discovered that strategic foresight reduces the level of uncertainty in R&D projects, enhances the understanding of customer needs, enables the identification of potential customers and market understanding as well as aids in the identification of opportunities and threats regarding firm’s product and technology portfolio. Therefore, the aim of this research was to: discuss the role and importance of horizon scanning for innovation and design; identify dominant methods and approaches used within horizon-scanning; and compare the methods typically used by different types of innovation practitioners.

Methodology

Semi-structured interviews were conducted based on a pre-prepared questionnaire, which primarily consisted of open questions and ‘probes’ to obtain in-depth information. Examples of open questions were: ‘What

methods do in-house innovation managers, innovation consultants and entrepreneurs use to horizon scan latest trends (top-level strategic trends)?' and 'How do in-house innovation managers, innovation consultants and entrepreneurs learn about specific technologies?'. Examples of probes were: 'Could you tell me about a project or product you worked on where you have (successfully) applied horizon-scanning?' and 'Do you follow any routines for gaining and internalizing knowledge?'. Additionally, closed questions were posed to receive factual information and summary questions to validate answers. A total of 18 semi-structured interviews were conducted and recorded in the period of June-August 2018 with the sample consisting of intrapreneurs, innovation consultants and entrepreneurs. Each interviewee was provided with an introduction and definitions of HS to ensure clarity and validity.

In the search for potential interviewees, topic-related industry papers, academic journals and LinkedIn were used. The interviewees were evaluated and selected to provide a variety of: positions, type of workplace, industries, and levels of practical experience.

Table 2: Screening process according to job titles

CASE	JOB TITLES
Intrapreneur	Chief Innovation/Technology Officer, New Product Development, Innovation Catalyst/Strategist, Consumer Insights, Research Scientist, Manager R&D
Innovation Consultant	Technology/Innovation Consultant, Strategy Insights & Innovation Lead
Entrepreneur	Founder, Co-Founder, Chief Innovation Officer

Subsequently, 93 potential candidates were contacted of which 18 individuals from 3 countries -namely the UK, Germany and the US -were interviewed. However, 2 of the 18 interviews were excluded from the study as they did not entirely match any of the three participant profile types.

Table 2: Interviewee information

CASE	CLASSIFICATION	INDUSTRY / FOCUS	DURATION (in minutes, seconds)
1	Entrepreneur	Tech/Drones	68:45
2	Entrepreneur	Tech/Logistics	43:44
3	Entrepreneur/Intrapreneur	Tech/Medical & Consumer Goods	78:26
4	Entrepreneur	Tech/Data Science & AI	25:18
5	Intrapreneur	Consumer healthcare	55:19
6	Intrapreneur/ Consultant	Government/Consulting	64:35
7	Intrapreneur	Software	42:45
8	Intrapreneur	Healthcare/Research lab	40:25
9	Intrapreneur	Government Innovation Agency	65:53
10	Innovation Consultant/Intrapreneur	Consulting	64:21
11	Consultant / Intrapreneur	Consulting	65:39
12	Consultant	Consulting	23:57
13	Innovation Consultant/Intrapreneur	Consulting	97:59
14	Innovation Consultant	Consulting/FMCG	70:23
15	Innovation Consultant/Intrapreneur	Consulting/Industrial & Product Design	62:53
16	Innovation Consultant	Consulting	66:05
17	Non-attributable *excluded	------	41:58
18	Non-attributable *excluded	------	35:30
			~ 1002 min.

All interviews were transcribed verbatim to ensure accuracy and detailed completeness. Afterwards, the anonymised transcripts were sent to the respective interviewee for approval, ensuring that the data was correctly captured and that no breach of confidentiality was made. Figure 2 shows that, 4 of the 16 interviewees are categorized as “pure” intrapreneurs, 3 as “pure” entrepreneurs, 3 as “pure” consultants, 5 as intrapreneurs and innovation consultants and 1 as intrapreneur and entrepreneur.

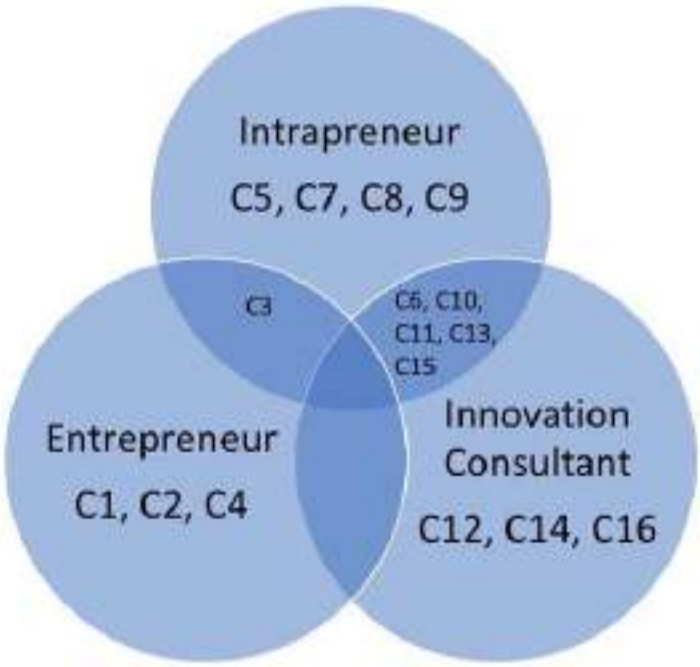

Figure 2: Classification of interviewees

Thematic Analysis

For the data analysis, the transcripts were incorporated into NVivo and coded using thematic analysis which aims to identify and analyse patterns of themes (Mortensen, 2018) as well as minimally organises, reduces and describes a data set in detail (Braun & Clarke,2006). Therefore, whereas codes were generated by identifying recurring topics and relevant information across the data sets, themes were generated through the proactive interpretation of the codes by allocating identified codes into broader themes. Furthermore, thematic analysis can be used for both explorative studies where one does not entirely know what patterns to search for with the themes depending on the data as well as deductive studies where one actively searches for pre-defined themes based on existing knowledge (Mortensen, 2018). In this study, due to the information gathered during the literature review and interview process, codes and themes emerged from both approaches. Table 4 provides an overview of the most relevant and dominant themes and codes.

Table 4: Data Points extracted and generated from NVivo

Theme	Codes (sub-codes)
Importance of HS - Advantages & benefits of HS	- Competitive advantage & resilience - Informed decision-making - Risk minimization & mitigation - Awareness and preparedness – minimizing uncertainty
Disadvantages & Challenges of HS	- Human intuition – bias - Information overload - Lack of time
Methods & approaches	- Web-based (news, academic journals, industry publication, market data reports) - Network-based (expert&personal network, conferences, networking events) - Tech scouting – collaborations & partnerships - Investigation of adjacent industries, sectors and companies - Consumer engagement – brainstorming, co-creation, observation - Exploration & evaluation – questioning, experimentation, pivoting - Pattern recognition – connecting dots
Additional frameworks	- Design thinking - Divergent and convergent thinking
Future implications	- AI

Limitations

Because the interviewees have transitioned within companies and job roles during the course of their careers, some can be attributed to more than one category. Therefore, making the comparison between the methods typically used by different types of innovation practitioners difficult to do comprehensively. As the length of their career paths spans between 6 and 28 years, the insights of the selected interviewees inevitably relate to their overall cumulated experience, indicating best practices based on past experiences and knowledge. However, the findings do not include insights from early-career practitioners as these were missing from the participant set.

Findings

Dominant methods and approaches used within horizon-scanning

Web-based HS

To get a general sense of current trends and technologies, the starting point of HS is gathering information on consumer behaviour and needs, market and technological landscape. The most common tools mentioned are reading and analysing academic journals, news articles, white papers and publications from industry and academia as well as market data reports.

“Typically, it’s keeping the finger on the pulse all the time“(C14)

C12 notes that the credibility of online information must be judged carefully, especially for novel and complex topics and that the capability of sifting out valuable from invaluable information is crucial. C13 further states that one needs a “good filter for distinguishing information and for removing the fake news”. Due to information overload and lack of time, most interviewees have activated newsletter/newsfeed functions to stay up-to-date, allowing them to quickly scan and monitor trending topics on a constant basis. After a topic of interest has been identified, they dive deeper into the subject matter by extracting relevant academic and scientific literature and industry publications, which tend to have a higher credibility and detailed coverage.

“I guess the key problem is time - I think for everyone, especially when you cover a broad area. It just isn’t physically possible to regularly check all these sources and journals yourself, so you are reliant on information feeds”(C9)

Whereas intrapreneurs usually have access to data reports from market insight research companies, entrepreneurs usually do not have the financial capital and need to gather the data themselves. The paradox is that although intrapreneurs are equipped with reports, they are overwhelmed by their complexity and struggle to retrieve actionable insights.

“Because quite often corporations have overlooked something, so you look for interesting and different insights and research data points and then look at what opportunities you can create from this because perhaps they haven’t thought of that”(C10)

Furthermore, intrapreneurs and consultants raised concerns about the value of market data reports as the reports oftentimes are perceived to be rather generic and partially useful.

“Yes, we do look at them but we take them with more than just a grain of salt”(C8)

Network-based HS

Another dominant method is attending conferences. Whereas conferences are regarded as a great platform for meeting people that can help spur innovation opportunities and idea generation, the actual content and topics being covered are often perceived to be out-dated, superficial and focused on recurring known top-level mega-trends. Therefore, the general consensus is that conferences are only of limited use when it comes to accelerating innovation. Innovation efforts, future-oriented visions and strategies are highly bespoke, unique and dependent on the organisation’s aims and objectives. The importance of networking was emphasized as it enables individuals to exchange opinions and viewpoints on emerging trends and technologies and their potential areas of application as “a lot of it involves conversations with companies that then reinforce and inform” (C6). Additionally, connecting with individuals at conferences is useful in that it may spark business investment opportunities, potential partnerships and further areas of investigation.

“Anyone who's in innovation needs to be active in terms of networking and networking in the triple helix model, so universities, industry and government agencies. Having those three in play [and attending] networking events or conferences within a particular topic area is probably the best way to pick up the latest trend and to use as validation”(C11).

Experts

75% of interviewees highlighted the importance of their professional and personal network of experts which they have established throughout the course of their career. More specifically, experts play a vital role not only for sparking and feeding ideas and gaining detailed knowledge about a trend or technology but also for making sense of potential areas of application.

“If I needed to have a technical discussion, I would turn to the most appropriate person to have that discussion rather than me sitting down and trying to become an expert”(C9)

Additionally, contacts are approached to test and validate ideas and information in a timely manner, with C8 noting that “different media [are used] to spot the trends and personal interactions to validate them”.

“Beyond screening academic journals and magazines, to get quick answers and perspectives, your network is really important. Just so it does not remain theoretical and hypothetical, it is important to have discussions with those who are actively working in that field so that [clients] don’t get the feeling that it’s just a lot of research and not tangible enough”(C16)

Moreover, conversations with network connections oftentimes enable innovation practitioners to spot possible overlaps or gaps in the market which could potentially turn out to be fruitful opportunities and enable them to stay informed.

“You ideally have a team of people and a personal network to create your savviness”(C11)

C13 states that “horizon scanning is having the right network, seeing the trends because if you want to do something new or go into a new area, you'll use your trusted network to get second opinions”. However, C14 and C9 stress the importance of drawing upon a diverse set of experts to extend one’s knowledge base and

learning curve and that opening up one's network and identifying knowledgeable experts is equally important for preventing bias and subjectivity.

"I know if I have invited certain people to a panel, we would have gotten a very skewed view of the world from it. So, it is like any system – it is only as good as the people and the information that you are tapping into"(C9)

Investigation of Adjacent Spaces

The importance of calling in subject-matter experts and diverse individuals from adjacent industries is particularly important to gain awareness of trends and technologies from adjacent sectors as they may be transferred to one's own product portfolio and business operation, resulting in the generation of incremental and radical products innovations.

In fact, each of the three types of innovation practitioner indicated that they scan and monitor adjacent industries for:

(1) existing technology which was not considered for own industry before

(2) existing technology which has had an advancing breakthrough

(3) emerging technology which could be applicable to one's product portfolio

(4) identifying gap and moving into adjacent space by adapting one's existing technology

"Taking something from one industry and putting it into another - that's innovative"(C5)

Furthermore, looking at adjacent spaces might trigger surprising and unexpected insights that one may have not been able to generate if HS was narrowly and solely focused on one's product category or industry. Thus, exploring and monitoring adjacent industries, markets and companies oftentimes results in novel opportunities and clarity of thoughts.

"Horizon scanning for me is looking: where have been successes in adjacent market? Has that been done in the market I'm interested in? How can we transfer that success?" (C11)

Additionally, C16 and C5 further mention that in order to position and paint pictures for several possible futures, drawing upon product analogues and adjacent business successes, trends and practices is highly useful to substantiate evidence through past indicators, highlighting that "this is where it is not a science, it really becomes more of an artform where you have got to be creative and show why it makes sense" (C16).

Experimentation

A crucial activity for boosting innovation and product development capabilities is to experiment, constantly ask questions and challenge the status quo, not only to understand the trends' and technologies' implications but also for finding the right problem to solve, executing on it accordingly and ultimately to find the right product-market-fit. Experimentation touches upon three different aspects that include brainstorming and testing, going back to basics and becoming an expert for understanding the technology and matching it with consumer needs.

(1) New or existing technology: brainstorming how to apply it to a product

(2) Existing products: brainstorming what new technology could be integrated and married with it - positioning it differently to fulfil changing consumer need

(3) Existing technology: Adapt for moving into adjacent space

"We slightly adapted it - so that existing technology was used in a different way for a different product. But the new way of applying this existing technology made the product look magical, novel and amazing"(C15)

To truly understand the underlying technology, its implications and applications, the act of asking questions, staying curious, playing around with the technology, testing and conducting experiments is often more fruitful for gaining specific technical knowledge than solely relying on experts whose expertise may be flawed or only partially useful for one's own needs and requirements.

"I always used to go along to someone that was potentially supposed to know more than me on something and I just remember asking in a very child-like way: "but why?" "but why?" "but why?". And they were just like "I don't know" - so it's really good if you can find out for yourself and not rely on experts" (C15)

Technology Scouting

All three different types of innovation practitioners stated they actively engage in tech scouting to uncover trends and technologies by scanning start-ups, academic research institutions, government entities, competitors and corporate research labs that develop or apply emerging technologies which may be applicable for one's own innovation projects. Moreover, exposure to these levers not only aids in the identification of upcoming technologies and trends but also in the collaborative investigation of technologies that are in their infancy which ultimately catapults them at the forefront of the competitive landscape. Additionally, sharing and complementing knowledge enhances the chances of identifying and assessing change and accelerates the development of technologies as every stakeholder can incorporate their unique knowledge, expertise and assets, which maps onto the open innovation approach.

"We come from an applied technology's view, academics come from a research view, the clinicians come more from a need's view. And so, in many cases bringing those views together helps us make sense out of the hypes"(C8)

C3 states that particularly large corporations pursue immersing themselves in a rich and diverse ecosystem "due to strong competition [as they] have realised the need to get involved with technologies at an ever-increasing earlier stage in order to beat their competitors to those technologies", indicating their objective to act ambidextrously.

Moreover, intrapreneur C8 states that hosting and attending hackathons, boot camps, university or business challenges acts as an avenue to spot and evaluate potentially relevant start-ups and researchers "where we try to see what they are developing as a potential view of the future because scientists are horribly bad at predicting the future - that's why they try to shape it instead. So, we need to sometimes look at multiple options that may materialize - bet on one and risk-mitigate on the others" (C8).

Ultimately, depending on the company's area of interest, its innovation strategy and product portfolio alignment, tech scouting may result in:

(1) forming partnerships to jointly co-create and advance technology

(2) identifying companies that own patented technology - try to get exclusive license before competitors

(3) acquisition of technology by merging with or acquiring respective company

(4) decision to bring technology in-house by replicating or reverse-engineering it

Connecting the Dots – Associative Thinking

All participants mentioned the importance of connecting dots as innovation occurs by combining different pieces of information and recognizing patterns as well as understanding the wider implications, conversions, interrelations and articulations of the spotted trends and technologies.

"HS is a practice that requires being educated on it – it's not necessarily a science, there is a lot of art to it because you have to use your creative mind when you converge a political, technological and economic indicator to understand what implication that is not only going to have on your business but also on the market and your consumers"(C16)

Hence, the general consensus among the participants was that connecting the dots is key for making sense out of the noise and develop innovative products accordingly.

"Innovation occurs when people connect dots; when they connect consumer insights and trends and they connect it with technology - they get eureka moments and it sparks ideas and new ways of thinking and new perspectives. So, doing horizon-scanning leads to, and catalyses, innovation and also to respond better to changes faster"(C3)

Human-centred methods & Design Thinking

Having been mentioned 77 times, the consumer plays a vital role across all three different types of innovation practitioners. Because market data concerning consumer trends does not always display accurate information on true consumer needs, habits and behaviour, the interviewees state that truly understanding the consumers' pains and jobs they seek to accomplish is the most vital and crucial aspect for commercial success which can only be achieved by offering unique and convenient products and services.

Furthermore, they indicate that most products fail due to insufficient consumer insight and not because of its technology. C10 further notes that solely relying and launching a product based on its technology will most likely result in a poorly thought out product as the consumers' needs have not been considered and addressed. Therefore, all three different types of innovation practitioners indicate that they deploy iterative human-centred methods, which map onto the design thinking philosophy that "brings together what is desirable from a human point of view with what is technologically feasible and economically viable" (IDEO,n.d.).

Thus, the importance to start with scanning for consumer trends by brainstorming, co-creation workshops and observing consumer behaviours is highlighted because "if you just constantly scan the technical horizon, you could be wasting your time. So, you need to generate insights around your consumer's behaviour and how that is changing and apply your technical know-how to solve those needs" (C10).

"In terms of market research, for me, it is not good relying on another person to be your eyes and ears about why a product would work or not. If you are inventing and developing that product, you need to be the person that speaks to potential users and see all the problems yourself" (C15)

HS can be linked to the method of divergent and convergent thinking which originates from the creative design process. Known as the Double Diamond Model, the four phases of discover, define, develop and deliver indicate the creation of several possible ideas (divergent thinking) before refining and narrowing down to the best idea (convergent thinking). As depicted in Figure 3, the iterative nature of the process is stressed for finding and confirming the problem. In fact, C7 underlines that the purpose of both design thinking and HS is finding the right problem and that "innovation is an equation of problem-finding + problem solving".

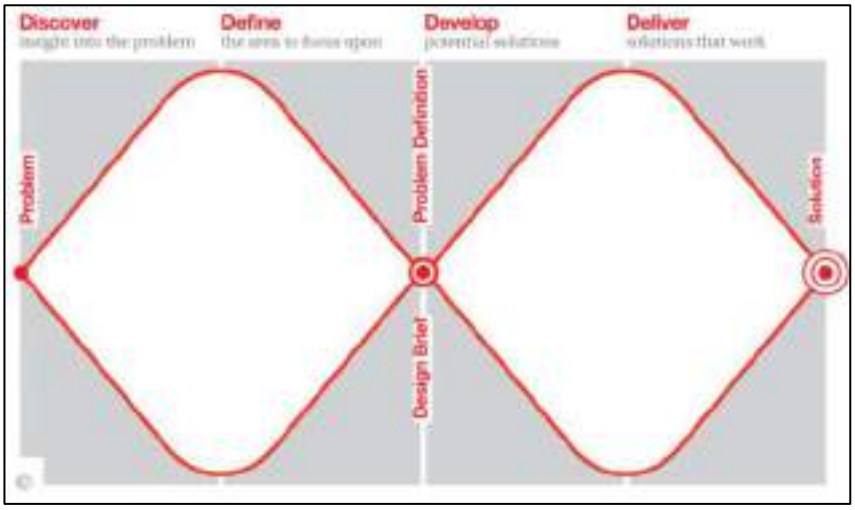

Figure 3: Double Diamond Model (Design Council, n.d.)

Future Implications: Artificial Intelligence

Due to recent advances in AI, 5 out of 16 cases mentioned that the future of HS may potentially entail AI conducting the web-based scanning, screening the internet for relevant trends and insights. In fact, C4 states that by leveraging data science and collecting publicly available data sets online, using predictive algorithms and machine learning, it is possible to discover patterns and capture weak signals before they become apparent and mainstream which humans may not have been able to spot.

As HS and trend-spotting involves scanning, absorbing and assessing signals based on subjective opinion and intuition, C4 argues that data science techniques offer individuals complementary, counter-intuitive, impartial and objective perspectives, ultimately resulting in simplified and better decision-making.

"Highlighting interesting signals in all the noise is the only way we can make things actionable – and when you manage to do this and translate data and insights into something actionable, that is where the real value occurs"(C4)

However, as AI is currently neither able to connect dots, interact with humans to understand their needs, pains and motivations nor to contextualise, transfer and interpret information, it lacks the creative component of HS that is key for sense-making and developing innovative products.

"AI is useful for identifying patterns, but the human is crucial for making sense of those patterns"(C4)

"At the end of the day, human creativity will never be beaten"(C13)

Discussion

Role and Importance of Horizon Scanning

This study provides insights into the practice of HS within innovation and technology management and sheds light on the methods and approaches that innovation practitioners use for conducting HS and ultimately product development.

Whereas Amanatidou et al (2012) distinguish between exploratory scanning or issue-centred scanning, participants underline that depending on the company's stage, maturity and innovation portfolio, the nature of HS changes, indicating that for new product development and early-stage start-ups in the fuzzy-front end of innovation, "*there is no point in horizon scanning everything in terms of technology – it wouldn't necessarily be a good use of time"* (C13) and that scanning existing products, regulatory pathways and IP protection are vital for accelerating the likelihood of success, highlighting HS's overarching nature. On the other hand, for companies that are positioned in the commercialization phase, HS shifts to scanning existing competitors, market opportunities and potentially disruptive start-ups that might be joining the market within a relatively short timeframe (C9).

Hence, whereas one needs to define HS's scope and objectives early on by divergent and convergent thinking, continuously HS the environment to be prepared for arising opportunities, developments and threats is equally important, supporting, further specifying and extending the proposed HS process by Rowe et al. (2017).

"*One of the challenges is having a technology which is ahead of its time and understanding why it's not moving forward but being ready to pick it up again. So, it is serendipity – so it is the prepared mind [and] in the world of the blind, the one-eyed man is king" (*C13*).*

Additionally, HS is crucial for developing innovative products and achieving commercial success as HS spurs awareness which is "*important for de-risking the breakthrough innovations because otherwise you've invested hugely until the last moment and then it falls apart because of something you didn't look into; it accelerates the incremental innovations"* (C8). Hence, HS's widely acknowledged purpose and value of minimizing risk, capturing opportunities and making informed and timely decisions by gathering information and gaining knowledge about the environment, market and consumers is supported by the study as *"ideally, you want to be the most knowledgeable, so you can make an informed decision […] rather than reacting to something that you are not quite sure you fully understand"* (C6).

> *"Horizon scanning is fundamental to creating something that has a good chance of success and is improving your chances of success. If you operate in a cave, you might make something but its chance of success outside of that cave is incredibly slim. I mean the chances are incredibly slim already, so it is next to impossible if you don't look beyond yourself" (C1)*

The final quote included below sums up importance of HS:

> *"I mean the easy way to look at it is "what would happen if you didn't horizon scan? You'd be trundling down the road with no headlights. So, it is absolutely crucial for driving innovation but also for future success of businesses and economies"(C6)*

Dominant Methods and Approaches used within Horizon Scanning

HS is a creative process which entails the acquisition, collection and synthesis of knowledge in order to make sense of the future and derive actionable insights (Könnölä et al.,2012). However, most scholars neglect or underemphasize the creative component. There is neither a magic formula nor straightforward rule for driving innovation and considering that the fuzzy-front end of innovation is highly iterative, non-linear and

unstructured (Rohrbeck, 2013).Therefore HS within innovation management is also a mixture of structured and unstructured processes and thus, requires the expertise, intuition and knowledge of experienced individuals.

Although Palomino et al.'s (2012) differentiation of web-based and network-based HS is validated by the interviewees' practices, it is only partially complete and not exhaustive in terms of practical application as it was discovered that screening adjacent spaces, connecting the dots, experimentation, tech scouting, bringing in experts as well as immersing oneself in a broad and diverse eco-system are important elements of HS. Thus, the true value of HS lies in continuous and collective learning as it enables individuals and companies to gain awareness, spot and act upon changes more rapidly and wisely and operate ambidextrously reducing the likelihood of being disrupted or missing opportunities. Particularly, scanning adjacent spaces allows individuals to spot existing and emerging technologies and companies for potential collaborations, identifying analogues or companies that may cannibalize and replace one's business – hence, companies can detect opportunities and threats prematurely and thus, make informed decisions accordingly.

Comparison of Innovation Practitioners

Table 5 provides an overview of the findings, broken down by innovation practitioner and methods that are primarily and secondarily being used.

Table 5: Summary of findings, broken down by innovation practitioner and use of method

Innovation Practitioner	**USE OF METHOD**	
	Primary	Secondary
Entrepreneur	- Web-based desk research - Networking events - Conferences	- Collaborations & Partnerships - Experts - Experimentation
Intrapreneur	- Tech scouting - Experts - Adjacent spaces - Design thinking	- Conferences - Market data reports - Networking events - Experimentation
Innovation Consultant	- Market data reports - Internal & personal network - Adjacent spaces	- Design thinking - Networking events - Conferences

Due to limited resources, entrepreneurs tend to be more active gathering information via web-based desk research and more engaged in networking events and conferences for pursuing business investment opportunities, whereas intrapreneurs usually have access to data reports and subject-matter experts in-house.

Drawing upon analogies from adjacent spaces enables consultants to substantiate their recommendations to clients, whereas for intrapreneurs it typically fuels inspiration.

Due to rigid hierarchical structures and organisational inertia, intrapreneurs in larger corporations increasingly adopt open innovation and tech scouting initiatives by proactively facilitating events with third-parties for boosting their savviness as well as innovation capabilities. Regarding tech scouting, entrepreneurs and their research partners benefit by receiving funding, mentoring and exposure to an established company, its resources and network, resulting in greater likelihood and higher chances of developing and commercializing a successful product.

Conclusion

As the aim of the study was to investigate the role of HS in innovation practice, it sheds light onto HS' importance, advantages and challenges. Having gained insights from 16 innovation practitioners, dominant methods and best practices were discovered and analysed. The study's main implication highlights that HS is a complex endeavour, that requires time, effort and resources, and exceeds the mere quantitative and

qualitative collection and analysis of data, as believed by many executives and market research companies that provide innovation practitioners with reports believing that insights on PESTLE, market and consumer trends suffice for driving innovation.

However, it is rather a question of sense-making - how to capture, spot and combine trends and how to translate those into meaningful and actionable insights that offer and maximise value, not only for the consumer but also for the stakeholders. Thus, it requires the correct interpretation and combination of spotted trends and technologies and evaluation of potential areas of application which entails creative thinking, exploration and validation through various sources.

Furthermore, this study discovered that HS in conjunction with creative and lateral thinking, technology scouting as well as human-centred thinking not only facilitates the early detection of emerging trends and technologies but also facilitates turning insights into actionable ideas, increasing chances for more successful product development, meaningful innovations and commercial success. By proactively immersing oneself into a broad and diverse eco-system, individuals can collaboratively and collectively shape the future and create value, secure first-mover advantages and mitigate risk of being disrupted. Thus, companies and individuals that incorporate the practice of HS develop a sense of awareness and understanding of the environment which allows them to anticipate and proactively respond to changes as well as make informed decisions concerning their product portfolio and strategic business operations, increasing the likelihood of resilience and sustainable competitiveness.

One challenge and obstacle of HS is its practical implementation as it is not a straightforward, sequential or linear process that follows a strict pattern or a specific set of steps. Hence, this makes it particularly difficult for companies to capitalize on HS and requires the expertise, experience and educated judgment, instinct and intuition of individuals that are capable to spot weak signals and drivers of change which could have positive as well as negative implications. Furthermore, due to the vast amount of available information, the ability to sift out valuable from invaluable information is crucial for organisations to capitalize on the correct trends and technologies; because if poorly executed, HS will lead to information paralysis, product failures and missing out on business and innovation opportunities.

Managerial Implications

The findings of this research may be used as insights and guidance for managing horizon scanning and incorporating it into innovation and technology management strategies. As HS can be regarded as a combination of art and science, companies should foster the creativity of their employees in the innovation process and establish specific roles for trend-spotters and technology scouts as well as allow employees to dedicate time and resources to scanning the horizon.

Suggestions for Future Research

Future research could entail more qualitative research on the methods in order to investigate which tools and approaches are most effective and correlate to companies' innovation performance. More research is needed into the challenges associated with spotting weak signals. Furthermore, although the field of Artificial Intelligence exceeds the scope of this paper, the author suggests for future research to be carried out evaluating how AI might impact horizon-scanning, if AI may potentially replace humans' activities to scan the environment as well as humans' ability to connect the dots, ultimately evaluating if AI might be capable of generating innovation strategies.

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Mapping Abstract Futures

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The future we need to explore is more abstract than it is concrete. As designers, we are constantly conjuring ideas based on a concrete world to improve what we have already seen. Within these predetermined frameworks, we unintentionally bring our own biases to planning the future based on what we know and what we consider safe. However, methods of gathering evidence must reveal the essential dynamics and tensions of the individual in the context of society. The cultural system that represents this process of adaptation can be plotted as a system of language that reflects the dynamics between the concrete and abstract worlds. A craving for such emotional intelligence requires that we expand our binary world into an abstract space for which only the human brain has the capacity. We need such a systematic view in order to think intuitively on multiple levels at the same time.

Keywords: applied sociology, epistemology, semiotics, strategic foresight, systems thinking

The Limits of Our Perception

The landscape of future planning is broad. It can be commercial and explore consumer products, or it can be a landscape of peace and democracy. However, in all cases, we establish predetermined limits of what we explore. We need to foresee all intersecting futures related to the work under consideration. Myopic approaches keep true innovation hidden. To predict any ramifications, we need to be unafraid of the inputs. We can always pull back. We tend to look for what we want to see at a particular moment instead of engaging tensions and evoking provocative ideas.

Consider the artist Piet Mondrian. He could paint a house as well as any other early 20th century artist could. However, his curiosity about his fast-changing environment led him to see his perspective in abstraction. A house is not simply a house in its immediate setting. A house lives in the context of the world surrounding it. What we really see in a Mondrian painting, as well as in other abstract works, is the functioning of the mind that produced the work, not the limited constraints of the apparent subject. We should always allow our minds to go beyond boundaries. The process should be constant and iterative.

We are challenged to re-examine the methods we use to frame the future. We live in a world where there are rallying cries for sustainability, global awareness, safety, privacy, and inspiration. These concepts are no longer tangential but can thrive as progressive initiatives that are fundamental and universal. Our perspectives on the future have much to do with the ideological biases in our research methods. We seek shortcuts and quick classifiers. However, quick classifiers no longer exist. The ways in which we classify and organize information need to be protean, working in tandem with our evolving intelligence.

Design has become cemented in the language of the machine age. As it leans toward speeding up the future, it exposes us to unintended future possibilities. Its methods of inquiry and analysis are biased toward what

technology can do much more than we can foresee as real human societal needs. A sustainable and ethical future requires an abstract framework of ideation. Abstraction literacy refocuses our thinking on well-formulated ideas, thus keeping design rooted in its essence.

We spend great amounts of time and money quantifying waning concepts. Quantifying things lends confidence. It gives us a platform to build on—a green light. However, quantifying abstract ideas worries us. If the query is framed correctly, there should be no problem quantifying abstract ideas. Still, we tend to default to educated opinions. A primary problem lies in how quantification is defined.

“More” still equals “better.” That should not be valid. We should be looking at the effects of the numbers on trajectories. If we do not, we open ourselves to the possibilities of the worst that could happen. People thought social media was a brilliant way to network. We did not expect the current negative affect on our health and society.

Because the word trajectory implies movement through space and time, it compounds the complexity that is desperately needed to be explored. Such exploration should empower us to think as we classify, analyze patterns, and evaluate effects.

Jammed in the Machine Age

The ideology of the machine age has left an indelible imprint on both forecasting and the design frameworks it informs. Le Corbusier's idea of "machine for living" best defines the dominant ideological relationship between the designer and the world brought forward into the information age. Le Corbusier noted, “A house is a machine for living in...An armchair is a machine for sitting in and so on” (Corbusier & Etchells, 2014).

Design evolved to become an engineering function, satisfying needs at scale. That language of efficiency and scale can be observed today in everything from suburbia to iPhones. Materiality has become the de facto meaning of design. Consequently, forecasting has become distorted by this process. Legacy design thinking abides by the laws embedded in the materials themselves, not in the world around them. The future we imagine depends on the expanding feasibility of the applications in our existing design vocabulary.

Ironically, the core of Le Corbusier’s philosophy is that the “machine for living” would be positively adapted to the materials and social conditions of the time (Ghyka, 1927). If the machine for living were positively adapted to our social conditions, then this process would be protean. However, in this model of materiality, technological utopias quickly became dystopias. The “appification” of the home is in the interest of what technology can do rather than what we truly need. Do we need constant surveillance to survive? We forget to look at the future in decline. What might go wrong in the context of success? These questions have been largely overlooked.

How could we not see the future decline of suburbia as we planned it? Why stop progress? We do not know whether we should be harnessing progress until it is too late. Robert Moses and Henry Ford had valid sustainable ideas, but we prioritized only industrialization.

In his article “For geoengineers, a scientific existential crisis” (Undark.org), Dave Levitan quotes Joshua Horton, a research director of geoengineering at Harvard University: “The world is full of things we wish didn’t exist but ignore at our peril” (Levitan, 2019). According to Levitan, technofixes for the climate crisis are not anyone’s first choice. These issues hit home hard.

An epidemic of loneliness accompanies our hyperconnected mobile world. Blind spots occur when the future is framed from a dominant position of technology over human response. Unraveling the future forces designers to consider the broad responsibility of purpose and sustainability to adapt to the lives of people rather than conform to the machines. Problems of bias and blind spots are to be solved now before increased technological momentum.

Revealing the “Unknown Unknowns”

Over the last century, advances in trend forecasting emerged from periods of war. An advantage during wars is the ability to assess the influence of weather on actions taken on the battlefield. We measure predictions of the immediate cost. In World War II, the ability to predict the weather delayed D-Day and allowed the window of opportunity by Allied forces on June 6. The assessment of risk and uncertainty informs the framework

developed for a set of tactical actions. We assess the available data and combine this knowledge with the available materials to propose a set of scenarios within that framework.

According to StrategyByDesign.com, “The military historian Liddell Hart says that the purpose of strategy is ‘to diminish the possibility of resistance...under the most advantageous circumstances.’” (Rhodes, 2011). Troops were warned to expect the unexpected within an articulation of a set of operating principles. The forecast model merely directs the path based on a finite set of variables and available materials. It does not consider the long-term aftermath. We feel those effects today.

The military forecast model is a framework of “known unknowns.” Donald Rumsfeld used this phrase at a press conference in 2002 to refer to the lack of evidence linking Iraq to weapons of mass destruction. The structure of knowing includes “known knowns” (things that will happen), “known unknowns” (risks we are aware of) and “unknown unknowns” (risks we are not aware of). “Unknown unknowns” present the most significant challenge. They represent the realm of abstraction, involve human variability, and require a broad scope of consideration.

American psychologists Joseph Luft and Harrington Ingham coined the “known” terms in their analytical technique called the Johari Window. The technique is used to examine what we know about ourselves, what others know about us, and what we do not know about ourselves or about others. Its purpose is to move us beyond a single perspective of the self and improve how we function in the world. The logical exercise determines and classifies the gaps in understanding, forming an algorithm of self-actualization. Identifying the notable voids is critical.

Figure 1: The Johari Window. Source: Luft & Ingham (1955)

At the 2019 Consumer Electronics Show (CES) in Las Vegas, product launches highlighted the struggle between the concrete and abstract domains of design foresight: a television disappears from view and a wearable device tracks how you sleep. These designs convey the existential crisis. Why do we want our electronics to disappear? Why are we not sleeping? Buckminster Fuller referred to this phenomenon as “weaponry over livingry” (Fuller, 1963). Fuller’s concept of “livingry” places design within a broader system of consideration. All the preliminary questions must be thoroughly investigated before we compound the problem.

Developing a Sustainable Model of Design Foresight

A current challenge to design thinking is the sustainability of purpose. Sustainability does not follow a linear path, but designing sustainability has become an excuse to make more consumer products and services. The more we dilute the process of investigation, the more we obfuscate the path to innovation, cluttering the world with designs that further agitate cognitive dissonance. The underlying thinking is that analysis slows the

production process, and complicates the path to completion. Design further complicates by saturating experiences with “tweaks.”

Consider personalized pre-packaged prescriptions. AI and machine learning promote pharmacy automation to increase accuracy and efficiency. This comes at a cost. Eventually, automation will allow human pharmacists to better interact with patients. At present, a senior person might be put off by the early stage processing of pre-packaging and perceive a complete lack of interaction regarding their care. A lack of compliance is sometimes the result.

Foresight always should consider the living abstract layer that designs will enter. The aforementioned disappearing television indicates that we feel crammed to technological capacity. The wearable sleep device processes more data than we can handle. In design, there is both a perfect future and a negative future. The application of design foresight should not lean too heavily on a bias toward material design perfection. We allow products to be visible when ease and elegance are applied to their design. Usability does not affirm that something is needed. The assumption of usability is made in the context of the product that exists in the first place.

The Technological Echo within Design Foresight

The absence of the natural process of evolution creates an echo effect in design. We design tools that design tools that design tools. In art, the term mise en abyme refers to the technique of placing the copy of an image within itself, suggesting an infinitely recurring sequence. The method is known as the Droste effect, named after an early 20th century Dutch brand of cocoa powder that used the technique in its packaging illustration. That algorithmic echo is the essential metaphor of the machine age of forecasting. From the assembly line to the “selfie,” our relationship to technology has reached the point of distortion. We surrender our forecasting to the “known unknowns” of the mechanical process, thus becoming the mechanics of our inventions.

Figure 2: Example of the Droste effect. Source: photograph of Droste’s cacao tin, designed by Jan Misset (1904)

Elizabeth Holmes and her company Theranos provide an example of the Droste effect. Holmes stole admiration by modeling herself after Steve Jobs. Her mission of democratizing healthcare offered a model of aspiration. Investors saw what they wanted to believe, and collectively drove the visibility of Theranos until it fell apart at the policy regulation level. Aspiration cannot be designed toward. The sustainability of health and society requires that design truly looks at the meaning of democratizing healthcare. We are already seeing reactions to Uber and its eclipse of accessible public transportation systems. We need not more apps. We need thinking.

Moore’s Law is the observation that the number of transistors in a densely integrated circuit doubles about every two years. This law became a forecasting model used to predict the growth of technology. The linearity of a forecasting model based on materiality alone leads to exponential distortion. The exponential trajectory

creates behavioral unpredictability. The more significant challenge then becomes how we can develop our designs to anticipate and adapt to this abstract layer of human response.

We assume that the perfectly ergonomic phone will create perfect communication. The opposite is true. How the design is received, contextualized, and eventually rejected must be considered in forecasting the evolution of its use. The utopia of suburbia becomes a dystopia of economic instability. The gap in our forecast lies beyond the explicit nature of design but within its implicit connection to the unpredictability of human expression. These “unknown unknowns” are biological, not mechanical.

Learning from the Process of Evolution

Practitioners of design foresight can learn from the natural world. Evolutionary biology reveals the interconnected ways in which change manifests. An example is the flight of birds. Feathers are interlinked with the meaning of flight. However, science has revealed that flight was not forecast by the presence of feathers. Flight is a secondary adaptation of thermoregulation. Opportunity affected the response of the birds to the environment imposed on them. To understand evolution is to understand the ways in which unexpected traits take shape. The feather becomes the trait of flight only in the context of its environment. This process of exaptation demonstrates that the biology of flight is a far more incremental process than we might think. The feather adapts to the environment and, in turn, the feather shifts from the trait of insulation to the trait of mobility and flight (Parry, 2013).

Our cognitive development follows a similar process of adaptation. The system of meaning creation and adaptation can be modeled using Piaget’s theory of cognitive development. Piaget’s theory describes how humans acquire, construct, and use language in their world. In the processes of assimilation and accommodation, we move from one framework of meaning to another framework of meaning as the context changes (Piaget, 1966). A child learns by interacting with the physical world and develops abstract concepts of the meaning of things. For example, as a child learns the concept of “hot,” other implied language enters into the schema, such as “danger,” thus framing a narrative that the child uses to apply to new phenomena.

This process of accommodation is the psychological framework of abstraction. It is how new lineages in culture emerge. Our language defines the reality in the context in which it is presented. In effect, it is a schema that provides us with a template for processing all that follows it. These schemata are the essential reality of design and foresight. Schemata reveal the ways design will work or not work in the future. They reveal the discrete relationship between the seen and the unseen, that is, the abstract and the concrete.

Social Systems Reveal Cultural Abstraction

A return to the fundamentals of sociology helps us determine what we can consider evidence to measure cultural adaptations. Biological analogies of creative synthesis influenced Emile Durkheim's model of social causation. A system of social facts shapes our world. We are not isolated individuals but interconnected organisms and parts of a whole. The interplay of individual and collective adaptation frames our world. In *The Rules of Sociological Method*, Durkheim outlined the following:

> *Sociology cannot dissociate itself from what concerns the substratum of collective life...If the population clusters together in our cities instead of being scattered over the rural areas, it is because there exists a trend of opinion, a collective drive which imposes this concentration upon individuals. (Durkheim, 1950, p. 58)*

This collective system is the framework that our design must occupy. Our methods of gathering evidence must reveal the essential dynamics and tensions of the individual in the context of society, both explicitly and implicitly. It must reveal the connection between what we perceive as material evidence and what is hidden as implicit responses to our environment. The traits that emerge are cycles of dissent and aspiration that emerge in our social exaptation.

Like feathers adapting to flight, language and behavior are adapted as cultural mythologies. Our design foresight must consider that shift in schemata from the adherence to rules to the starting point of a symbolic design rebellion.

Mapping the Concrete and Abstract Layers

The uncertainty and chaos of forecasting are traits of cultural change that reflect the relationship between the explicit and the implicit. Hidden biological response and human expression attempt to mitigate the chaos. These traits are the abstract ideological underpinnings of “unknown unknowns.” They influence our everyday life and consumption. The symbols and language of culture make apparent the abstract layer, serving as evidence for application in the design process.

The cultural system that represents adaptation can be plotted as a system of language that reflects the dynamics between the concrete and abstract worlds. We can use a model, such as the Johari Window, to examine how culture responds implicitly to reveal traits of future behavior. We can then see the inception points of cognitive dissonance as well as cognitive aspiration. The patterns reflect a holistic view of how design functions in the world. We can then track how culture migrates in a taxonomy of words, images, and gestures.

Language reveals the abstract world of implicit meaning before it takes concrete shape in cultural norms and values. Semiotics, the study of linguistic signs, provides us with the tools to distinguish the abstract and concrete elements of culture. These linguistic signals represent the dynamics of cultural adaptation in direct relationship to the environment within which they emerge. The relationships between residual, dominant, emergent, and disruptive codes of meaning are given a cognitive, social context. The process of signification that shapes these codes consists of a series of social facts that rise and fall. They can be measured and patterned to reveal the abstract spaces that determine the context of uncertainty.

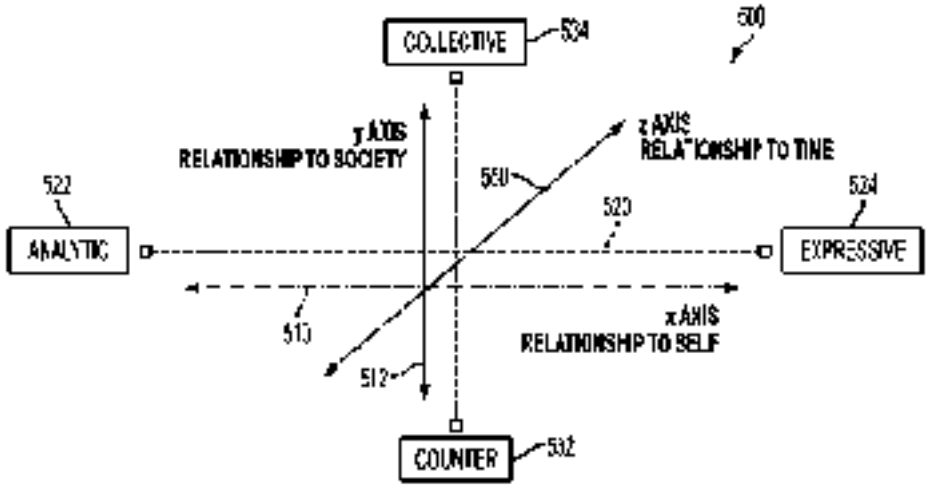

Figure 3: A system and method for culture mapping. Source: U.S. Patent No. US9002755B2.

The matrix diagram (Fig. 4) is based on a patented method of analyzing and classifying open and closed corpora into discrete behavioral archetypes that can be visualized as a system of signifiers within a semiotic square (Fig. 3). It classifies and quantifies linguistic signifiers along three principal axes. The x-axis represents the relationship to self from analytical to expressive. The y-axis represents the relationship to society from affirming societal norms and values to resisting societal norms and values. The z-axis represents time. This framework provides an ideological systematic view of the dynamics and patterns that emerge in expressed language, including words, visual images, and gestures. It contextualizes the relationship between certainty and uncertainty.

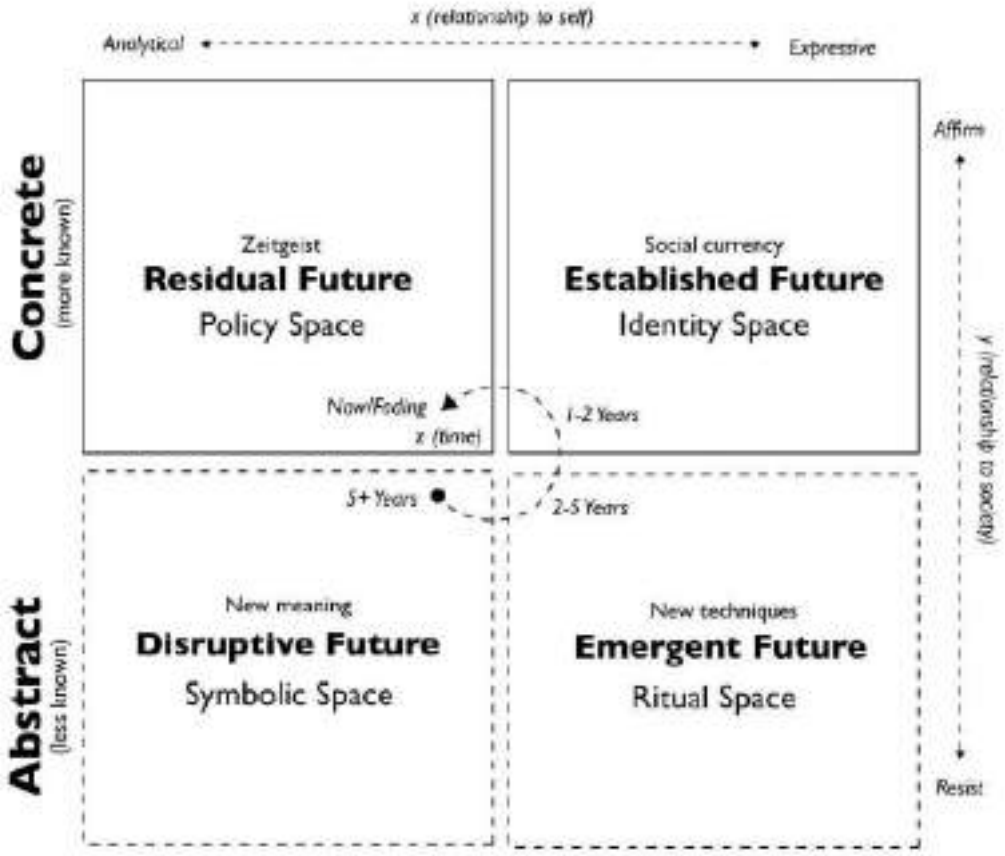

Figure 4: Abstract/concrete foresight matrix, adapted from a system and method for culture mapping. Source: U.S. Patent No. US9002755B2.

The framework maps the relationships between discrete elements of the collective social system to reveal gaps. We can also use this mapping of layers to reveal the migration of meaning. The migration is charted by classifying the coordinates of human expression.

In the matrix model, the two top quadrants represent the concrete layer of cultural meaning creation: identity and social currency migrating within the framework toward social zeitgeist and public policy. This layer affirms societal codes. The two bottom quadrants represent the abstract layer where new meaning creation forms. This layer resists societal codes. New meaning emerges as a pattern of dissent to the social order. It manifests as symbolic and philosophical traits that eventually are made physical through new techniques and rituals. These techniques and rituals become the social currency that informs the concrete layer when the schema is updated.

Ideologies emerge within these domains as taxonomies of expressed language, revealing codes of social cohesion within discrete social groups. The method allows for visualizing the full picture of the variability of how design works as part of a complete living system, including dynamics beyond the control of the imagined isolated user. The reality is that there is no "user." The individual is always connected as part of the larger system.

The described archetypal framework reveals the narrative variability that is promoted by environmental, political, and social forces. It is rooted in Carl Jung's essential cognitive theory of psycho-physical patterns common to all humanity (Robertson, 2009). And, much like Jung's hero's journey, it too is a system of shadow and light, entering into the unknown to restore order. Within the framework, linguistic clusters form making apparent relevant archetypes and their codes. By mapping them as a part of a measurable social system, we

can integrate unconscious elements, thus demonstrating how linguistic evidence emerges in patterns that reveal critical schematic shifts.

The Concrete Layer Must Overcome Mechanical Inertia

Design foresight capitalizes on the inertia of materiality. Parsing through an "Established Future" and a "Residual Future," we look for what is popular and then seek to scale it. The traditional framework for design foresight begins ideation by looking at unmet needs within existing design. The diffusion of innovations affirms this approach by assuming that future behavior can be modeled on a linear path toward critical mass. It relies on the predictability of social dynamics, which is more about materiality of design moving from adoption toward economy of scale. It is an additive process. It applies design to the feasibility of existing materials in relation to the articulated needs of a user rather than their unarticulated needs. As we scale on the surface layer of adoption, we undermine the social order we need to keep a design viable. We assume people want more and improved versions of what they have.

Wearable technology, for example. The appetite for data-driven wearable applications has expanded into every area from health and sleep to monitoring the activities of your adolescent. To meet the needs of the "helicopter parent," the global positioning systems (GPS) company Tampa Bay Monitoring provides its ankle-monitor technology for children. It was intended for people released on bail or parole. This designs the idea of passive restraint into our daily lives. Satisfying need alone keeps the design process in the loop of adding applications to mitigate the unease that the technology causes and perpetuates.

The "privacy paradox" has emerged as a measurable trait of social response to technology use. As technology makes it easier to share data, countermeasures emerge to avoid surveillance. We must consider that as we design, we create an unseen response that immediately affects future relevance and sustainability. In their study, Alyson Young and Anabel Quan-Haase (2013) examined the ways in which "the privacy paradox" operated by examining the Facebook behavior of undergraduate students. Their findings showed a distinction between social privacy and institutional privacy.

> *Social privacy concerns revolve around concrete individuals. Therefore, they are accessible and easy to understand. By contrast, institutional privacy concerns deal with companies or public institutions. Institutional privacy concerns describe people's uneasiness and fear that their data is used for unwanted purposes. (Lutz & Strathoff, 2014, p. 85)*

We market a cycle of near-term dependency. Archetypes of material innocence and inertia emerge to propagate that compliance. At the 2019 CES, Deepak Chopra stated, "I think technology has created a lot of stress for a lot of people, but that's not the fault of technology. It's the fault of the people who use technology" (Fowler, 2019). In Chopra's opinion, our future health lies in more applications, not fewer applications and on more data not less, which betrays the essence of design. We have an ethical responsibility to design for a sustainable universal future.

James Williams, a researcher in design ethics at the Oxford Internet Institute leads the resistance against "Big Tech." In response to the conviction that our minds are being rewired for commercial purposes, he posits that the idea of human rights should be extended to cyberspace. We label design as "smart," but it needs constant feeding and adjustments. The result is a dissociation from design as an augmentation of human life. We do not want health applications. We want to be healthy.

The concrete layer of design should culminate in a framework of collective permanence, mindful of its residual imprint. It should represent the sustainable aspiration of our cultural zeitgeist. To that end, we should seek design law that ensures the cultivation of supportive innovation. In developing good law, we maintain the strength of the entire social system. We are also applying the categorical imperative, which is a supreme principle of morality according to 18th-century German philosopher Immanuel Kant (Paton, 1953, p. 134).

We have the potential to accomplish great achievements by affirming the dynamic traits of the social system. Making technology easy and accessible has the potential to create a transparent and collaborative society.

Cracks in the system emerge as breakdowns in our ability to control the uncertainty of human response. In *The Demon Haunted World*, the American astrobiologist Carl Sagan wrote, "Once you give a charlatan control over you, you almost never get it back" (Sagan, 2013). An example surfaced when Samsung mobile phone owners realized they could not remove Facebook from their phones. It was preloaded and blocked from deletion

(Frier, 2019). The lack of control became increasingly uncomfortable when Facebook was sanctioned for selling users' data.

A proposed change to West Virginia's public worker health plan asked teachers to download a mobile fitness app called Go365 and earn points on it by using a Fitbit or other fitness tracker to monitor their steps. The proposal was not successful, but it demonstrated how lines between personalization and empowerment can quickly become sinister.

Leveraging the Abstract Layer as Uniquely Human

The metrics of sustainable design are livability, participation, and knowledge. The signifiers of disruptive design are found in the categories of "Disruptive Future" and "Emergent Future." The evolution of disruptive and emergent futures is triggered by the failures of design codification in the concrete layer. When we consider the symbolic space (i.e., the space of the "unknown unknowns"), we are considering that purpose is an essential foundation of materiality. Artificial intelligence both defines the materiality of our time and tests how technology becomes intimate and interwoven with human thought and aspiration. The line between the human and the machine has begun to blur.

A pattern of response emerges when the policy space becomes disconnected from the social order. Revolution is one human reaction to the overreaching of control. We are wired to rebel for the survival of the species. The symbolic language of dissent and philosophical repositioning emerge within culture as a disruptive challenge to imposed atrophy.

In 2016, Edward Snowden summarized the archetypal dynamics of technology, stating, "Privacy is the fountainhead of all other rights. Freedom of speech doesn't have a lot of meaning if you can't have a quiet space." (Schrodt, 2016). An immune response is a declaration that the system is broken and the starting point for design language that seeks to resolve that break.

We should be empowered in the process of ideation to return to zero. We need to see the power behind zero, consider the points of obsolescence, and be aware of how this space links to deeper sources of meaning. If we can remain connected to the semiotic "notness" of design, we can save innovation from being reduced to meaningless gimmickry.

There is a point at which the analytical expression of dissent is transformed into physical action. The ingenuity of the "hack," improvised solutions, is formed in the expressive abstract space. The hack represents the essence of the natural human order of physically coding the symbolic with a new schema through creativity. In food, it is the point at which organic food becomes a recipe that I can make and eat. We have a right to foods that comply with the standards of organic farming. However, we do not consider the essentialness of this right until we cannot do something that we believe is essential.

We know how to be creative. We also need to think creatively. Apple introduced its Research Kit software to allow medical scientists to gather insights within their own control, thus reinforcing the physician-patient relationship. It is a natural human desire to want balance, information, and a voice. Such initiatives are beginning to pull back on populating consumer applications.

Informing Speculative Design

Abstraction looks at speculative design in a way that better informs the designer about the public in question. It functions as intervention allowing designers to deduct "knowns" and "unknowns" from critical futures, both positive and negative. Yet-to-be-realized information, disruptive and emerging, exists within the shadow spaces of these critical worlds. By methodically exhausting what one can know helps get ahead of and mitigate any potential black swan events. Also, the more a designer knows, the more ambiguity can be built into prototyping to allow for natural, open-ended design.

Mapping abstract futures for a global sports brand speculated a new vision for sports in Asia based on socio-political tensions. Recession and mistrust of establishment affected how teens and young adults saw their future. This could not be explicitly articulated. Younger people wanted to reclaim their national identity, and find their own individualism in a highly collectivist society. The answers lived implicitly in how they went about playing their sports, the type of sports they chose and the badges they wore. They were rebooting national identity for a new generation.

Visualizing this more abstract space of emerging identity empowered the brand to think beyond what any one sport represented. It allowed designers to build meaning and relevance in terms of how people affirm who they are in relationship to their society. It allowed them to cultivate muses to fuel their inspirations through emerging traits.

In Autumn 2018, MIT's Design Issues published *Provocation, Conflict, and Appropriation: The Role of the Designer in Making Publics*. The article discusses various approaches to speculative design. Each case shares an underlying commitment to viewing design as embedded in the production of publics and to making visible their issues and shared struggles. The struggles exist within one framework, but they have varied time trajectories and "notness" spaces.

The evolving approach to speculative design is to shift the designer's role from singular artist to conspirator, bringing greater participation into the role for diversity. Mapping abstract futures doesn't lessen the role of the designer. It better informs their design.

Longitudinal Reliability and Validity

Mapping abstract futures for American food producer Land O' Lakes meant it first needed to understand the bigger context of the future of food. People want nourishing food, safe food, food security, transparency, and sustainability. Their demands follow the same challenges as their expectations for privacy. Within their smaller circles of friends and family, they understand: "Food is what I expect." "Privacy is what I expect." However, when the public circle widens, human scale is lost.

Land O' Lakes wanted to live up to the relevancy that society forecast for them. As a legacy brand, they sought a renewal of identity. What were the signals in the social discourse that held possibility for them? Big food blind spots are typically in terms of what a corporation cannot do or scale. Instead, they create facades of seeming innovation.

However, Land O' Lakes had been nurturing a collaborative system of co-op farming since 1921. They knew there was power in being a "farmer-owned" cooperative. Being "farmer-owned" distinguished them from publicly owned big food competitors. It was their "known known." It was direct and valid. It became the co-op's mantra. Yet, it unexpectedly rooted Land O' Lakes in the concrete layer, leading to implicit biases of traditional farming and nostalgia.

The "farmer-owned" positioning also was not supporting the breadth of agritech at Land O' Lakes. Initiatives were presented as layered, when they were in fact well-integrated. The disconnect and the desire to understand the disconnect was their "known unknown." "Farmer-owned" needed better interpretation.

Natural language processing uncovered that "farmer-owned" and its future was not about self-pride. Thought-leading farmers were preoccupied with the concept of stewardship. Their concern for stewardship thrived from farmer-to-farmer as they shared notes and sought each other's support. The stewardship conversation was the "unknown known" that the outside world was not hearing.

Mapping abstract futures, the team exposed the "unknown unknowns" behind "stewardship." They learned that within a co-op system of stewardship, big learns from small and small learns from big, feeding smart collective knowledge to a future state of innovation. Land O' Lakes' un-siloed approach in terms of farm size allowed for the forward-thinking synergy.

The team also learned that gender dynamics were playing a critical role behind stewardship. This was not about masculinity or girl power or "leaning in." This was still about sustaining farming for the ages, and doing the work to bring real food to people. Many family farms were already run by women (just not designated on paper). Men and women had been working in farming side-by-side for centuries.

The concepts converged under a relatable conviction of "All Together Better," bringing Land O' Lakes messaging back to the collaborative essence of farming -- with a resounding modern focus for the future.

Ultimately, this was expressed through their SHE-I-O initiative highlighting the female role in farming, as well as putting forth voices of Land O' Lakes farmers talking about how they disagree but come together to solve problems.

Each iteration delves into the meaning of stewardship and the gravitas it reflects within "farmer-owned." Further intriguing "unknown unknowns" are found within empirical evidence across Land O' Lakes -- from

rethinking university food services in the midst of student protests to their SXSW Copernicus Project challenging beliefs about how our food systems should be. The protean approach to innovation unfolds as a system of social facts. In-the-flow testing against ideology spaces keeps the process inductive and flexible.

Abstraction and the Value of Human Critique

Abraham Maslow's law of the instrument states, "if all you have is a hammer, everything looks like a nail" (Maslow, 1966). Hence, the process becomes a means to shape materiality rather than shaping the abstract space of how the material will be received and adapted over time.

Mapping relationships between the abstract and the concrete provides a strong model for inductive decision-making. Design foresight that leverages the abstract layer creates frameworks that connect back to the humans involved. Feedback loops should not disassociate the concrete from the abstract. In a provocative talk at the 99U conference in 2017, Natasha Jen of Pentagram described the lack of critique in the process of design thinking:

> *What is design criticism? For those who have gone to design school, you know how important that is in every step of the design, every discussion. You bring forth an idea. You bring forth evidence and then everybody crit the heck out of it...real designers surround themselves with evidence. You've really got to have the evidence and you've got to have the crit in order to make the world better. (Jen, 2017)*

Critique is fertile domain for design foresight. It demands that our investment in evidence be based on the natural order of "messy" traits that will determine the framework of use, moving away from "short-termism" to "long-termism." As technology moves toward increasing intimacy, this ideological challenge will increase.

Abstraction is the ultimate test to re-include the human in the design process. Consider that artificial intelligence is gaining computational power. In 2017, AlphaZero, a machine-learning algorithm created by Deepmind, a Google initiative, mastered not only chess but shogi (Japanese chess) and Go. In a matter of hours, the algorithm became the best player, human or computer, the world has ever seen. We can reach the ultimate machine, but we do not consider the ultimate human.

Artificial intelligence and machine learning are rudderless without an abstract framework for a truly sustainable future. The issues of bias and blind spots are problems to be solved now before they gain increased technological momentum.

The craving for emotional intelligence requires that we expand our binary world into an abstract space for which only the human brain has the capacity. Music has its own metaphor: "It's not the notes you play, it's the notes you don't play" (Popik, 2012). This absence is the essential space that separates humans and the silence that transforms materiality into meaning.

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Research Perspectives IN THE ERA OF Transformations

Bringing futures scenarios to life with video animation: A case of disseminating research to nonexpert audiences

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In social science, researchers are often confronted with large amounts of data generated through qualitative methods such as interviews, interpretive narration, and oral history. While selecting an appropriate form of communicating the findings at the end of a research project is every research's obligation, the dissemination of key insights gained from academic research, and presenting these in other formats that effectively extend the research results and new knowledge gained to nonexpert audiences, is many times forgotten. The purpose of this research is to address this gap in the literature by answering the question of how to communicate futures scenarios to nonexpert audiences, corporate decision-makers, and their staff using video animation as a medium. The process presented in this paper is based on a use case in which academics and designers, at a design school, took the findings of a financial services futures study and applied storytelling and visualization techniques to bring futures scenarios to life with video animation.

Keywords: design foresight, research dissemination, storytelling, visualization, video animation

Introduction

In social science, researchers are often confronted with large amounts of data generated through qualitative methods such as interviews, interpretive narration, and oral history. Selecting an appropriate form of communicating the findings at the end of a research project is every research's obligation (Berg, 2001). In academia, the dissemination of the authors work traditionally serves research communities, who are reached through journal articles and conference paper presentations (Barnes, Clouder, Pritchard, Hughes, & Purkis, 2003). However, dissemination of key insights gained from academic research and presenting these in other formats that effectively extend the research results and new knowledge gained to nonexpert audiences, is many times forgotten (Dahlstrom, 2014; Troman, 2001). Top executives in industry know that they can profit from research findings, sometimes directly. Nonetheless, scholarly literature focused on dissemination strategies able to illustrate academic research findings to business stakeholder communities is still relatively scant (Phillipson, Lowe, Proctor, & Ruto, 2012; Starkey & Madan, 2001).

The purpose of this research is to address this gap in the literature, by answering a core research question: "How to communicate futures scenarios to nonexpert audiences, corporate decision-makers, and their staff using video animation as a medium"? Specifically, the aim is to contribute to improved practice and the impact of foresight by providing an exemplar of a research dissemination process in conceptual and operational context. That is, for design and foresight researchers to diffuse the research finding's most salient features outside of the academic setting, could the presentation of foresight data in an accessible video animation narrative become an effective use of medium?

The paper begins with introducing the background that motived this research, before introducing what can be learned from the design and foresight literature with regard to the core research focus in narrative foresight, storytelling, and visualization context, as the relevant areas of inquiry. The paper then outlines steps in transforming written research into animated futures scenarios using narrative storytelling to deliver ideas (Dahlstrom, 2014; Milojević & Inayatullah, 2015; Price, Matthews, & Wrigley, 2018). The process is based on an applied research use case in which academics and designers, at a design school, took the findings of a financial services futures study and deployed storytelling and visualization techniques to bring futures scenarios to life with video animation. Finally, key observations are presented of the applied process framework that can help improve the researcher's understanding of theoretical and practical considerations of presenting research findings to a boarder audience through video animation.

Background to project

Complexity and hyper-uncertainty in business, increasingly effecting almost any industry, are some of the elements that present the context in which organizations view their current and future state. Managing the allocation of resources and capital funding into projects are becoming increasingly difficult for stakeholders responsible to balance short-term objectives, with the longer-term strategic direction needed to adapt and survive amid accelerating change in the external macro-business environment (Buehring & Liedtka, 2018; Hamel & Valikangas, 2003; Vecchiato, 2015; Wolf & Floyd, 2017). To tackle these challenges, decision-makers are called upon to develop their organizational learning by practicing systematic futures thinking to anticipate scenarios of the future (Adegbile, Sarpong, & Meissner, 2017; Rohrbeck, Battistella, & Huizingh, 2015). Developing systematic futures thinking and forward-looking research capabilities can help organizations to envision how seeds of change from today's fringes might make way into the mainstream and how, conversely, the elements from today's mainstream might fall to obsolescence (Cagnin, 2018; Slaughter, 2002). Areas deeply concerned with changes in the external environment, in both theory and practice, are foresight and design - each focused on thinking about, and gaining a better understanding of the future (Buehring & Liedtka, 2018; Cagnin, 2018; Gabrielli & Zoels, 2003; Heger & Rohrbeck, 2012; Wilkinson, Mayer, & Ringler, 2014).

Integrating Design with Foresight

Just as the foresight discipline comprises of a wide range of approaches and activities, such as trend forecasting and storytelling techniques designed to help business stakeholders envision opportunities in the future (Inayatullah, 2008). The practice of design in business encompasses visual communication tools and processes that engage interdisciplinary stakeholder teams responsible for creating sustainable value propositions that ensure the organization's future (Bohemia, Rieple, Liedtka, & Cooper, 2014; Buhring, 2017; Heskett, 2001; Lojacono & Zaccai, 2004). Traditionally, foresight processes focus on the contingency as its entry point, building future scenarios based on key trends and uncertainties in order to lay out a set of plausible futures. Whereas in design, possibilities are taken as the starting point, laying out a portfolio of concepts based on the question "what if anything were possible?" Where the design thinking realm is likely to generate preferred scenarios (in the eyes of users), foresight generates plausible scenarios (based on trends and uncertainties). Similarly, design has the ability to envision, visualize, and communicate things that do not yet exist (Candy & Dunagan, 2017; Dunne & Raby, 2013; Eggink & de la Bruheze, 2015).

The development of futures scenarios is equally central to both foresight and design practices. While effectively disseminating insights derived from, e.g. trend analysis, expert consensus (cf. Delphi method), simulation, causal modelling or other forecasting techniques, the outputs can vary between written text and/or numerous visualization styles. Data visualization, as a communication medium for storytelling, is considered important when the research team is not the same as the one that will have to act and make decisions based on the reported data findings (Vaughn et al., 2013). Equally, stories have proven as an effective way of conserving and passing on information, and framing data through visualization techniques and images as sequences of events, may provide audiences with stronger memories (Austin, 2010; Dahlstrom, 2014; Dator, 2009; Ma, Liao, Frazier, Hauser, & Kostis, 2012). More recently, some scholars and creative folks within design practice have experimented with experiential and enacted immersive scenarios (Candy, 2010; Candy & Dunagan, 2017; Schleicher, Jones, & Kachur, 2010). To this end, however, precious little guidance exists on how to apply the logic of narrative and visualization as understood by writers, designers, or animators to the creation of outputs that bring futures scenarios to life. (Raven & Elahi, 2015).

Narrative foresight and storytelling

Based on established concepts from design and foresight literature theory, narrative storytelling focuses on the stories individuals, organizations, states and civilizations tell themselves about the future (Milojević & Inayatullah, 2015). In this research, the study is focused at the intersection of three areas of inquiry: design and foresight, and methods such as storytelling and data visualization, where the process of communicating the findings derived from a futures study or project to nonexpert audiences, is based on the logic of storytelling as a prerequisite to provide visual representation of narrative fiction (Cagnin, 2018; Dahlstrom, 2014; Raven & Elahi, 2015).

A narrative fiction model, comprising of idea, character, setting, storyboard, composition, technique and colour (cf. Maass, 2002), is used to present data in a format that is more readily accessible yet aimed to be much richer than typical "infotainment". The motivation for adopting a video animation style as a medium is that people in modern societies have undoubtedly become more used to dealing with content on digital displays and screens (Feather, 2013). A century ago, almost all popular fictional entertainment was consumed in books (Blundell, 1988; Thompson & Bordwell, 2003). Electronic storytelling (in the shape of the radio drama or news reports) was in its infancy. Education, similarly, was delivered almost entirely in the form of a teachers standing over textbooks, and that state of affairs continued throughout the 20th century. But there have been rapid changes in the past few decades. Today, the default medium of sharing content is electronic and visual: people watch stories unfold on television, on their computers, on movie screens and even on their telephones (Dahlstrom, 2014; Introna & Ilharco, 2006; Rosen, 2004). Conversely, conversations are more likely to happen by digital means, through text or social media, than by voices (Dahlstrom, 2014).

In an organizational environment, the context in which this design foresight research took place, the objective of practicing futures thinking and foresight is to decide on what decisions management can make today to create a best possible future for the organization (Horton, 1999; Slaughter, 2002). Equally important in strategic foresight practice, however, is to stimulate not only futures thinking through scenarios and narrative storytelling, but to provoke a call to action from the intended target audience once research is completed, and insights have been disseminated (Slaughter, 2002; Vaughn et al., 2013). As Michel Godet, a pioneer in the field of futures studies pointed out:

> *"Even though I introduced methods into the field of futures studies, I think that scenarios are overdone. Making scenarios is fine, but so what? Once a scenario is drafted, what do we do to take action, to make whatever we want to happen or not to happen? We should really be turning them into a project-based approach (Godet, 2012, p. 47)."*

The purpose of using animated video in this design foresight research was to transform the written report findings into narratives and visuals, while at the same time giving the data a new shape to engage and make it acceptable to a nonexpert audience of corporate decision-makers. Empirical studies support narrative and visual processing as generally more efficient; for example, Glaser et al. (2009) describe four important factors in narratives, namely dramatization, emotionalization, personalization, and fictionalization, which makes it an effective form of knowledge acquisition. Stories can change or enhance the observers' perceptions of futures, seeing themselves in different perspectives, and identifying their "self" by interpreting and completing the story in his or her head (Sametz & Maydoney, 2003). Moreover, as Wyer (2014) highlights, narrative cognition is considered the default mode of human thought, which provides the structure and underlying foundation for memory. Hence, the integrating foresight and design principles in forms of 'narratives and storytelling futures scenarios' manifests a basic hypothesis that providing the user audience (i.e. corporate decision-makers) with a format of comprehension, is to gain a deeper understanding of change, and acting on the implications of possible realities emerging in the macro-business environment.

Applying design to foresight outputs for non-academic audiences

In this paper, a real-life use case featuring a major research project undertaken by a university in partnership with a global leader in wealth management, is presented. Large-scale research produced a significant amount of data over a long period of time, as it was really a series of futures study projects spanning over a three-year timeframe. Traditionally, findings would be shared with senior executives in printed report formats. Prior research were futures studies, producing data resulting from varying forecasting techniques designed to help envision trends in wealth management and private banking over the 2030 time horizon. In the 2018 incarnation of this project, a decision was made to produce a portion of the findings in the form of an

animated video—and thus making the most salient findings "consumable" by a larger and more varied group of staff and internal stakeholders.

During this process, a great many discoveries were made about the necessary steps, which have to be taken to make the most of this modern medium, and to successfully bridge these two worlds—or indeed, two sets of two worlds. That is, the communication-style gap between academia and industry had to be bridged, as did the gap between printed data and dynamic images. Furthermore, steps in this process may be considered to have transferable value for design research, futures scholars, and practitioners involved in strategic design and innovation. The following table (1) describes the four process steps taken in this project:

Table 1: *Four process steps in video animation design*

Process Step	Activities and processes	Key considerations
1) The Challenge:	• Outlining important issues at the beginning. o What is the present form of the report data? o Who are the audience members who will ultimately "consume" the key findings? • Transitioning from producer of a research report, to producer of a short film (e.g. a timeline for preparing a traditional research report is very different from the timeline for creating a movie production.) • Identifying the production stages, and their specific objectives.	• Research Data • Technological advances
2) **The Exploration**:	• Clarifying the aims and objectives. • Identifying key activities relating to the writing, editing and filming process. • Familiarization with the research findings; identifying the most salient features of the research data. • What form should the output take e.g. visual lecture, character-based storytelling, narrative animation? • Creative options available, and best formats (delivery systems) to meet the desired outcome(s). • The length of story / narrative animation, respective of target audiences. • Available resource (e.g. time, talent, materials, financials). • Learning from other disciplines.	• Choosing the genre
3) The Interactions:	• Issuing of key research data sets (most salient features) to project stakeholders, and seeking feedback / identify remaining issues. • Project Management: Allowing for multiple iterations between key project stakeholders incl. secondary parties, such as the writers, the animators, and the actors. • Time management: Allowing ample time for extrapolating the most compelling data features. • Developing the script. • Selecting the animation type format.	• Preparing the script • Selecting the data • Applying narrative techniques • Choosing an animated style format
4) The Delivery:	• Rendering and sequencing the video animation. • Issuing of video to project stakeholders, and seeking feedback / identify any remaining issues. • Fine-tuning video animation, sound track, and any additional opening/closing messages	• Gathering audience feedback

Following, are the detailed explanations of each process step:

Step 1 - The Challenge

Research comes in two main forms: quantitative and qualitative. In simple terms, the first involves the collection of numbers and the comparison of data; the second involves interviews, discussions and theoretical projections. In this particular project, there were both types of data, but the emphasis was on the second. Since the aim was to consider future scenarios, there was no actual numerical data available about financial services in the distant (2030) future. The project depended on taking current data available through secondary research, and exploring alternative futures and directions inspired from prior research, which produced a set of futures scenarios developed through Delphi as a proven foresight technique in futures studies. Hence, the findings were necessarily generalized and non-specific. Notwithstanding the rigorous nature of research, anticipation of possible futures must be rooted in firm ground, hence copious amounts of data were analysed and synthesized. Consequently, a portfolio of materials considered as important for the intended audience must be gathered before any work on the video deliverable can begin. In this particular project exemplar, the relationship between the academics and the industry representatives had already progressed over a 3-year timeframe, hence, substantial amounts of documented data was available.

Research Data

The research data generated in prior research (i.e. project 1, project 2) provided valuable insights and trends, additionally, illuminating the early signs of change that would substantially determine alternative futures as influenced by the numerous projected changes in modern society. For example, business activities in the future would involve human face-to-face interaction for some functions, and automated interactions for others. The general move towards convenience would continue. Individuals would expect to be able to use technology to do business anytime, anywhere, and anyhow. And, as with any commercial activity, there would need to be a focus on recruiting future clients at a young age and being aware of their changing needs. There were worries, too. For instance, if more activity was done through digital screens, the relationship-building process between clients and representatives of the industry might be disrupted or destroyed. The change of demographics was also considered key; especially relevant to the rise of Asia's upper middle class population. Thus, in the geographical context of this study, gaining a deeper sense of the emerging needs and aspirations of Chinese consumers was considered important.

Technological advances

Making sense of uncertainty is particularly relevant when technological advances, such as artificial intelligence, machine learning, big data analytics, and hybrid human-machine systems could play a vital role for mature organizations to sustain the effectiveness of their strategic innovations, and the enterprise itself. Hence, technology roadmaps as potential future enablers of client-centric services and experiences was a critical focus in this futures study project. This raised numerous questions that were not easy to answer. For example, if business core functions were going to be more automated, would there be a need for expensive physical buildings on High Street corners? How much of the physical infrastructure of businesses might disappear entirely? If computers did the back-office work, would there be a need for so many staff performing administration? Moreover, if a foresight study is taking a ten or twenty years outlook into the future, what can be realistically anticipate will happen? Technology is generally designed to make life easier. As the first step in defining the challenges, this futures study project was encouraging as the data derived from previous research provided many thought-provoking data sets that would lend themselves perfectly to visual interpretation.

In the second stage, the objective was to explore the ways to select and deliver the information.

Step 2 - The Exploration

The exploration of formats for this project began with researchers having to accept a few simple facts: books are long, movies are short. A film contains a fraction of the amount of data in a book. For example, a Harry Potter movie may be about two hours long. But a Harry Potter audio book can take more than 20 hours to read out loud. So in that sense, films can never deliver as much data as books. But in another sense, the opposite is true. The adage that a picture speaks a thousand words (Magill, 1989) is valid even in its most literal interpretation. One could easily expend a thousand words describing a painting by Hieronymus Bosch and fail to do it justice. In terms of delivery of information, a filmed image has thousands of pixels of data, and may deliver more information (albeit of a different kind) than a chapter of a book.

Furthermore, there is a difference in audience reach and audience impact. A chapter of a book can deliver a large amount of information to the person who sits down and studies it. That may be a small number of people. Books are not passive entertainment – they have to be actively read by participants who have to be willing to do the work, so readers are self-selected enthusiasts for the material. In contrast, movies are more easily accessible, so can find wider audiences, and if well put together, can have as much impact as books (Ma et al., 2012). A short film can have enormous emotional powers. Still, this is not a clear win for movies. Book readers are a self-selected group of people seeking information (data) and willing to work to obtain it, so books end up doing their job well. Movies, in contrast, reach a wider but less focused, less committed audience. Viewers are not asked to work as hard as readers, and thus may reach a lower level of engagement.

Choosing the Genre

Once it was acknowledged that the film would deliver a relatively small, yet critically important selection of the most salient features derived from previous studies, and newly added findings, the next choice-making process was focused on the genre. A futures project would naturally require images of things that don't yet exist. Working within the parameters and financial constrains typical of any research project, it would clearly be impossible to make a live-action movie in a science-fiction mode. The costs associated with producing a short animation movie can vary greatly, when comparing a professional 3D animation production that produces Pixar-style movies with a much more cost-effective 2D animation. While budget constraints are inevitable, the real emphasis in the choice-making process should be placed on illuminating preferable or desirable futures concepts and emerging ideas, which the project stakeholders have carefully assessed and selected based on the research dissemination aims and objectives. However, it must be emphasized that animation project teams opting for a 2D animation format to present their futures study findings, should allow for stakeholder expectation to be managed, as limitations on the animation quality and the length of video requires a balanced approach (Vaughn et al., 2013). Secondary research into the length of applicable video animations, and informed by well-reviewed short animation films in a similar genre, were typically between two and five minutes in length.

In this use case, a small team of animators was engaged to produce a 5-minute animated video. Step 3 in the process explored the interactions between all parties concerned, i.e. academics and the industry representatives, but also the secondary parties, such as the writers, the animators, and the actors.

Step 3 - The Interactions

Professional moviemakers speak of a system known as “the pipeline”; its purpose is the ordering of the processes into an efficient linear timeline (Mullen & Andaur, 2010). The script is written, reviewed and finalized before any production work starts. The video work is then done, and filmed (animated) segments are edited and reviewed and approved before any final rendering is performed. The aim of the pipeline process is to prevent changes after filming or rendering have begun, and thus avoid creating frustration and wasted work.

Preparing the script

Frequent meetings and exchanges between academics and industry representatives, and between academics and animators, were needed. Script ideas were circulated and presented in reiterative form; the logical idea for the “future narrative” script using prior research as source materials, was to show a day in the life of a person doing his or her wealth management banking in the future (i.e. 2030 time horizon). This format would be a simple translation of the key ideas that have transpired from the academic futures studies reports, and converting these into a visual presentation showing a typical day of an individual in the future. However, experiences in this regard have shown that extreme predictions (i.e. events yet to be experienced) can be open to mockery (Tetlock, 1999). Lest not forget that people have been producing cartoons predicting the future since at least the 1950s—showing citizens going to work in flying cars, and so on. As a possible counter measure, design teams could insert detectable elements of self-awareness in the animation cartoon—if the work included a degree of ironic self-mockery, it was less likely to be attacked. For example, in this case study, the opening scene was designed to a 1950s style “day in the life of a future citizen” element, thus teasing the audience to common folklore of science fiction genre. In a subsequent draft, the cartoon opening scene was replaced with a Star Wars parody – rising yellow text and grandiose epic music. This choice-making process was decided as academic statements have the potential to default to over-wordy jargon in a video context. But placing some useful academic statements into the Star Wars passage enabled the project team to deliver key

introductory context-setting lines using academic language in a way that was most probably acceptable to the viewers.

- *Selecting the data*

What data should actually be include? This question took a long time to deal with. The first draft included quite detailed summaries of the main points in the print findings. Subsequent drafts contained less and less material directly lifted from the print work. In this particular case study, all parties eventually agreed to use relatively few direct transcripts of ideas. It should be noted that this was a single case, and may not be representative of most cases – it was a pleasant surprise to the academics and the creative partners that the industry representatives were so willing to move away from a literal transmission of the print work towards a thematic one (Figure 1).

Figure 1: *Animation video story master board - production design – high-level scene sequencing*

The final draft was much more story based, including only a general and quite impressionistic view of the findings. Once this had been agreed, the process went quite smoothly. All parties agreed that while academic reports have lengthy lists of findings, stories, and especially short cartoon-style animations, almost always have a single powerfully delivered message. Subsequently, instead of using the "day in the life of a future citizen" outline, it was decided to tell the story of a single event in the life of a single individual. In this use case, a young person reaching adulthood and dealing with his wealth creation needs. The core message was simple: "*Everything you think you know about handling future wealth creation activities is going to change".*

- *Narrative techniques*

A member of this project was a fiction writer who introduced techniques from narrative production. For example, what is sometimes known as the Sherlock-Watson technique (Eger & Martens, 2017), is when one character regularly explains things to another character – and in doing so, gives necessary information to the audience without the need for excessive narration or voiceover. Another technique in storytelling is the use of the twist at the end (Ekström, 2000). Relevant to the use case, the story included a teacher who introduces the main character to a digital version of himself. The twist at the end was the revelation that the teacher is not a human teacher at all, but the teacher's own digital alter ego.

- *Choosing an animation style format*

Researchers and designers of video animations can often experience frustrations during the iterations of the visual work. There are numerous different software programs which can be used to produce animated videos.

The most popular software programs include Flash™, Blender™ and Maya™ . All of these produce work in very different styles and qualities. The most cost-effective and fastest is Flash™. However, in this use case the results of the first draft looked clunky and unappealing. It quickly became clear that Flash™, while relatively easy to use, can produce uncomfortably simplistic work. Multiple iterations of the visual material storyboards (Figure 2) eventually led to a compromise where the quality was at its best considering the project-related budget constraints.

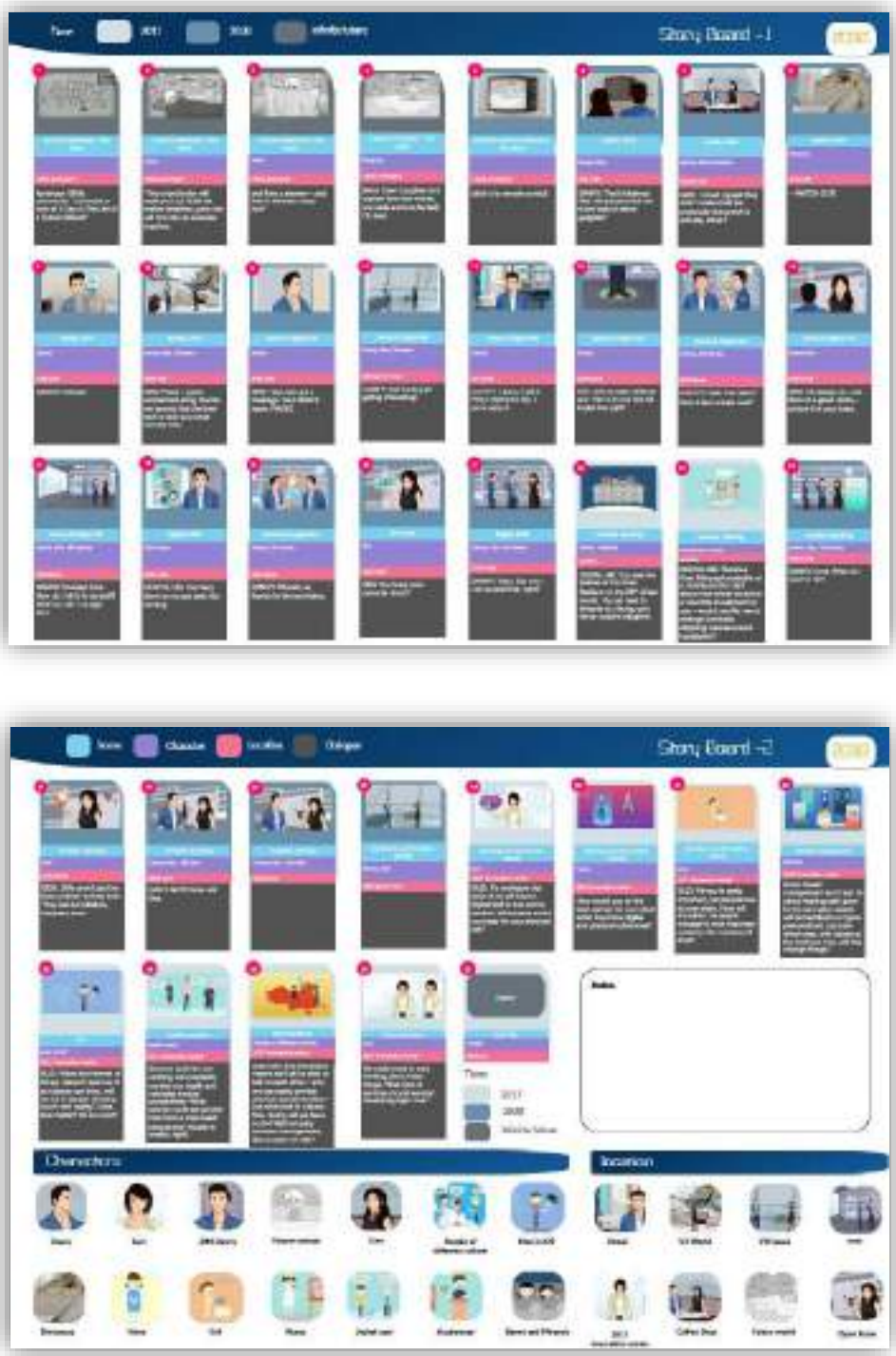

Figure 2: *Animation video storyboards - production design, incl. character development*

Step 4 - The Delivery

One of the main discoveries made in this use case was that what was imagined were the two main considerations – the handling of authentic academic findings and the delivery to a real-world audience – were joined by a third element: artistic validity. The short movie had to work on its own terms, as a short movie. It needed internal logic and had to be artistically satisfying. In the final stages, judicious editing was applied to tighten the scenes and make sure the story elements moved swiftly enough to hold an educated audience's attention. Pacing was vital. Furthermore, a great deal of time was spent reviewing music libraries – using the right soundtrack elements for each scene can make a major difference in touching the audience emotionally (Walker & Boyer, 2018).

The final test of how well the learnings from trials during the production phase were applied in the animation video production, is the first reaction of the stakeholder viewing audience. How they (in this use case they were financial services decision-makers) react is a matter of concern. If busy people are pulled away from their desks to be made to watch a preachy cartoon made by non-bankers about banking, any form of denial or rejection would be an undesired outcome. To disarm accusations that production teams are telling industry players how to do their jobs, the project team decided to end this futures short film with an animated character asking a series of questions – thus presenting the work as a conversation starter, rather than a preaching message. "*Here are possible futures for your industry"*, the movie said. "*But what do YOU think?"*

- *Audience Feedback*

As a final outcome of this use case, the futures scenarios that were transformed into a short (7-min) video animation movie received gratifyingly positive feedback from its intended audience. Futures scenarios and their interpretations were hailed as interesting, thought-provoking and succeeded in sparking rich conversations among wealth management decision-makers and their staff about the different types of business operating model futures [2030]. Unlike with written reports and academic papers, the feedback was instant – as soon as the video animation film was finished, people expressed opinions and shared the ideas that the 'design storytelling with futures scenarios' had triggered.

The following diagram (Figure 3) is a high-level visualization of the actual production design activity flow applied in this video animation project.

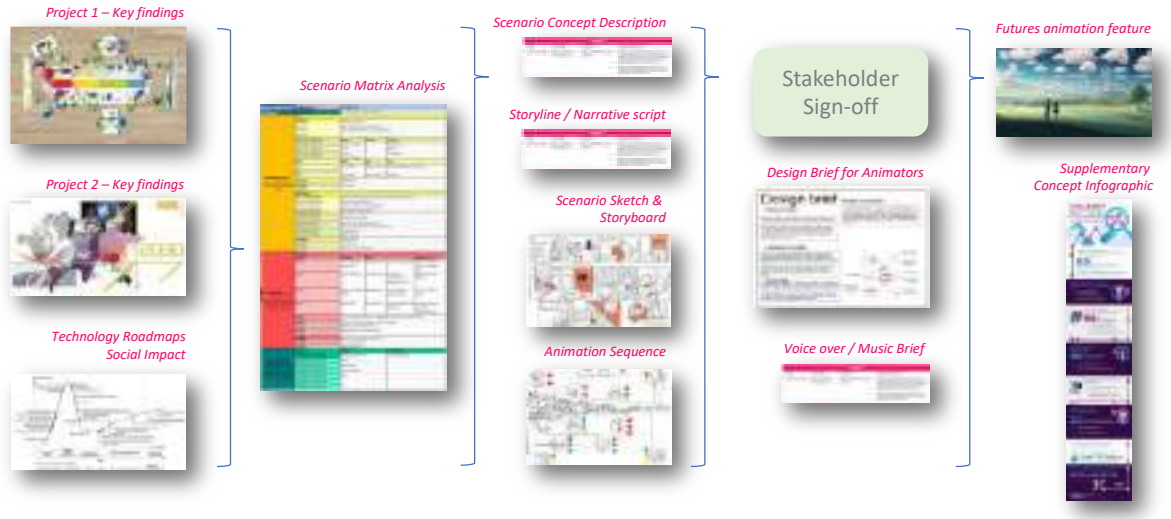

Figure 3: *Animation video production design – high-level activity flow*

Ten key observations

Important observations were made in this use case, which apply strongly to futures narratives animation where artistic interpretation is needed to show things that don't yet exist. It can be argued that futures studies should have an obvious imaginative appeal, hence, the call for adopting visual interpretations. From the learning of this use case, the following table (2) is a summary of key observations made:

Table 2: *Four process steps in video animation design*

Key Observations	Lessons Learned
1) Set Stakeholder expectations	Audiences are used to extremely high production values for screen productions. They regularly see work with quality writing, visuals and acting. Academic researches should not try to compete. Instead, they need to set reasonable expectations for themselves and their viewers, aiming to simply produce watchable, functional videos that provoke interest and can trigger further explorations. As this use case has highlighted, when resource limitations may prevent the production of a hyper-realistic 3D animation, making a simple, likable 2D animation video can be an important medium to deliver a message and provoke questions leading to actions.
2) High selectivity	Successful writers of academic studies pride themselves on the wide comprehensiveness of their work, missing no angles, and covering every possible interpretation of their data. Successful creators of good short films pride themselves on the opposite -- their brutal selectivity and their skill in ignoring all but the key elements. Thus major compromises are necessary. Academic researchers will need to realize that significant elements of their printed report will not be included, and may only be represented in thematic form.
3) Tight scripting	The careful, precise language of academic research findings has the potential to come across as unattractive wordy jargon in TV format, where sentences have to be very short and very punchy. The involvement of experienced screenwriters should be considered as vital.
4) Self-awareness	Academics research delivers serious work. But TV is a medium with a light, entertaining tone, and the presentation of lengthy, hyper-analytical material can come across as too overwhelming for nonexpert audiences. Thus video representation of academic work benefits from a light touch, or even the inclusion of elements of irony, wit or self-deprecation.
5) Deadlines	Academic researchers value precision of language, and the editing process will continue until the writer is pulled away. In filmmaking, however, the pipeline system means that the script must be completely finalized before the production process begins. Filmmakers are strongly opposed to any re-visitation of the script after this moment.
6) Single message	A report containing academic research findings can make numerous important points. In a short film, however, only a single key message can be delivered. Other findings can be included, but only if they reinforce the main message. In this use case, it was: "*Everything about this industry is going to change."*
7) Climax	The delivery of a lecture or the recitation of a paper at a conference is a linear presentation of data—an evenly paced list of facts in a straight line. Films are very different. Animation storytelling videos need to have more of a "story shape", with an introduction, developments, a climax, and a twist at the end.
8) Team game	An academic report is often the work of a single author. Yet video productions are necessarily team games—there are numerous contributors to the final product, from the director to the camera operator to the sound technician to the editor. A strong sense of collaboration is needed, as all the elements, and all the contributors, are important.
9) Audience awareness	Printed reports are "pull" media. They are only read by the interested reader who chooses to read it. But videos are "push" media, unspooling on any type of screen. Thus material should be prepared for a wider, less informed, less sympathetic audience. This is a positive in some ways – more people will see the report. But it can also be a negative. The material needs to be shortened and simplified, without

Key Observations	Lessons Learned
	being “dumbed down”, which is a challenge any production team needs to anticipate.
10) Right for some	Learnings from this use case suggest that the presentation of research material in video form, especially for a futures narrative storytelling project, can be very satisfying--yet it is challenging, time-consuming and requires many man-hours and an appropriate budget. A film (animation video) reaches a wider audience, but also a less specialist, less engaged one. The material can be more easily accessed, but is necessarily simplified. As a result, it can be argued the majority of research reports, especially very technical ones, should continue to be presented in traditional form, as printed documents. But a minority of research reports – especially in the context of futures studies, and their futures scenarios, can benefit greatly from translation into video format. While challenging at times, a positive learning process will benefit academic researchers exploring this type of medium to successfully deliver the key conclusions of a body of research to a wide nonexpert audience, corporate decision-makers, and their staff.

Conclusion

The dissemination of design foresight research brought to light several important issues. An exemplar of a research dissemination process was presented in conceptual and operational context, were the challenge was to concentrate a relatively large number of research insights into a brief animation video of seven minutes in length. A list of academic findings considered most relevant to a nonexpert audience was turned into a narrative story plot that worked on its own terms. Researchers and designers delivered an important message derived from design foresight research in a dynamic format that was designed to getting non-academic staff thinking and talking about alternative futures relevant to their industry. A meaningful experiment was conducted in presenting academic research findings in a different format using narrative storytelling and dynamic visualization techniques. However, this process also illuminated the challenges in bringing futures scenarios to life with video animation. While it was highly engaging, it is important to stress that this type of dissemination activity takes time. Moreover, many of the research findings were identified as being too challenging to interpret in narrative storytelling form; hence, disseminating design foresight research in short video format runs the risk of only conveying a smaller view into a larger research project. At worst, it might be little more than an expanded visual abstract, thus, project stakeholders have to be very selective, and remain mindful of the principle that simplification is necessarily misleading (Punch, 2013).

What was learned from this use case is that researchers and designers have to work hard to concentrate the material, ensuring that a wide range of ideas is delivered quickly and efficiently, but without overloading the story frame. Equally relevant was the realization that what is lost in the amount of detail may be more than compensated for in terms of reach, accessibility and impact (Macoubrie & Harrison, 2013). That is, in a world in which high quality and exciting visuals are the norm for entertainment and education purposes, it is inevitable that academic researchers responsible for effectively extending the research results and new knowledge gained to nonexpert audiences, will have to become innovative in keeping audiences engaged. Furthermore, artistic considerations have to be reasoned in addition to academic ones, as these can subtly change the ultimate message of the work: academic research address the head, while narrative storytelling and dynamic visualization techniques have the ability to also touch the heart. To this end, the objectives for engaging the audience have to be clear upfront to ensure that the approach most favoured by the research stakeholder team, is also the most effective form of research dissemination (Punch, 2013). In this use case, the objective was to experiment with video animation in order to disseminate research results and new knowledge gained to a larger group of nonexpert audiences. In future studies, however, this approach will benefit from adding additional outputs, thus balancing the key findings gained from design foresight research across complimentary median, for example, combining video animation with infographics.

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Systemic Design for Policy Foresight: towards sustainable future

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In the last 15 years, tackling wicked problems have evolved into a process that requires multiple change-makers able to face with complexity. At the same time, it has generated an increasing interest and proficient relation among foresight and design, due to their shared interest in anticipation and future orientation. Such relationships are visible on similarities they both have on the mindset and methodology used when approaching future scenarios. This paper aims to delve into a better comprehension on how the combination of Systemic Design and foresight can think both creatively and systematically about the future and have a strategic role in a policy-making process. This example of collaborative foresight is illustrated by RETRACE Interreg Europe project (A Systemic Approach for Transition towards a Circular Economy funded by the Interreg Europe), demonstrating how Systemic Design with a foresight vision can play a leverage effect in the transition of the European regions towards Circular Economy in a long-term horizon.

Keywords: Systemic Design, Policy-making, Foresight, Decision Making, Circular Economy

Introduction

Today's complex global and erratic changes are rooted in multiple causes which have become interconnected over time. On a worldwide scale, climate change, high rates of poverty and market instability are just some of the critical drivers that have a great impact on how governments of today operate. The interconnected nature of such global trends, reveals uncertainty as a key issue in our society. This demands us to redesign our public policy conditions in order to be more future-oriented towards sustainable development.

Currently, it is impossible to conceive that wicked problems can be solved individually, in fact, an interconnected world requires a structure of interconnected solutions and change-makers able to understand and visualize complexity. For that reason, it is necessary to adopt anticipatory approaches that enable the combination of technology, design, business and social organization such as strategic foresight, systemic perspectives and participatory methodologies which can activate innovative mechanisms of sharing knowledge and experiences. In particular, the Systemic Design (SD) method tackles the complex phenomena through specific design tools which highlight the hidden potentialities of a scenario, delivering new relations among the local actors and entities, through promoting active collaboration among them (Bistagnino, 2011).

In the last fifteen years, there has been a growing relation among foresight and design, due to their shared interest in anticipation and future orientation. This relation is visible on similarities they both have on the mindset and the methodology used when approaching future scenarios. The practice of looking forward into the future should be at the base of our current policies, as the urgency to shift from unsustainable growth to sustainable development, primarily push the governments to face with complexity. Therefore it is needed

nowadays an innovative approach that fosters society to “think outside the box” (Considine, 2012). Precisely, it is exactly in these scenarios where the role of design, as discipline, becomes vital to approach complex environments, meet unexpected solutions and oversees innovative futures contexts.

It is true that policymaking is today more cross-sectoral rather than the past. In fact, we see examples of a bottom-up and top-down approach, groups with multi-stakeholders belonging from different sectors, a growing interest in a more collaborative approach to cope with global challenges (Krauz, 2016).

According to the above, this paper aims to delve into a better comprehension on how the combination of SD and foresight can think both creatively and systematically about the future and have a strategic role in a policy-making process. Moreover, it explores how systemic designer’s mindset and methodology can support foresight practices and strategic decision-making, developed in a collaborative and multi-stakeholders process. We illustrate this process of collaborative foresight through a specific case study, RETRACE Interreg Europe project, aiming at fostering SD as a policy-design method for regions to move towards a Circular Economy (CE) (Barbero, 2017). In fact, this case study shows how SD, with a foresight vision, can play a leverage effect in this transition, in a long-term horizon of 15 years.

The paper is structured as follows. In the first section, the research is framed inside a complex and interconnected context which requires multiple actors and strategies to cope with the major everydays challenges. Here, the three main areas of investigation are introduced - strategic foresight, policy making and design - whose cooperation reveals to be strategic towards a sustainable development. It follows the analysis provided in the section 2, aiming to deepen into the role of design, which evolved over time, shifting its focus on larger systems. The sections 3 and 4 respectively examine in depth the relation between design with foresight and policy-making. Lastly, through the case study reported, this paper features evidence of the fruitful relation among SD and foresight, by deepening the project’s phases, results and future developments.

Future orientation and strategic decision making

In our current era of unpredictable societal and environmental transformations, governments need to be more future-oriented than ever before. While on the one side, society seeks to be affected by quick changes to tackle everyday issues, on the other side a long-term vision is necessary to anticipate unexpected and disruptive events that often occur, as natural disasters or economic crisis, generated by critical drivers such as climate change, poverty and market instability. These events are just the visual expression of the complex phenomena that characterize today’s world, which leads to an inevitable uncertainty.

These complex and persistent situations are commonly called “wicked problems”. The concept of "wicked problem” can be described as a trivial and enduring situation that cannot be solved immediately due to its inner complexity and its exogenous/endogenous relations. As highlighted by Rittel and Webber (1973), a wicked problem cannot be analyzed and solved with the traditional linear and analytical method of problem-solving, since it has multiple causes and interconnections that make it hard to clearly define it (Briggs , 2007). Thus, the description given by Jones (2014) summarizes all the concepts above mentioned defining a wicked problem as:

> *a persistent, interconnected and generally worsening challenge (...) that cannot be “solved” (...) rather understood in their ecology of relationships. (Jones, 2014)*

The concept of wicked problem is widely known among the community of system thinkers, futurists and, more generally, among all those people who face with complexity. In fact the themes of complexity, uncertainty and wicked problems are both at the center of systemic designers’ investigations, as they aim to tackle global challenges, and are also taken into account by policy-makers who are increasingly using anticipatory strategies and tools to tackle social, economic and environmental issues. Among these, strategic foresight has been used since the 1970s, through the evolving conception of future thinking:

> *from a predictable world of controlled solutions to an unpredictable world of continuous learning and rapid adaptation through redesign and innovation. (Wilkinson et al, 2014)*

On that view, strategic foresight has been initially used by the industry as “corporate foresight”. This method is applied to better address decision-making by looking forward into the future. Since 1990 it has broadened its domains to public policies given the higher complexity of today’s globalized world. In fact, it has evolved from being a linear forecasting approach to be conceived as an on-going series of efforts that illustrates what could be the possible futures and what is necessary to realize these (Rohrbeck et al., 2015).

A generic foresight methodology can be summed up in the six steps outline in the table below:

Table I A generic approach to a comprehensive foresight project

Step	Description	Product
Framing	Scoping the project: attitude, audience, work environment, rationale, purpose, objectives, and teams	Project plan
Scanning	Collecting information: the system, history and context of the issue and how to scan for information regarding the future of the issue	Information
Forecasting	Describing baseline and alternative futures: drivers and uncertainties, implications, and outcomes	Baseline and alternative futures (scenarios)
Visioning	Choosing a preferred future: envisioning the best outcomes, goal-setting, performance measures	Preferred future (goals)
Planning	Organizing the resources: strategy, options, and plans	Strategic plan (strategies)
Acting	Implementing the plan: communicating the results, developing action agendas, and institutionalizing strategic thinking and intelligence systems	Action plan (initiatives)

Figure 1: A generic foresight methodology. Source: Bishop et al, 2007

It is important to stress the fact that foresight is not used to predict the future, rather to understand what could be the multiple futures that may occur and the value of learning from these. Through identifying and studying the change drivers it is possible to be prepared for the opportunities and threats of tomorrow, in order to develop in advance the best strategy to adopt.

As Vecchiatto (2012) said:

> *it is a planned learning process that requires strategic agility and adaptive capability about the future in order to react more quickly and more effectively to external opportunities and threats as they arise.*

This means to continue re-assess and re-align the project (or the system) boundaries. For this reason, strategic foresight requires a broader, flexible and open mind people able to navigate through the multiple scenarios that emerge from the changing of variables. As remarked by Wilkinson et al. (2014):

> *In times characterized by low predictability and inevitable surprise, the capacity for anticipatory adaptation, resilience and self-transformation is now seen as the key to long term success.*

An adaptive mindset and the ability to navigate through multiple scenarios, is something proper of systemic designers, as mentioned above. But, before going deeper in outlining the systemic designer's shape, it is worth to track designer's evolution over time.

The changing in the role of designer: from product to system

Nowadays, the design has trespassed its own frontiers making its domain broader and less tangible than ever. While traditionally, this discipline has been linked to the creation of objects, starting from the mid-late of the 20th century design has enlarged its application to services and systems (Ceschin & Gaziulusoy, 2016).

Recently, a consistent stream of designers are applying their skills and methods to go beyond a tangible outcome, towards intangible goals like sustainable behaviors and development. One of the reasons for this change is the increasing recognition of designers' impact. In fact, in the last fifty years, designers have been accused of the globalisation effects on mass production and uncontrollable consumption. In reaction to these phenomena the design community acknowledges to be a "dangerous breed", as described by Victor Papanek (1971) in his book "Design for the real world". Movements around design for sustainability have gained momentum providing a different vision on the role of the design. Therefore, the shift towards the dematerialization is considered the tipping point for design as the beginning of an evolving process towards services and systems. At the same time, it shifted the designers' attention from the single user to the communities as users, becoming a more participatory discipline while expressing its social and democratic nature (Buchannan, 1992).

This demonstrates the different shapes that design has, but it is clear its approach to deal with problems. Designers are able to focus on different scales as they can visualise problems, think about new strategies and

eventually “materialize” their ideas. According to Bicocca and Barbero (2017) it must be acknowledged to designers the ability to:

- **make information simple and accessible,** by managing big quantity of data and making them accessible to an end-user through easy-reading maps, schemas and scenarios (i.e. IDEO cards, gigamaps …);
- **think creatively**, and if applied to policy making, it can bring innovative solutions;
- **create connections in complex systems**, to offer a wider look on the problems and to boost transdisciplinarity. Systemic Designer are able to interconnect the elements of a system, in order to generate new business activities, products and relations.

More recently, due to the higher complexity of social, economical and environmental issues that become interconnected overtime, a new approach is needed in order to deliver systemic an interconnected solutions (Brown and Wyatt, 2015). From that panorama emerges the SD, which means understands and tackle problems on a systemic and complex level. SD merges human-centered design inside complex, multi-stakeholder systems. As explained by Jones (2014), this expertise combines designer skills such as research, reasoning methods and visualization practices, generating new reconfigurations for complex services and systems.

Furtherly, Jones (2014) outlined this evolution process in four contemporary domains of design, which have increasing complexity:

- **Artifacts and communications**: that is the traditional way of conceiving the design practice, as a way of producing artifacts
- **Products and services**: this stage includes the services for value creation (i.e. service design, product innovation and user experience)
- **Organizational transformation**: design as a change-oriented practice, using complex and bounded strategies for business transformation
- **Social transformation**: design as a change-oriented practice, for complex social systems, policy-making and community design

From that perspective, the Department of Architecture and Design of Politecnico di Torino developed the SD approach that reconfigures the flows of material and energy from one component of the system to another, modifying outputs of one process into input for another one, in order to obtain zero emissions (Bistagnino, 2011). This approach favors the visualization of hidden potentialities and supports the active collaboration among local actors, enhancing locally-based value chains (Barbero, 2012). The SD methodological approach has been described by Battistoni (2017) and it can be divided in 6 main steps:

- **Holistic Diagnosis (HD)**: it consists on a desk and field research, combined together to investigate the current scenario on the economic, social and environmental aspect, also considering the flow of energy and matter.
- **Definition of problems and leverages for change**: Starting from the framework outlined in the HD, connections and influences are analysed in order to outline possibilities and threats of future scenarios. Problems are regarded as leverages for change from which the project can be defined and initiated.
- **Design the system**: A new production model is designed whose aim is to tend to zero emissions by optimizing energy and material flows and by valorizing the waste as resources.
- **Outcomes Evaluation:** evaluation of the environmental, economic and social benefits belonging from the new production model.
- **Implementation**: implementation of the previously designed system in the specific context and consequent estimation of the new business plan feasibility.
- **Results analysis and feedback**: evaluation of the implemented system and discovering of new opportunities, making it autopoietic.

Through this methodology it is possible to create synergic linkages among the productive and natural realm of the surrounding territory (Barbero & Fassio, 2011), while reinforcing the socio-economic systems connected to that territory, in a long-time perspective.

Design for foresight and policy making

From the designers' features outlined above, it is important to highlight their future-oriented vision, social vein and capacity to deal with wicked problems. That is why is no surprise the increasing collaboration between designers and governments (Bason, 2014) in the activity of policymaking.

> *Policymaking is the process by which governments translate their political vision into programs and actions to deliver 'outcomes' - desired changes in the real world (Blair, Cunningham, 1999).*

So policymaking has to deal with long-term vision and strategy. This cooperation has often taken shape inside the so-called "Policy Labs" (i.e. Public Policy Lab in New York, EU Policy Lab in Bruxelles) usually set in government administrations (Bailey, 2017), or it is facilitated through the use of collaboration toolkits (i.e. IDEO cards). These ones support participatory processes, communication and exchange of information among different disciplines and sectors in order to combine bottom-up and top-down approaches in governance. Also, a large number of programmes and initiatives promoted by the European Commission witness how design expertise is increasingly involved in the definition of new and innovative strategies. Among these, it is worth to mention the "European Design Innovation Initiative ", the "European House of Design Management", "Design for Europe (2014)".

As pointed out by Bailey (2017) the involvement of design in the process of policy making, enables "organizational flexibility, provisionality, and anticipation". So, the key feature that connects designers to policymaking is the human-centeredness, as both are on the quest towards a better future for society. Furthermore, designers can support the process of policymaking by stressing not only on numeric trends but also on qualitative aspects such as culture, uses or local resources.

Chen et al. (2016) argued on the inadequacy of designers to operate on such a large scale, as in the public policies domain (always detected by the social science), since they are historically focused on the small scale of a product or service. As previously explained, the designer's role has evolved towards the awareness of sustainable development, leading to a more conscious design born in cooperation with other disciplines. According to Bason (2014) design is a "hybrid blend" of anthropology, systems thinking and data science, so problems are depicted differently under his lens; furthermore it enables creative collaboration and communication among different disciplines as it makes policies visible and tangible.

From the point of view SD, it overcomes the problem of the small scale through an holistic approach. Thanks to this, it is possible to constantly shift from the small to the large scale and to focus on a particular policy or intervention, while taking into consideration the bigger picture. Additionally, the SD goes beyond the simple and more common "problem solving" typical of Design Thinking, by questioning on new problems that emerge - or could emerge - from a deeper understanding of the context. Starting from the system mapping and highlighting problems and opportunities for intervention, the SD provides a different perspective of a specific context. As a result, it proves to be an effective method to deal with complexity and problems interconnections.

What strategic foresight and SD have in common, is the capacity to constantly question about past, present and future conditions by continuously re-discussing our assumptions. Nevertheless, the involvement of designers in policymaking is still an emerging trend that faces different challenges. First of all, the resistance from some policy professionals and institutions used to work in a more bounded ground that could not leave space to the openness, non-linear and cooperative methods of designers. Secondly, the rejection of external perspectives, usually uncomfortable, given onto topics and policies that always are developed "behind closed doors". Third, the request of quick response that contrasts with the long-term perspective that an innovative action requires (Bailey, 2017).

Cross-cutting approaches: Foresight and Systemic Design

> Foresight projects tend to account for systemic changes in the search for a future ideal state (Jones, 2014)

As discussed above, the practice of looking forward into the future is something shared from futurists, designers, and policy-makers. This section presents similarities, differences and possible future developments among the three different domains.

Starting from a generic foresight approach (Figure 1), it is interesting to see how similar is the methodology adopted by designers when approaching a new project. Both futurists and designers start with scoping the context: the identified problems and the collected information are delivered under the shape of a scenario, which describes the most plausible futures. After choosing the preferred future onto define the new project, a strategic plan is developed in order to be translated into new solutions that should be later implemented through an action plan.

If, on the one hand, sometimes it has been criticized to futurists the lack of action after pointing out new possibilities, on the other hand, designers, are accused to perform a short-term vision that doesn't favor sustainable development. Surely, it is important to acknowledge how the similar methodological approach shared by futurists and designers can be considered an important common ground of cooperation, on the lead of a multi-stakeholder group of policy-making. On that view, it can be considered that the systemic designers could be the right expert to involve in order to overcome the challenge of performing only a short term view.

From the previous, it can be understood the ongoing synergies between SD process and the Foresight framework (Figure 1). Most certainly, both processes share common points that are those which this paper is outlining, such as:

- **Intrinsic future orientation**: as suggested by the etymology of both names: "fore-sight", which means "seeing ahead, knowing in advance" and "pro-ject", which means "to set forward" (Hines and Zindato 2016).
- **To conceive multiple futures / solutions**, because everything changes so it's not about solving a finite problem, rather tackle the multiple problems that emerge from the changing of variables. Complex systems define a class of problems that are often described as non-linear, adaptive, self-organizing and emergent (Hadzikadic, 2015).
- **To deal with complexity,** and with wicked problems that characterise today's global challenges (Rittel and Webber, 1973).
- **Continue re-assessment and re-alignment of the project (or of the system) boundaries**, always questioning about present assumptions (Weigand et. al, 2014).
- **Micro / macro scale**, SD is able to shift from the specific intervention to the wider context on which this intervention is set. (Bistagnino, 2016)
- **Short / long term**, SD is able to deliver solutions on the short, medium and long term by developing a strategy on multiple scales. (Bistagnino, 2016)
- **Open to a collaborative process of multi-stakeholders** since complex problems cannot be solved in isolation but require the cooperation among science, humanities and technology. (Bason, 2014)

Among the tangible deliverables shared by the two disciplines, other connections are seen through the use of:

- **Scenario**: a powerful visualisation of possible or desirable futures with a strong system thinking basis (Ringland, 2010; Godet, 2010)
- **Action plan**: which materialize the strategy previously developed into a series of actions necessary to achieve specific objectives. This document should also specify the timeline, the actors involved and the expenses (costs or funding) (Barbero, 2017).
- **Roadmap**: especially used in polymaking since it specifies the concrete actions and programmes to address a full-scale implementation, shared by policymakers and stakeholders (Bailey,2017).

Since tackling wicked problems is an evolving process that requires multiple change-makers able to face with complexity, this paper explores how the systemic designer mindset and methodology can be supportive in foresight practices and strategic decision making, developed in a multi-stakeholder group. To enable this analysis it was relevant to summarize and point out the connection points among the two disciplines, as stated before. In order to deliver a wider examination on SD and foresight approaches to the discussion, it will be further narrowed the specific case study of RETRACE Interreg Europe project.

Research Exploration: RETRACE Interreg Europe Project

To illustrate how SD methodology, as proven an effective example of foresight in policy making, it will exemplify through the specific case study of RETRACE.

RETRACE is an European project financed by the Interreg Europe ETC Programme, under the 4.2 Specific Objective – Improving Resource Efficient Economy Policies. Through this kind of projects Interreg Europe aims

at improving the implementation of regional development programmes and policies by promoting experience exchange and policy learning among different regional actors (Barbero, 2017).

In this open-ended learning process, the SD approach has been used as a central methodology, shared among the partners, allowing strategic foresight and policy-making in their transition towards a CE. The goal of RETRACE is to develop sustainable Regional Action Plans (RAP) for each of the regions involved, standing the research on contextual data and matching them with the Good Practices (GP) experimented in the other countries.

The project is headed by the Department of Architecture and Design (DAD) at the Politecnico di Torino, involves 8 private and public partners and more than 70 stakeholders from five regions of EU countries: Piedmont Region (IT), Bizkaia (ES), Nouvelle-Aquitaine (FR), Slovenia (SL) and North-East Region (RO). The coordination of the 8 partners comes from the synchronized work between universities, local authorities, government offices, associations and public administration including:

University	*Managing Authorities*	*Public Company*	*Technological Centre*	*Foundation for the local economic development*
Politecnico di Torino (Lead Partner) (IT)	Piedmont Region / Directorate for regional system competitiveness (IT)	Provincial Council of Bizkaia - BEAZ S.A.U. (ES)	APESA - Association for Environment and Safety in Aquitaine (FR)	Azaro Foundation (ES)
Higher School of Advanced Industrial Technology – ESTIA (FR)	Government Office for Development and European Cohesion Policy (SL)			
	North-East Regional Development Agency (RO)			

Table 1: RETRACE Interreg Europe project partners. Source: (Authors)

Each region gathers a Stakeholder Group which includes a wide spectrum of organizations from development agencies, non profit organizations, social enterprises, research centers and innovation clusters, for a total of 70 actors involved. These stakeholders across the RETRACE regions have been key figures for the development of several proposals grounded in the local context, by supporting the transition to a CE or by creating effective tools for this change.

Figure 2: Project development _ RETRACE Interreg Europe project timeline and phases. Source: (Authors)

The timeframe of RETRACE goes from April 2016 and it will end on March 2020. Two macrophases characterize the project: first the research and then the implementation phase. The phase 1 took place from 2016 until 2018 with a series of intense research activities. Among these, the HD was at the foreground of SD methodology which enabled the collection of qualitative and quantitative data, followed by the analysis of

interactions between them (Battistoni and Giraldo Nohra, 2017). As a result, the data collected were presented through infographics, which enabled an easier fruition among a multidisciplinary team. The scope of the HD was to highlight critical factors, as well as hidden possibilities, through a three steps process:

- **Analysis of the regional framework:** concerning the territory and the industrial sectors, collecting quantitative data from official national databases (e.g. Eurostat), as well as qualitative data based on reports and on-site interviews with local stakeholders.
- **Analysis of current policies:** that addressed traditional sectors on environmental sustainability in the domains of water management, urban waste, energy and environment. The aim was to highlight the potential policy gaps that could obstacle the transition towards CE.
- **Analysis of the principal economic and industrial sectors:** Combining the previous steps through the overlapping of the policy instruments and the context information. This assessed potential synergies at systemic level among other sectors or processes at a regional and interregional scale.

While conducting the HD, the first half of the project was dedicated also to the organization of the Field Visits (FV) which lead to the identification of more than 40 GP (Pereno and Pallaro, 2018). During the field visits, the stakeholders discussed strengths and weaknesses of each good practice, in order to transfer this knowledge to the other partner countries.

After matching the results of the HD and the experiences brought from the GP, specifical RAP were developed. The RAP specified the nature of the actions that need to be implemented, their timeframe, the players involved, the costs and funding sources (Barbero & Giraldo Nohra , 2018). To achieve the RAPs each Region contemplated their current Smart Specialisation Strategies (RIS3) and development targets, which included a low-carbon CE, setting a framework for the future sustainable development of Europe.

In April 2018 the second phase of RETRACE begun, which is consisting in the implementation of the RAPs emerged in the first phase.

In the following section we are going to illustrate the preliminary results already obtained, together with those expected in the future, better explaining how RETRACE is relevant for the scope of this paper.

Retrace's results through Foresight lens

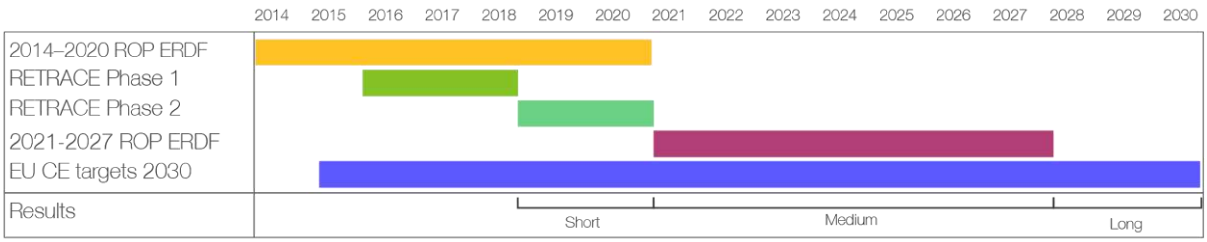

*Figure 3: Project Results development _ RETRACE Interreg Europe project *Regional Operational Programme (ROP) European Regional Development Fund (ERDF) *Sustainable Development Goals (SDG) Source: (Authors)*

In order to understand how RETRACE is framed in the context of "design with foresight for policy-making towards CE" it's worth to do an overall resume, taking the case of the Piedmont region as example.

The HD performed a central role as it scoped the context in a very deep way: in fact, through desk researches and FV, the SD obtained a first scenario related to the current context of the Piedmont Region. Matching these results with policy gaps and taking into consideration the already existing RIS3 of Piedmont region, a RAP has been developed. The RAP can be seen as a strategic action plan in which the policy gaps have been addressed - through the Regional Operation Program (ROP) - with the implementation of 3 to 6 concrete actions (roadmap).

Even if the duration of RETRACE is 2016 / 2020 it should be considered that it operates in the realm of interregional policy making though, it is admissible that the impacts will resonate after the end of the project. Starting from this assumption, RETRACE forward-looking actions have been developed on a short, medium and long term, where the short and medium ones are strategically designed in order to trigger future

implementations and address the change. This practically demonstrates the “actionable and proactive“ mindset of designers that, enriched with a foresight vision, are providing tangible deliverables in the short term, while aiming to activate broader actions in the long term. Though, for each action, a specific indicator to measure its effectiveness has been identified.

The identified actions aim to affect the policies at different levels (Barbero & Giraldo Nohra, 2018):

- **A level that implies a direct activation** of new measures or eventually implies an impact on existing measures, within the defined framework of the 2014–2020 ROP ERDF;
- **A level concerning governance and policies**, in a medium-term perspective;
- **A level concerning culture**, in collaboration with the Politecnico di Torino, to train a future class of professionals who will be able to promote a circular approach to the economy.

From above, we have selected the specific action called “Bioeconomy Platform” belonging from the first level, in order to give to the lectures an insight of a short-term action which have impact on the medium and long term horizon.

Bioeconomy platform

The Bioeconomy platform is framed within the Green Chemistry and Agro-food sectors which, as emerged from the RIS3, are priority areas in which the Piedmont Region is particularly specialised (Barbero & Giraldo Nohra , 2018). This given to the enterprises involved, the technological know-how and a strong concentration of innovation activities and research centers.

The platform has been initiated by a regional call for R&D projects aiming to create “circular connections” between different companies and research organisations, in the field of “Bioeconomy”. On that purpose, the Region intended to finance the development of innovative solutions and collaborative aggregations, facilitating the exchange of knowledge and skills between companies and research centers.

Short Term Results

The first results of this call delivered a total of 11 projects submitted. Furthermore 8 out of 11 projects are connected to CE. Below we report some statistics:

Total 138 partners: 38 Research Organizations, 100 companies

Topics covered by submitted projects and outcomes:

- Biofuels (1 project, 9 companies and 3 RTOs involved)
- Fertilizers (2 projects, 22 companies and 7 RTOs involved)
- Biomaterials/bioplastics (2 projects, 29 companies and 12 RTOs involved)
- Nutraceutics (1 project, 14 companies and 3 RTOs involved)
- New value chains to reuse agricultural and agro-industrial wastes and byproducts (2 projects, 31 companies and 8 RTOs involved).

These results are classified as “short term results” because they are given within the duration of the project. As previously explained, policy actions don’t change in a range of a 4 year project, but they take a more medium and long term adaptation. That said, this first short term results aim to initiate managing authorities in to bigger actions with wider impacts on a medium and long term perspective. Moreover, due to the high interest and participation of companies and research centers on this platform, the following paragraphs make a prevision on what will be the most plausible futures on the mid - long term horizon, based on the current changing drivers. Among these, the overall regional situation is characterised by good resources to transition towards a CE (e.g., research and innovation initiatives, technological development, strong economic sectors with leading industries, key change-makers, networks). On the other hand, it must be underlined that the regional panorama still lacks of a critical mass of industrial and research investments on CE, which calls for further actions (Barbero & Giraldo Nohra, 2018)

Medium-term Results

The mid-term results of the project will be reflected after the completion of RETRACE on the next programing period 2021–2027 ROP ERDF. As explained above, the actions proposed on RAP could only propose tangible-short actions as they were unable to modify the current 2014–2020 ROP ERDF. Furthermore, the CE paradigm on this current programming period is not explicitly addressed as a policy goal. In this context, the RETRACE

actions and strategies will provide an essential input in defining an effective approach to address the CE policy goals on the future programming period for EU funds, in a more systemic and territorial way. On the local point of view, actions like the Bioeconomy platform, will increase awareness and cooperation among industrial, research and innovation players, stimulating other similar initiative that will become real on a mid-term horizon. The eco belonging to this successful action, can resonate also on the national level, creating a wider spectrum of calls which encourage the allocation of more fundings on projects related to CE. On that regard RETRACE supports the improvement of the ROPs especially under the governance point of view, encouraging the focus for new calls to be launched, in order to boost research and investment measures on CE. More generally, the RETRACE outcomes will influence how regions will oversee the development of CE on the next 6 years.

Long Term Results (EU CE TARGETS 2030)

On a long term perspective, the RETRACE results must be framed on the targets that EU has set for a sustainable development by 2030. For that purpose it must be acknowledged the considerable EU policies towards a CE as - the already ongoing - *Circular Economy Package, EU Bioeconomy Strategy and the EU Plastics Strategy* (EC, 2019). Considering the ambitious CE targets of the EU by 2030, the RETRACE inputs are a relevant milestone as they are addressing regions to achieves major environmental-economical-social advantages through the intervention of regional funds. Based on the elements mentioned above, it is possible to oversee the evolution of RAP actions towards EU 2030 CE targets. In the specific case of the Bioeconomy Platform, one of the possible results will be the increasing use of second-hand materials and enhancement of the by-product value chain among the network of connected enterprises.

Overall results

Thanks to the contribution of RETRACE the actions intended in a short term view will influence the call for proposals throughout all 2018. At the same time, with a long term vision, it will allow to orientate and bring out more clearly the planning concerning the processes of resource efficiency and CE.

Designers, in this project, have a central role since they are the experts who are providing the SD methodology. It is important to stress that the methodology is shared and put in practice by all the partners and stakeholders of RETRACE, creating new mechanisms of sharing knowledge and experiences, on the local and inter-regional scale. On that sense, designers are both at the head and in the middle of design-led innovation. As providers and mediators, their versatile role allow a Quadruple Helix approach where university, industry, government and civil society cooperate in order to co-develop strategic decision-making. This reflect a concept of innovation intended as a contamination of different disciplines and sectors. In order to allow this type of innovation, visualization through infographics, schemas, and gigamaps (Sevaldson, 2011) delivered by systemic designers, perform a key role in the process since complex concepts are made accessible and usable through a simple and common language. This action facilitated the peer reviews meetings, generating deep discussions around the regional data presented and enabling a knowledge transfer to the other partner countries.

Cross-cutting projects like RETRACE offer an inspiring example of forward-looking decision-making. Thanks to RETRACE new policy opportunities have been co-developed in Europe, standing on real data and providing real solutions in handling environmental uncertainty.

Conclusions

This paper contributed to address strategic anticipation in design research, by proposing a collaborative approach shared among SD, strategic foresight and policy-making in order to move towards CE in a long-term horizon.

As extensively discussed, complex and wicked problems are key issues in our society that demands us to redesign our public-policy framework conditions. During the research, it emerged that “strategic agility and adaptive capability” are key elements to react more quickly and effectively to the multiple futures that could arise. Moreover, the interconnections of today’s global challenges demand collaboration among different disciplines in order to tackle the emerging challenges and to deliver systemic and interconnected solutions.

Through this paper, it is highlighted how systemic designer’s mindset and methodology can be supportive in foresight practices and strategic decision making, developed in a collaborative and multi-stakeholders process.

On that view, it has been examined how the role of design is changed over time, broadening its lens and shifting its focus on larger systems. Consequently, designers has turned into key players on delivering innovative strategies on the micro/macro scale and on the short/long term. Specifically, Systemic Designers are able to navigate through the multiple scenarios that emerge from this complexity. Literature and the field of practice have shown the intersection points between foresight and systemic design practices. In fact, both design and foresight envision plausible futures and try to strategically design multiple solutions aiming to reach an ideal future outcome.

The RETRACE case study, which supported this research, features evidence of this fruitful relation, proving to be effective in the development of strategic decision making towards a sustainable future.

This paper took the case of the Piedmont Region as an example in order to understand how RETRACE is framed in the context of design with foresight for policy-making, towards CE. The SD methodology adopted in the case study highlights the connections between SD and Foresight. In fact, the holistic diagnosis performed a central role in scoping the context, collecting qualitative and quantitative data and delivering a first scenario. Matching these results with policy gaps and taking into consideration the already existing policy-strategy of Piedmont Region, a strategic action plan has been developed. Finally, the implementation phase of the project, has defined a roadmap of 3 to 6 concrete actions that are going to be developed on the short-medium-long term and aim to affect the policies at different levels: direct activation and implementation (Short), governance and policies (Medium), culture and education (Long). On that view, the RETRACE actions perform an essential input for stimulating the allocation of more EU funds on the next programming period and also fit with the targets that EU has set for sustainable development by 2030.

Inside the RETRACE project, systemic designers performed a double key role as providers and mediators: they share their proper methodology among the partners and make complex concepts and interconnected data accessible and usable to all, through visual maps. This practically demonstrates that systemic designers, enriched with a foresight vision, can play a leverage effect in the transition of the EU regions towards CE, by strategically designing concrete actions which address a long term change.

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Track 5.j Introduction: Innovation Through Design for Meaning

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This track brings together researchers and practitioners to share and discuss the approach, subsequent outcomes, contributions and possible futures of the design for meaning landscape.

For many fast moving consumer goods, home goods, office goods, vehicles, transport systems and elements of the built environment there are a growing number of instances in which a business opportunity can only be achieved by exploiting a new technology or a new cultural code (Holt and Cameron, 2010). Such cases of disruptive innovation or radical innovation are premised on the possibility of defining a new meaning for the potential consumers (Giacomin, 2017). The idea that design is a manner for making sense of things (Krippendorff,1989) is frequently discussed in professional circles, as is the idea that design involves doing philosophy with the hands (Wendt 2015). For many practicing designers the activity of design cannot be separated from the intended meanings of the artefact which is being designed.

Within market-driven economic systems the commercially active designers must consider the forms of value and meaning which a product, system or service may hold for its customers (McCracken, 1990). It is in fact frequently claimed that the meaning of a commercial offering is the actual basis of the business (Verganti, 2009). Experts from the branding sector usually concur, an often repeated statement being Aaker's (2002) proposition that "if a brand is "packaged meaning", a slogan can be the ribbon that ties the package together and provides an extra touch". The increased material wealth of industrialised societies has in recent years lead to debate about the meaning of designed artefacts, and about the role of meaning in the innovation processes of commercial enterprises. Numerous indicators point to a certain current glut of products, systems and services in people's lives, and to a trend of increased sophistication of selection on the part of the consumer (Wallman 2015).

Beyond the commercial considerations, it can also be suggested that consideration of target meanings is important towards defining the long term role which an artefact will play in the lives of its owners (Giacomin, 2017). The relational role of artefacts has been neatly expressed by Csikszentmihalyi and Rochberg-Halton (1981) as "the objects which people use, despite their incredible diversity and sometimes contradictory usage, appear to be signs on a blueprint that represent the relation of man to himself, to his fellows, and to the universe". In this view (see figure 3) artefacts are not simply functional tools, but are also relational mediators which shape the long term aims, objectives and behaviours of an individual or of a group.

Considering the importance of meaning in design it is perhaps surprising to note the frequent lack of clarity about these matters in design discussions and in design practice. In many websites, documents and publications of a commercial nature the word "meaning" is deployed without reference to the anticipated nature of the meaning and without reference to the individual involved. Further, semantics such as value, ideology, meaning, function, ritual, myth and metaphor are often used interchangeably, with important

practical consequences in terms of possible misunderstanding. In the words of Sudjic (2008) “design is the language that a society uses to create objects that reflect its purposes and its values. It can be used in ways that are manipulative and cynical, or creative and purposeful. Design is the language that helps to define, or perhaps to signal, value”. It would thus appear reasonable to ask that designers speak their language clearly.

The aim of this track is to encourage the discussion of design for meaning frameworks within businesses, including topics such as:

- developing and managing brands through meaning (paper 1);
- use of data, design ethnography, real fictions and co-creation to support innovation within design innovation teams (paper 2);
- the role of analogies, metaphors and meanings within business design innovation (paper 3);
- organisations and processes for achieving targeted design meanings (paper 4);

In the first paper, *“Making Markets: The Role of Design in the Process of Legitimation”,* the authors examine the impact of design on the evolution of a product market from illicit to mainstream. The authors argue the importance of congruence with normative and cultural-cognitive structures in fostering legitimacy. By means of an ethnographic study of the newly-legal recreational cannabis market in the US, the authors analyse a market that has attained regulatory acceptance in some states but lacks normative and cultural-cognitive legitimacy. The authors offer a framework for managing products in new markets, arguing that design can enable legitimacy by drawing on symbolic relationships to other products, considering affordances, and enhancing strategic socio-cultural innovation.

In the second paper, *“Meaning of artefacts: interpretations can differ between designers and consumers”,* the authors explore an important point in relation to the concept of “meaning” by which the meanings that become connected with products don’t always have to be the meanings intended by the designers. Substantial divergences in meaning might be expected to lead to some degree of commercial difficulty at some point in an artefact’s life cycle. Their research suggested that three primary categories of meaning which designers should consider during their design processes, i.e. function, ritual and myth, covering a spectrum from the purely instrumental to the purely symbolic, could be commonly encountered in practice, either individually or could be co-present to some degree. Their findings also suggest that some meaning divergences occur between designers and consumers, and would appear to highlight the need for carefully executed ethnographic and user testing activities.

In the third paper, “*Design for Meaning of Smart Connected Products”,* the authors explore the topic of meaning-driven innovation from a Product Design perspective. It focuses on the design of Smart Connected Products: internet-enabled phygital products that blend hardware and software. Their work highlights three kinds of meaning that are relevant for Smart Connected Products: the meaningful identity of the object as product category, the meaning of the product in relation to its shape and functionality, and in relation to a phygital ecosystem. The paper reflects on the methods that can support designers in the development of meaningful smart products and presents the “Mapping the IoT” Toolkit, a downloadable tool that guides in specific activities aimed at framing the product’s meaning.

In the fourth and last paper, *“From Hype to Practice: Revealing the Effects of AI in Service Design”,* the authors discuss the current and even hyped topic of artificial intelligence (AI) in the context of service design. It takes in consideration the design principles for the context of artificial artefacts that are produced and consumed in a multi-user context supported by virtual environments and focus on the fact that design is ‘language-like’. It also considers that with the shift towards the application of natural language processing (NLP) tools, services and products go beyond the conceptual and semiotic language. Their paper discusses not only what AI enables for the front and back ends of service delivery but also the practical role of the service designer and service design process in the context of AI-enabled services. The authors evaluate the datasets through coding cycles aiming at identifying the shifts AI brings to service design.

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Making Markets: The Role of Design in the Process of Legitimation

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We examine the impact of design on the evolution of a product market from illicit to mainstream. We argue the importance of congruence with normative and cultural-cognitive structures in fostering legitimacy. To understand the role of product design in this process, we conducted an ethnographic study of the newly-legal recreational cannabis market in the US, a market that has attained regulatory acceptance in some states but lacks normative and cultural-cognitive legitimacy. By analysing product design and interviewing managers, we find that design plays a pivotal role in legitimation. Producers transform a market by manipulating two distinct aspects of materiality: *material in relation* – how products relate to accepted products, and *material in use* – how design guides and enables consumption. We offer a framework for managing products in new markets, arguing that design can enable legitimacy by drawing on symbolic relationships to other products, considering affordances, and enhancing strategic socio-cultural innovation.

Keywords: market emergence, legitimacy, product design, material culture

Introduction

Markets are complex and evolving social systems. At any given time, the mutual understandings among producers, consumers, and other stakeholders such as regulators and the general public (Weber, Heinze, & DeSoucey, 2008) may make markets appear stable. However, because they are dynamic, they are also susceptible to transition or disruption given new technology, an infusion of new or more powerful stakeholders, or shifting regulation. However, there has been limited examination of an essential part at the heart of the market—the product—in market change. This raises two important research questions. First, what role does product design play in legitimation? And second, how can managers leverage design to foster legitimacy in new or transitional product markets? Our inquiry draws from a material culture perspective, emphasizing the role of objects in regulating social relations, carrying out social functions and providing symbolic meaning (Woodward, 2007) to investigate how products' material elements and associations shape meaning in ways that enable a mainstream market to emerge.

Recent studies of market emergence have emphasised meaning being shaped by marketing communications, consumer practices, and discourse in popular media. While marketing researchers have noted that product design can impact market growth (Giesler, 2012; Martin & Schouten 2014), scholars and managers still lack nuanced understanding of how and why a product's material design promotes legitimacy. Gaining insight into the legitimation of previously stigmatised products or categories is important, whether to help managers

encourage adoption of beneficial products or social advocates weaken the appeal of products that have potentially harmful implications.

The links among materiality, systems of cultural meaning, and mainstream markets are evident in the automotive sector. For example, minivans emerged as a category when marketers identified new potential in a "family vehicle" market positioning and car designers leveraged existing automotive classifications and attributes (e.g. cars, trucks, vans) in ways that facilitated market change (Rosa et al. 1999). Both physical cues—such as built-in children's car seats—and marketing messages referencing space and convenience communicated the desired positioning to consumers, who interpreted and acted upon the information. In this dynamic system, consumers' behaviours in turn generate new signals in the marketplace, which are (or may not be) incorporated into the socially-constructed pattern of consumption and production practices. In this way, attributes signifying "minivan" stabilized as producers and consumers developed shared knowledge structures about the product category (Rosa et al. 1999). However, product meanings continue to shift with evolving social values and product iterations. For example, the sport utility vehicle (SUV) later emerged from the minivan category. The design of SUVs employed visual references to military vehicles such as large grills and boxy, tank-like shapes, which conveyed a sense of control and safety for owners that particularly resonated with American attitudes toward personal safety in the 1980s and 1990s (Lauer, 2005). However, SUVs' popularity waned once environmental movements made fuel economy salient and gas prices increased in the late 2000s (Holt 2012; Luedicke, Thompson, & Giesler 2010). As this example illustrates, markets evolve as meanings change, becoming more congruent with cultural norms and values that shift over time.

The study presented here is the first phase of a larger project examining the role of materiality in the shift of a product category from illicit to legal and increasingly mainstream. Whereas new legislation may pave the way for market transactions to occur legally, regulatory legitimacy alone does not ensure a product's acceptance and eventual diffusion among mainstream consumers, particularly if previous prohibitions prevented learning about the market or if consumption remains counter-normative. Given significant evidence that consumers make product judgements based on visual form (Hoegg & Alba, 2007; Rindova & Petkova 2007) and material properties (Peck & Childers, 2003) among other sensory cues, we posit that product design is an important mechanism for facilitating consumer acceptance and investigate how it can contribute to legitimacy. By underscoring the links between materiality and cultural values, we illuminate the role of material culture in the legitimation process. Specifically, we identify two aspects of materiality, which we term *material in relation* and *material in use* that are critical in shaping product meaning and thereby increasing acceptance.

Objects' material factors are a key element of product adoption and use (Jordan 2000). Design research has articulated the ways that product designers convey meaning and appeal to consumers' aesthetic preferences (Krippendorf, 2006), while marketing research has examined how existing stigma can influence producers' decisions (Giesler, 2012). Yet to our knowledge, no research has examined the role of design in fostering acceptance in new (or newly lawful) markets. While extant work has articulated the importance of product symbolism in marketing and adoption of new products (Homburg, Schwemmle, & Kuehnl 2015), it has primarily focused on symbolism relative to the user (i.e. an object's expressive value) rather than the system of socio-cultural interpretations that give a product this meaning. We build on prior consumer-focused studies to illuminate the role of design as a tool that producers employ to facilitate product comprehension, desire and adoption. Additionally, most research on product design in marketing management has theorized the introduction of new products into mature, stable markets rather than new or shifting markets (Hung and Chen 2012; Luchs, Swan, & Creusen, 2015). In mature markets, consumers have well-established ideas about product function and meaning within the category (i.e. cultural-cognitive legitimacy) and there is generalized social approval for use (i.e. normative legitimacy). For this reason, previous studies have emphasised the role of design in differentiation and competition (Homburg et al. 2015). In new or transitioning markets, however, knowledge and meaning of product attributes are much less defined (Carpenter & Nakamoto, 1989). We extend this work to present cases in which similarity—rather than differentiation—can provide a strategic advantage as companies work together in the early stages of a newly regulated market to teach consumers about the category as a whole.

To understand the role of material form in the legitimation process, we examine a previously illicit product in the process of acquiring legitimacy: the market for recreational cannabis (marijuana) in the United States. In particular, we study the recreational cannabis market in the state of Colorado, where individuals over the age of 21 have been able to legally purchase marijuana from licensed retailers without a prescription or license since 2014. This regulatory shift, and the commercial transitions that have followed, represents a significant market transformation and an ideal context for study. Because recreational consumption occurred in an illegal

(and thus unregulated) market prior to 2014, many mainstream consumers lack an understanding of the product category or associated consumption practices. The result is that few consumers have developed preferences related to specific brands, retailers, product forms (such as edibles, beverages, topicals, tinctures) or delivery mechanisms (including vaporizers and transdermal patches). The social stigma surrounding marijuana consumption is longstanding, and negative stereotypes are often invoked in the debates taking place among media, activists (both opponents and proponents), producers, and consumers. Thus, current producers must be particularly mindful of breaking away from pervasive and embedded stereotypes (Dunne 2014) if they are to engage consumers' attention and shift attitudes from aversion to acceptance.

Finally, this context is fitting for examining the evolution of mainstream markets because while cannabis (the botanical genus name for marijuana) is not yet legal throughout all of the United States, producers have already undertaken considerable efforts to make it appealing to the mainstream market in anticipation of federal statutory acceptance. These include developing products, brands, and retailscapes that are purposively distinctive from the prevailing, negative imagery surrounding the category (Birkner, 2015; Halperin, 2015; Klara, 2014). Whereas the materials and modes of consumption previously associated with marijuana include bongs, pipes, rolling papers, and "magic" brownies, the new products populating the shelves of contemporary cannabis retailers include carbonated beverages, lip balms, skin lotion, premium confectionary, and slim vaporizing pens.

Literature Review

Market Systems and Legitimation

Markets undergoing transition face a unique set of challenges; product markets that appear without any precedent to aid categorization—or depend upon the construction of a new or modified categorization—have difficulty attaining legitimacy. For example, consumers confronted the first "horseless carriages" with trepidation, fearing motorcars to be both deviant and dangerous (Chiu, 2008). New industries become accepted not purely though regulation, but through the more complex, social process of attaining legitimacy (Scott, 1995; Suchman, 1995). Legitimacy is the quality or property of an institution being regarded as "appropriate, proper, and just" by social actors (Tyler, 2006, 376). Legitimation can be understood along three axes: normative, cultural-cognitive, and regulatory (Scott, 1995). Regulatory legitimacy entails legalization, oversight, and enforcement by the state. Normative legitimacy is achieved when a market or company aligns with social morals and values (Scott, 1995; Suchman, 1995), and cultural-cognitive legitimacy is achieved when the market is not only understood by individual consumers but incorporated into existing cognitive structures, tacit knowledge, and assumptions (Humphreys 2010a).

Objects exist somewhere in between the legal, normative, and cultural matrix, and can affect these elements in important ways.

Product Design

Design is an important domain for marketers, as it determines the properties of an artefact that help express its function (Bloch, 1995) as well as its emotional and symbolic value (Verganti, 2008). Design research in marketing has examined consumer response and preference (e.g., Bloch 1995; Moreau, Bonney, & Herd 2011; Mugge & Dahl, 2013; Orth and Malkewitz, 2008; Veryzer & Hutchinson 1998); product innovation (e.g., Gemser & Leenders, 2001; Schreier, Fuchs, & Dahl 2012; Verganti & Öberg, 2013), and branding (e.g., Beverland, Wilner, & Micheli, 2015; Beverland 2005; Kreuzbauer & Malter, 2005). Yet these domains of research tend to focus on individuals rather than examining how marketplace meanings are shaped at a collective, symbolic level.

In a recent review of the marketing literature on design, Homburg and colleagues (2015) identify three dimensions of design: functional, aesthetic, and symbolic. Consumers' operative and stylistic preferences are addressed through products' functional and aesthetic aspects, but design also appeals to consumers' emotional and sociocultural needs (Dell'Era & Verganti 2011). Designers draw from and encode cultural meanings in products with the expectation that consumers interpret meaning from the product's symbolism (Bloch, 1995). However, this symbolic dimension refers not to individual preference, but to categories of social meaning.

Although the development and interpretation of product meaning plays a vital role in legitimation, we know little about how producers—whose primary domain of control is the physical product and related marketing communications—may strategically leverage product form to turn a previously illegitimate consumption practice acceptable and appealing to a broader consumer base. Product design and development teams make decisions about product materials, form, and appearance with the intention of making artefacts appealing to the consumer (Hsiao & Chen 2006; Redstrôm 2008; Sudjic, 2009) but also to meet the expectations of other stakeholders including regulators, shareholders and critics. The attempt to conform to convention inevitably communicates the product's symbolic qualities (Redstrôm, 2008; You & Chen 2007). Thus, we must understand how design—whether of products, packaging or merchandising and distribution—imbues meaning and influences adoption.

Material Culture

Material culture can be summed up as the "social implications of things" (Miller, 1987: 85), a frame that highlights the capacity of objects to shape individual behaviour (Sunstein & Thaler 2012); subconsciously establish consumer expectations that shape social norms and guide cultural associations. Material culture foregrounds the cultural values manifest in material objects. We argue that materiality primarily shapes product meanings in two ways: through its symbolic relationships with other objects, which we call *material in relation*, and by influencing consumer interaction, which we call *material in use*. *Material in relation* describes the relationship of a material object to other objects: contemporaneous, past or future. These associations can affect perceptions of legitimacy in that they can be either consistent or inconsistent with valorised cultural meanings. For example, e-cigarettes were designed to retain some material elements congruent with cigarettes, such as their shape, but to avoid problematic associations like tobacco. E-cigarette designs thus tend to emphasise the "clean" coolness of technology (inclusion of LED light and battery operation) over the "dirt" associated with the smoke and ash of traditional cigarettes by vaporising a liquid rather than burning plant material). Thus, material elements of the design rework symbolic associations between the new, hopefully "desirable" product and older, stigmatized products. Forty (1986) describes how the new electrical appliances of the 1930s were designed to mimic previous category types—electric cookers looked like their gas predecessors, which had in turn imitated coal—but also to convey a series of new, desirable associations: electricity was clean, silent, instant, modern, and revolutionary (pp, 197-8).

Importantly, designers employ materials and forms to create and communicate both meaningful similarities (Srinivasan, Lilien, & Rangaswamy 2006) and differences from competitive products. We posit that by signalling comparative similarity and difference to existing products, product design plays a pivotal role in the legitimation process.

Materiality also potentially affects legitimation through *material in use*. Here the material elements of design play a role not through their symbolic relations with other objects, but through their affordances possible (Gibson, 1977; Norman, 1988): by directing action, becoming congruent with some user goals and incongruent with others. Material comes to have meaning by virtue of being used in a particular way for a particular task (Heidegger 1927/1996). Evaluating affordances may tell us what types of objects are likely to become legitimate and which are not.

Despite the many ways that the design of objects shapes consumer acceptance, both at an individual and collective level, marketing researchers have given little attention to the properties of material objects as they relate to market transition and legitimation. This is surprising, because both the design and consumer psychology literatures have demonstrated that the appearance of objects influences consumer perception and valuation of those objects (Argo, Dahl, & Morales 2006; Hekkert, Snelders & Van Wieringen 2003).

Method

Data collection

Our study of the recreational cannabis market began in 2014, when Colorado legalised recreational cannabis. We began with ethnographic immersion in the state's capitol and most populous city, Denver. One of the authors contacted individuals featured on a prominent national news programs and newspapers requesting interviews. Once these were arranged, she employed a snowball sampling process, asking interviewees to suggest others in the industry that should be contacted and, if contact was successful, asking those individuals

in turn to suggest further resources. The result was a series of semi-structured interviews with nine prominent industry producers and marketers in their offices or manufacturing facilities. Interviews lasted an average of 1.5 hours; each was audiotaped and transcribed verbatim. The author asked interview subjects for recommendations of retailers (dispensaries) to view and events. She then visited these venues (as well as others) and conducted nonparticipant-observation of dispensaries in Denver to examine retail design, product mix and merchandising as well as engage in *in situ* conversations with retail store staff about consumers' responses to specific products. She also attended the 2014 annual Cannabis Business Awards ceremony to access producers' discourse regarding market strategies, trends and consumer insights.

A summary of the data is provided in Table 1.

Table 1: Interview and Observational Data

Name (pseudonym)	*Organization*	*Title or Role*
Alan	Brand A: cannabis consumer packaged goods	Chief Marketing Officer
Anne	Brand A: cannabis consumer packaged goods	Director of Marketing
Barbara	Brand B: cannabis branding consultancy	Co-founder and Strategic Director
Beth	Brand B: cannabis branding consultancy	Co-Founder and Creative Director
Carol	Brand C: cannabis-related special events organizer	Founder
Donna	Brand D: cannabis business developer	Co-Founder
Janice	Brand E: cannabis retailer/dispensary	Owner
Frances	Brand F: recreational cannabis testing lab	Operations Director
Gillian	Brand G: cannabis-related public relations consultancy	Founder
Company	*Description*	*Engagement*
Brand B	Cannabis-related branding consultancy (branding, store design, public relations)	interviewed firm's founders in their offices
Brand A	One of the largest and most established consumer packaged goods companies	met president and interviewed CMO at headquarters (spoke by phone with Director of Marketing)
Brand C	Cannabis-related special events organizer; planning and catering	interviewed president/founder at office
Brand H	Retail store billed as "The Apple Store of Cannabis"; first recreational cannabis-only retail store	emailed with owner, observed merchandising; service interactions; spoke with manager
Brand I	Retail store with snowboarding theme	observed merchandising; spoke with two bud tenders (employees); took photographs
Brand J	Retail store recommended by informants for its accessible, upscale design.	spoke with manager and two bud tenders (employees); took photographs
Cannabis Business Awards 2014	Annual award ceremony for Denver-based businesses; primarily entrepreneurs	observed awards ceremony; spoke with other attendees; spoke with salespeople at trade booths; some photographs

Ethnographic and Visual Analysis

All three authors read and independently conducted open coding of each transcript and set of field notes. We shared, analyzed, and discussed the textual data in multiple meetings, allowing for patterns in the data to emerge and then engaging in discussion. Semiotic analysis was conducted on product imagery and designs. We catalogued the data and adopted several analytic categories of critical visual analysis: form, medium, genre and comparison. Form is the way a subject is presented; medium refers to the material form of object; genre refers to a type or category; and comparison foregrounds the features of something by juxtaposing it with something similar but significantly different (Rose, 2005; Schroeder, 2006). We considered these categories in our analysis, comparing products in this newly legal market with existing products.

Findings

We find that materiality plays an important role in the legitimation of the recreational marijuana market in Colorado. The primary challenge for firms in this new market is to employ material elements in ways that shift product connotations away from existing, stigmatized meanings and toward interpretations congruent with accepted products and social practices.

In terms of the mechanisms facilitating the market's legitimation, our interview and visual analyses reveal that designers and marketers attempt to establish recreational cannabis as a legitimate market for mainstream consumers by pursuing congruence between new recreational cannabis products and established, legitimate cultural meanings. Producers' work comprises two distinct types of framing: *material in relation* and *material in use.*

Material in Relation

The first way that designers and marketers shape product meaning is by manipulating material in relation. That is, producers introduce products that are related to existing, legitimate product forms and thus congruent with normative cultural meanings. Producers make strategic decisions about goods (e.g. product form, packaging, advertising) in order help consumers categorize and reframe the product towards desirable associations and away from possibly objectionable associations. Prior research has established that designers do so when introducing innovative products for which there may be category ambiguity (Goode, Dahl, & Moreau 2013). By emphasizing similarity to legitimate products and difference from previously stigmatized products, designers influence the creation or modification of meanings that consumers ascribe to the product. The relationship of an object to other objects affects how consumers ascribe cultural-cognitive legitimacy to it.

We find that the ways that physical products resemble one another plays a key role in legitimation as a framing process. For example, marijuana is linked to intoxication as well as smoking, which traditionally has been one of the dominant modes of cannabis consumption. These associations are problematic in part because cigarette smoking recently has lost legitimacy in the United States as health officials and regulators have attempted to abate tobacco consumption. Designers of cannabis products, then, must not only introduce product forms that will attract prospective consumers, they must also avoid materially signalling association with an undesirable class of adjacent goods. Circumvention of negative associations also has implications for sensory faculties beyond the visual; in the case of cannabis, this includes smell and taste. Accordingly, producers seeking normative legitimacy design goods in forms that avoid undesired connotations, and the result has been a proliferation of edibles and topical applications (foods and lotions infused with THC, the active ingredient in cannabis). Thus, designing objects that contrast with forms and meanings of illegitimate, existing material objects enables producers to encode products with new, legitimate meanings.

An excellent example of designing material in relation is the recipient of the 2014 Cannabis Business Award for Best New Product: a transdermal patch like those used to promote smoking cessation by a company called Mary's Medicinals (Figure 1). Visual analysis of the transdermal patch foregrounds its form as innocuous; packaged in a slim, discreet foil packet, the company's brand identity connotes an old-fashioned apothecary. The opaque, colourless package appears without marketing artifice or hyperbole (the company's tagline is "For us, it's simply black and white"); its typography evokes a time when pharmacists were professional chemists who produced their own compounds. This impression is underscored by the stamp of a product number, reminiscent of the numbering on other handmade or limited-edition goods. The only image is a tiny cannabis leaf set in a plain square. The product *medium*—a small (2 inch x 2 inch), white, adhesive square—is similarly banal, as it is worn on the skin, under clothing. The patch's *genre* is that of bandage, connoting care and

comfort rather than self-indulgence or amusement. Retail staff asked to describe the product emphasized its discretion (as does the company website). Scent-free, it was described by more than one budtender as "cannabis you could consume at work," evoking the internet slang "(not) safe for work," a phrase used to advise users of things that are considered (in)appropriate for public consumption and underscoring how innocuous the product is interpreted to be.

Figure 1: Mary's Medicinals transdermal patch. Image source: cannabis.net

The producers in our study worked on two relational aspects of cannabis products: their difference from stigmatized products (e.g. cigarettes) and their similarities to acceptable products (e.g. bandages). Evoking specific and culturally determined material codes, designers can thus suggest meanings for new offerings by defining the product through a network of semantic relationships (Krippendorf & Butter 1984). These, in turn, provide category cues (Goode et al. 2013), signalling both what the product is (or is like), and what the product is not.

"Donna," co-founder of a cannabis business development organization, is keenly aware of the need for new product forms to avoid associations with smoking. Contrasting the emerging smokeless product forms such as topical lotions and vaporizers against existing delivery forms that require a flame source for consumption such as bongs, pipes, or dabbing rigs (a device that vaporizes concentrated cannabis when heat is applied with a butane torch), she wryly commented, "I do not believe the majority of Americans want a blow torch involved with their evening relaxation activity."

Because new products stand in relation to those already in the market, producers make a concerted effort to foster associations with conventional goods with which their product may share properties or attributes. In the case of cannabis, related categories include alcohol, medication and confectionary, because: each is expected to be consumed at adults' discretion, in moderation, and is motivated by a desire for pleasure or relief. Just as private label packaging is often intentionally designed to resemble the leading brand (Kapferer, 1995), so too is comparison encouraged between cannabis products and common goods through design elements such as brand identity (logos, colours), packaging, and marketing communications imagery. For example, House of Jane® produces single-serve coffee pods infused with THC. Combining coffee with cannabis and packaging it in ubiquitous single-serve pods can be seen as a deliberate attempt to transfer the legitimacy of coffee, a commonplace beverage which is "used" to alter mood or alertness, to recreational marijuana. By drawing directly on the visual cues and meanings of an accepted and mundane product like coffee, designers employ the practice of reframing (Dorst, 2011), creating an analogy between consumption of THC with conventional products that may be used similarly.

The use of analogy and metaphor—creating an association between a source and a target through comparison—is a central design practice (Blackwell, 2006; Cila, 2013; Moreno et al. 2014) which also has been explored in the marketing literature as an important means of communicating product semantics. Importantly, although producers in our study signal similarity to legitimate products, the process does not produce homogeneous branding and product design. Just as in mainstream product categories, brand positioning varies, and design plays an important role in expressing brand personality. Further encouraging normative

legitimacy, these representations appeal to social values such as innovation and technology. We observe that discourses associated with new technologies can also provide a legitimizing function; cannabis for this "new" market is framed as innovative, rather than old. "Anne," the marketing director at Brand A, explains:

> *We are an innovative company. Innovation on delivery-assisted products [new ways to consume] is led by our science team. It could be something that is a format that we are going to be the first to bring market…[like] a dissolvable strip, an ultra-thin film [like Listerine breath strips. We also look at fast moving consumer goods.] It's winter, so we have the opportunity to capture a huge amount of consumer traffic that's coming to the mountains in Colorado. We want to see a seasonal product out there, and we know that a small chocolate bar is something you can innovate quickly and roll out efficiently. We ask ourselves, what are the top sellers? What do you see in Starbucks? You see a lot of hot chocolate, and a white chocolate peppermint bar coming out of every good chocolatier…so we said, 'Let's go for it.'*

By actively studying other industries, producers in our sample—fully aware of their category's extant associations as well as desired replacements—intentionally forge parallels with specific products, places and meanings intended to overwrite existing cultural symbols. Most of the producers we interviewed were equally conscious of the risks of weak or undesirable category comparisons.

Previous research has shown the importance of media framing, network creation, and consumer collaboration to legitimacy, but these are elements external to the product. An object's materiality, and its capacity to encode and convey cultural meanings, is an important mechanism that can enable legitimacy. Positioning products to invite and facilitate comparison with other goods is the hallmark of *material in relation*.

Material in Use

The second way that producers shape meaning is by designing products that promote legitimacy through *material in use*. As revealed above, the physical resemblance of one product to another has implications for legitimation. However, product design imbues not only relational capacities, but functional ones as well. Producers also strategically employ material design to influence consumers' uses of products at two critical points—acquisition and consumption.

One purpose of design is to "provide [users] with information to express the usage, the function, and the other symbolic qualities of the product" (You & Chen 2007). This is a special challenge in the cannabis context, because it is an experience good and even where recreational use is legal, there are restrictions on how it can be displayed for sale. In categories where product quality is difficult to assess prior to use, designers must communicate necessary information and meanings prior to use through careful attention to shapes, materials, colours, and forms (Crilly et al. 2004; Orth & Malkewitz 2008). Marketing director Anne joined Brand A with experience in consumer packaged goods and luxury brand development, and is well aware of her industry's constraints:

> *Consumers don't have the opportunity to engage with our product. They can't walk over and pick it up, which makes it a very different challenge to connect with consumers in a meaningful way. Consumers are very, very tactile, they like to turn something over, pick it up, see the weight of it. If you can't touch a package, it's hard to connect […if I'm a consumer, I want to] walk into a dispensary and engage with a brand that feels good to me, and feels that it's approachable and safe, and innovative, and trustworthy. That's really where we can start to move the needle with design, [so] that once they get to the store we can communicate 'Honestly, this is the brand for you. We're trusted, we're safe, we're tested.' You relate to our packaging—really, to our brand—on a tangible level.*

Similarly, acquisition is unlikely if the consumer is uneducated or intimidated by a product's use, and consumers may need to be "taught" how to use the product to achieve satisfying results (Becker, 1953). Here, materiality in the design of educational materials is used to facilitate information transfer. This is particularly evident in the context of recreational marijuana, where many new or lapsed consumers may fear overconsumption of THC.

In an effort to establish legitimacy of recreational cannabis, retail service personnel in dispensaries serve a function similar to sommeliers, making personalized recommendations for a strain, dose and product delivery system based on consumers' prior experience and goals. Educational materials build cognitive legitimacy by helping consumers interpret product attributes such as the level of THC. For example, consumer packaged

good company Dixie Elixirs produces a card that is distributed at point of purchase with recommendations for product selection based on the consumer's experience with cannabis, body weight and personality type. The card's accessible design and tone not only teaches consumers how to select products to maximize satisfaction, but its presence reassures neophytes that they are not alone in needing guidance. In this way, material elements of the products and accompanying marketing materials guide use in socially desirable ways.

An important function of brands is to instil trust (Aaker 2009), and this is no less true for products in new markets. Consumers use brands as a signal for reliability and assurance, particularly under conditions of high risk or uncertainty (Erdem & Swait 2004). Indeed, branding may be particularly important in markets seeking legitimacy, because consumers have concerns about risk (Humphreys and Latour 2013). A second means that producers employ to foster trust is through packaging and product forms that protect consumers from known risks as well as facilitate successful product use. Alan, CMO of Brand A, describes the company's new chocolate bar, designed to facilitate moderate consumption:

> *It's almost the size of a Ghirardelli [mass market chocolate brand] square, and the good news is that it's a 10 mg piece of chocolate. We've actually demarked it into quarters, and it says on each quarter '2.5 THC.' So, you can break it off if you want, have 2 ½ milligrams, or have the whole thing in 10 mg [one adult dose]. We began the line because we quickly realized that not everyone not understands necessarily that 75mg or 100mg [of THC] is a lot and you shouldn't have all that…we want people to be able to have the whole thing, to not be scared, not have a bad experience.*

These products have been strategically designed to meet regulators' standards without frightening or otherwise deterring consumers. Compliance with regulations, safety labels and re-sealable packages also ensure that prohibited consumers, such as children, do not accidentally access the product. Thus, the object's form helps guide consumers toward desired uses and away from potentially problematic ones. As such, design integrates aesthetic components – such as form, color, texture – with invitations for action (Djajadiningrat et al. 2004).

Discussion

Regulatory change is not enough to allow a mainstream market to emerge if an overwhelming majority of eligible consumers remain too apprehensive to participate. Producers of recreational cannabis goods face significant challenges in achieving normative and cultural-cognitive legitimacy. They must overcome deeply entrenched negative stereotypes about marijuana consumers, educate a marketplace of non- or lapsed-consumers with limited understanding of the modern industry, and design products that can be interpreted as normative, safe, and desirable. These challenges are deepened by the need for companies within the industry to innovate and establish competitive value in the newly created market. Each of these issues can be impacted by design. *Material in relation* focuses attention on how an object relates to other, existing, objects. Designers build congruence between (currently) stigmatized goods and accepted products in adjacent or analogous categories while also distancing the new products from other stigmatized objects. *Material in use* points to ways that material elements can facilitate successful, normative consumer acquisition and use. Producers strive to both educate and indicate relevant product information so that expectations for a product are aligned with experience and to deter normatively problematic uses.

Managing Product Design for New Markets

Our findings suggest several implications for managing products in emerging market categories. Although marijuana in the United States may be a unique context, our findings are broadly relevant to product development in any new or transitioning market.

Our findings suggest that companies should design products that activate shared knowledge structures related to legitimate market categories but be equally sensitive to undesirable associations that may be hidden by existing, taken-for-granted understanding of established markets. While recreational cannabis producers longed for the acceptance enjoyed by other goods considered legitimate for adult consumption such as alcohol, they also underscored how their products offered relative advantages, such as a propensity for calm, rather than aggressive, behaviour and the low likelihood of hangover.

In addition, we suggest that in the initial stages of legitimation, consumer acceptance will be greater if product forms (as opposed to brands) are visually like competitors', because this promotes the development of new,

shared knowledge structures of the category among consumers in ways that facilitate purchase behaviour and engagement. Our findings suggest that at least initially, producers employing a strategy featuring *material in use* do so similarly to others in the industry. This mutually-reinforcing mimicry can aid the category, particularly until a dominant design emerges (Srinivasan et al. 2006).

Prior research has demonstrated that a consumer's level of product expertise influences product adoption. Our research demonstrates that *material in relation* is a key component of producer strategy to make a previously stigmatized product acceptable and appealing to mainstream (i.e., generally novice) consumers. As managers strive to align their products' material elements away from undesirable socio-cultural meanings related to illegitimacy and toward new social meanings related to other, legitimate consumption domains, they invariably produce new, discontinuous innovations. Relating designs to existing products allows new consumers to consider otherwise intimidating products.

Our findings also suggest that designers should attend to details that facilitate consumers' cognitive associations with established, legitimate markets. Evidence in the data suggests that this can be accomplished, for example, by borrowing product form, materials, packaging, sensory elements, and branding. In our data, many producers emulated designs from legitimate product categories by using principles of similarity, difference, analogy, media, and genre.

Our recommendation to attend to design at the outset of market development diverges somewhat from results in other industries, where product design becomes more important over time (Bruce and Daly 2007). Our findings also suggest that aesthetically pleasing designs are essential to providing sensory comfort and pleasure (Bloch, 1995) and ensuring normative congruence, thereby lessening defensive tendencies and facilitating the establishment of new social norms.

Ultimately, the materiality of both products and retail spaces are critical elements of the marketing mix. Yet new products and products in previously stigmatized markets have a legitimacy problem: whether unrecognized or considered unacceptable by consumers, managers must grapple with a series of strategic decisions when (re)introducing new products. Our work underscores the importance of careful product design in concert with deep consideration of the socio-cultural environment in which products are acquired and consumed.

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Research Perspectives IN THE ERA OF Transformations

Meaning of artefacts: interpretations can differ between designers and consumers

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Previous research has suggested three primary categories of meaning which designers should consider during their design processes, i.e. function, ritual and myth, which cover a spectrum from the purely instrumental to the purely symbolic. The research hypothesis of the current study was that the previously identified three primary categories of meaning would be commonly encountered in practice, and that statistically significant differences would occur between designers and consumers. A semi-structured questionnaire was deployed with ten designers and with ten consumers using a set of twenty photographs of designed artefacts. The results suggested that all three categories of meaning could occur individually or could be co-present to some degree. The results further suggested that statistically significant differences occurred between the group of designers and the group of consumers in the indicated category of meaning and in the adjectives used to describe the artefacts. The findings suggest that some meaning divergences may be occurring between designers and consumers, and would appear to highlight the need for carefully executed ethnographic and user testing activities.

Keywords: Function, ritual, myth, meaning, human-centred design

Introduction

There has in recent year been much debate in professional circles regarding the meaning of designed artefacts. Numerous indicators point to an excess of products and to a trend of increased sophistication of selection on the part of the consumer (Wallman, 2015). Consumers are claimed to increasingly favour purchases which are rich in emotions (Chapman, 2005 ; Oatley, Keltner & Jenkins, 2006), experiences (Schifferstein & Hekkert 2007 ; Shaw, Dibeehi, & Walden, 2010) and meanings (Dunne, 2008 ; Wendt, 2015).

Regarding meaning, standard dictionaries of the English language suggest that the word “meaning” can express at least three possible concepts: the sense or signification of a word or sentence; the significance, purpose or underlying truth of something; the motive or intention of something. The meanings which consumers associate with commercial products were considered by Friedman and Lessig (1986) who noted that “one can regard consumer behaviour as a continuum ranging from information processing to aesthetics consumption. On the one extreme we can see a logical, methodical information-processor using choice heuristics. At the other extreme we see the consumer aesthetically consuming based upon such feelings as fun, elation, and hedonic pleasure”. Fournier (1991) extended the logic by suggesting that consumer objects can be grouped according to the nature of the consumption experience so as to place them along a continuum from the utilitarian to the hedonic. Eight categories of consumer meaning were defined. They were objects of

utility, action, appreciation, transition, childhood, ritual enhancement, personal identity and position or role. Adopting a similar point of view to categorise a large number of commercial projects, Diller, Shedroff and Rhea (2008) suggested fifteen categories of meaning: accomplishment, beauty, creation, community, duty, enlightenment, freedom, harmony, justice, oneness, redemption, security, truth, validation and wonder.

Krippendorff and Butter (2007) suggested four theories of meaning in relation to the artefacts of design: a theory of meaning for artefacts in use, a theory of meaning for artefacts in language, a theory of meaning for artefacts in their life cycle and a theory of meaning for ecologies of artefacts.

The claims of sociologists regarding the constructed nature of meaning and its relativity to a given culture at a given point in time are supported by several studies of the meaning of artefacts. For example, research by Csikszentmihalyi and Rochberg-Halton (1981) has shown that meaning can change as a function of age, gender and other demographic descriptors. Further, studies such as those of Watson (2002) or Wallendorf and Arnould (1988) have shown that the meaning associated with an artefact can change substantially as a function of the cultural context in which the artefact is emerged.

Through examples such as that of the motor vehicle, Pantzar (1997) has suggested a natural cycle for some artefacts of design which begin their existence as luxuries and toys, becoming more central to society as time passes, eventually becoming necessities or commodities. Through examples such as eyewear, Pullin (2009) has instead suggested a natural cycle in the opposite direction for some artefacts of design, which enter society as functional tools and as time passes become objects of identity and personal expression.

An important point in relation to the concept of "meaning" is that studies on semiotics and sign process (Fisch, 1986) have suggested that the 'intended sign content' chosen by a creator may turn out to be different from the 'received sign content' of an end user. Siefkes (2012) specifically suggested that "the meanings that become connected with products don't always have to be the meanings intended by the designers" (p. 9). Whether designer notions of meaning are being received by consumers to a high degree, or, instead divergent from that of consumers to some degree, is a question which can be suggested to merit investigation. Substantial divergences in meaning might be expected to lead to some degree of commercial difficulty at some point in an artefact's life cycle. Further, knowledge of possible divergences might prove useful towards the prioritising of the design processes involved, for example by prioritising ethnographic and validation activities.

Three Categories of Pre-existing Meaning of Designed Artefacts

Giacomin (2017) has suggested that any commercially active designer would be expected to clarify, decide upon and communicate the following at some point in the design process if meaning is being considered an important characteristic of the artefact:

- the relevant corporate or brand ideology;
- the form of value which the consumer is anticipated to derive from the artefact;
- the meaning which the artefact is anticipated to provide or facilitate for the consumer;
- the adherence between the artefact and some existing function, ritual or myth;
- the opportunity or need to define a new function, ritual or myth due to technological or societal change;
- the focal metaphor of the artefact;
- the physical, informatic and manufacturing specifications of the artefact.

The visual representation which was proposed as a means of capturing the concerns and questions is shown in the framework of 'design for meaning' in Figure 1. For simplicity of use, the diagram was organised with the starting point being the corporate or brand ideology (Hatch & Schultz 2008) and the terminating point being the final product, system or service specifications. The diagram is subdivided into two sections in relation to the fundamental consideration of whether the artefact should adhere to an existing technological or societal stereotype or, instead, whether there is the opportunity or the need to define a new meaning due to technological or societal change.

Giacomin (2017) suggested that for many fast moving consumer goods, home goods, office goods, vehicles, transport systems and elements of the built environment a deviation from an existing function, ritual or myth can be problematic, but that there are a growing number of instances in which a business opportunity can only be achieved by exploiting a new technology or a new cultural code (Holt & Cameron, 2010). Such cases of disruptive innovation (Bower & Christensen, 1995 ; Clayton, 1997) or radical innovation (Dahlin & Behrens 2005 ; Norman & Verganti 2014) are premised on the possibility of defining a new meaning for the potential

consumers. The establishing of such new meanings was expressed by Giacomin (2017) using the term "meaningfication", which was defined as:

> *The use of data, design ethnography, real fictions and co-creation for the purpose of designing artefacts based on new meanings which emerge from the interconnection of evolving patterns of technology, experience, personal identity, societal identity, value assignation and consumption. (Giacomin, 2017, p. 22)*

When a designer identifies an opportunity which interconnects several previously unrelated technological and cultural codes, and articulates one or more product, system or service concepts which address the opportunity, the process can be described as one of "meaningfication".

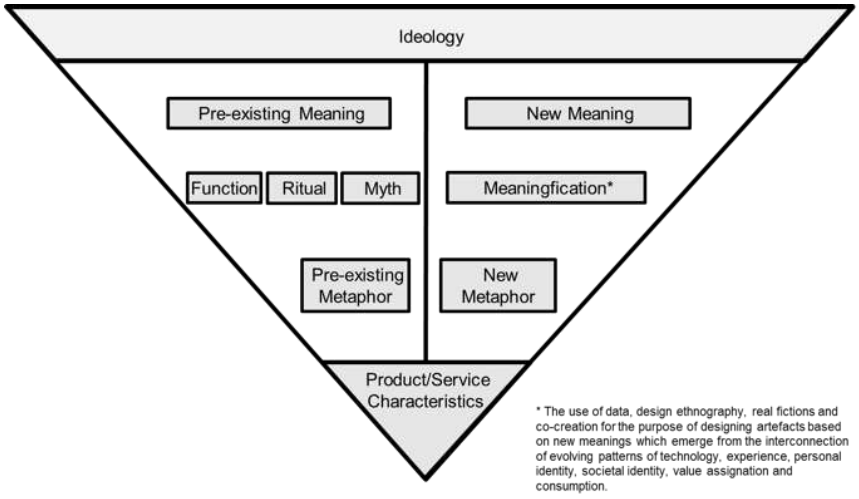

Figure 1: Framework of design for meaning. source: Giacomin, 2017

Three primary categories of pre-existing meaning are proposed in the framework of Figure 1 covering a spectrum from the purely instrumental to the purely symbolic. These categories of meaning can occur individually, or in the case of some products, systems or services might be co-present to some degree. Each category of meaning involves dialogue which focuses mainly, but not exclusively, on one specific consideration to optimise. The concept of "design for meaning" suggests that the three categories of pre-existing meaning of function, ritual and myth can provide a bridge between the global meaning of an artefact and the specific metaphor which is deployed by the designer.

The category of "function" is meant to reflect all those situations in which a physical or informatic use is acting as the focus of attention, with less attention being paid to the psychological or sociological considerations. The category of "ritual" is meant to reflect all those situations in which the meaning of the artefact is closely related to action of a symbolic nature. The category of "myth" is meant to reflect all those situations in which the meaning of the artefact is mainly symbolic, thus not necessarily requiring dedicated externally visible activity on the part of the consumer.

The aim of the study presented in this paper was to investigate the potential usefulness of the "design for meaning" framework for distinguishing between meanings when organising the design of artefacts. The objective of the current investigation was to establish if the three previously identified primary categories of meaning are commonly encountered in practice, and to note any statistically significant differences in meaning between a group of designers and a group of consumers. For this purpose, a set of twenty well known commercial artefacts was chosen as the basis for the exploration of associated meanings.

Methods

Participants Selection

Review of the ergonomic, psychological and sociological literature suggests that the use of ten participants can often be considered sufficient for purposes of qualitative analysis (VanVoorhis & Morgan, 2007). Given the

exploratory and qualitative nature of the current investigation it was decided to assemble a group of ten designers and a group of ten consumers for a total of twenty individuals.

To be selected each designer had to have more than three years of design experience, preferably in commercial practice. To be selected each consumer had to have no experience in a design related discipline. In order to reduce one well known source of bias, the sampling was performed in such a manner as to ensure equal numbers of male and female participants in each group. Efforts were made to also achieve a relatively similar distribution of the demographic descriptor of age. Across the complete group of twenty individuals the participant age ranged from 22 to 48 years with a mean value of 28.2.

To simplify recruitment and procedures all individuals were staff or students of the university. All were unpaid volunteers. All phases of the recruitment process and of the study itself were performed in compliance with the university's ethics policy and with the terms of the specific ethics approval granted by the university.

Artefacts selection

Given the exploratory and qualitative nature of the current investigation it was decided to use representative designed artefacts which provided a wide spectrum of characteristics along a continuum from the utilitarian to the hedonic. The selection criteria adopted with respect to the design for meaning framework were the following:

- the artefact is a commercial product;
- the artefact's brand association is expected to be evident;
- the artefact's design metaphor is expected to be simple enough to be understood;
- the artefact does not exhibit significant hidden product characteristics.

Additional selection criteria adopted for the study were the following:

- the artefact is commonly encountered in everyday life;
- the artefact is expected to be familiar in terms of affordances and stereotypes;
- the artefact is not contentious in terms of meaning or association with world affairs.

After shortlisting it was decided to choose the final artefacts from the commercial sectors of durable consumer goods and of fashion, because analysis of the shortlist highlighted that these two commercial sectors offered a wide variety of artefacts which people encounter in everyday life. The twenty final artefacts are shown in Figures 2 and 3.

Figure 2: Seven fashion goods used in the study

Figure 3: Thirteen durable consumer goods used in the study

Working Definitions of Function, Ritual and Myth

Working definitions of the semantics "function", "ritual" and "myth" were required for use in the study so as to minimise variations in response due solely to different, potentially incorrect, interpretations of the semantics on the part of the participants. In order to keep the guidance as simple and intuitive as possible the dictionary definitions referenced by Giacomin (2017) were adopted:

Function:

- the way something works or operates;
- the natural purpose of something or the duty of a person.

Ritual:

- a series of actions or a type of behaviour which is regularly and invariably followed by someone;
- a set of fixed actions and sometimes words performed consistently and regularly, especially as part of a ceremony or collectively.

Myth:

- a traditional story, especially one concerning the early history of a people or explaining a natural or social phenomenon;
- an idealised, exaggerated or fictitious conception of a thing or person;
- a widely held but false belief or idea.

These definitions were provided to the participants in the form of written text which was presented for a fixed period of time during the induction and familiarisation stage of the study. In this manner, it was presumed that each participant was provided equal access to the core definitions of the study and similar time for reflection and understanding.

Procedure

Each participant (n=20) was received separately in a closed room in the Human Centred Design Laboratory of Brunel University. Upon arrival the participant was provided the background information to the study, including the relevant health&safety and ethics considerations. The participant was next asked to read the written working definitions of "function", "ritual" and "myth" which had been adopted for the study.

The lead researcher next presented each of the twenty artefacts, one-by-one, by means of a large photograph and asked the participant to respond to the following questions:

- *"Is function an obvious meaning which can be associated with this artefact ? Yes? No? Unsure?*
- *If "Yes", can you suggest at least three adjectives which describe the artefact in terms of function?*

- *Is ritual an obvious meaning which can be associated with this artefact ? Yes? No? Unsure?*
- *If "Yes", can you suggest at least three adjectives which describe the artefact in terms of ritual?*
- *Is myth an obvious meaning which can be associated with this artefact ? Yes? No? Unsure?*
- *If "Yes", can you suggest at least three adjectives which describe the artefact in terms of myth?*

For each artefact the question set attempts to first identify the presence or absence of each of the three a-priori defined categories of meaning, then moves on to request adjectives which describe the way the artefact manifests that meaning.

The forced choice format was used for the meaning attribution in order to elicit deeper processing, to minimise satisficing behaviours (Smyth, Dillman, Melani, & Stern, 2006) and to reduce acquiescence (Schuman & Presser 1981). The option of selecting "unsure" was provided in order to avoid the potential bias which can occur when people are forced to choose an answer that may not be completely true for them (Smyth et al., 2006). The collection via an open ended format of three adjectives to describe the artefact was instead inspired by the ethnographic criteria of Hanington and Martin (2012) which aim to extract balanced and unbiased views from people.

To minimise learning and fatigue effects the order of presentation of the working definitions of the categories of meaning on the instruction sheet were randomised for each participant, as was the order of presentation of the twenty artefacts. To further reduce the bias which is caused by artefact order of presentation (Gescheider, 1997) the participants were asked to respond to each artefact based on its own merits, independent of the preceding artefacts. Across the complete group of twenty participants the time required to complete a study session was never greater than 16 minutes for any given individual.

Data analysis

All written responses were initially recorded on sheets of paper and then later transcribed by the lead researcher into the NVivo software (Bazeley & Jackson, 2013). NVivo supports qualitative, quantitative and mixed methods research by means of a variety of statistical algorithms and logical tools. Using NVivo, counts were performed across the complete data set consisting of all the responses from all participants. The number of times a category of meaning (function, ritual or myth) was cited was totalled for each individual artefact and across the complete dataset of twenty artefacts. The number of times a category of meaning was cited was also totalled for each individual participant and across the complete dataset of twenty participants. Statistical analysis of means and ANOVA were then performed across the subgroups which were being compared.

Results

Table 1 presents the total number of times a category of meaning occurred across the complete database of twenty artefacts and twenty participants. The numbers provided in Table 1 are the sums obtained by counting how many times the category of meaning was found in the database. Table 1 does not contain an "unsure" column because none of the participants chose that option for any of the artefacts used in the current study.

Table 1: Number of times a category of meaning was selected across the complete set of twenty artefacts

	Category of meaning		
	Function	*Ritual*	*Myth*
Consumers (n=10)	128	112	101
Designers (n=10)	117	76	81
All Participants (n=20)	245	188	182
All Participants Percentage	**39.8%**	**30.6%**	**29.6%**

Table 1 suggests that the category of "function" produced 245 responses which accounted for 39.8% of the total tallied across the complete set of twenty artefacts and twenty participants. Table 1 also suggests that the category of "ritual" produced 188 responses which accounted for 30.6% of the total, while the category

"myth" produced 182 responses for 29.6% of the total. A two-tailed normally distributed ANOVA performed across the dataset (n=20 people) at a 95% confidence level suggested that there were no statistically significant differences between ritual and myth responses, while instead the differences were statistically significant between function and ritual, and between function and myth.

The sum of the responses for the three categories of meaning is 615, which exceeds the value of 400 which is obtained by multiplying the number of artefacts by the number of participants. This confirms that in the current study the participants frequently indicated more than a single category of meaning for a given artefact. In fact, several examples can be identified in the database where a given artefact was considered to possess some amount of each of the three categories of meaning.

Table 1 also suggests that the group of consumers, who were anticipated to have no background in design theory or practice, attributed more meanings than the group of designers. Differences between the two groups were particularly evident in relation to the categories of "ritual" and "myth", suggesting that typical consumers may be considering semiotic and symbolic content which is not immediately apparent or relevant to designers. A two-tailed normally distributed ANOVA performed across the dataset (n=20 people) at a 95% confidence level suggested that statistically significant differences existed between the responses from the consumers and those from the designers for the categories of ritual and myth, but not for the category of function.

Table 2 presents the total number of recorded adjectives for each category of meaning across the complete database of twenty artefacts and twenty participants. Table 2 suggests that the category of "function" produced 1050 adjectives which accounted for 42.5% of the total. Table 2 also suggests that the category of "ritual" produced 688 adjectives which accounted for 27.8% of the total, while the category "myth" produced 732 adjectives for 29.6% of the total. A two-tailed normally distributed ANOVA performed across the dataset (n=20 people) at a 95% confidence level suggested that the differences in the number of adjectives between each of the three categories were statistically significant.

Table 2: Number of adjectives used for each category of meaning across the complete set of twenty artefacts

	Category of meaning		
	Function	*Ritual*	*Myth*
Consumers (n=10)	542	406	402
Designers (n=10)	508	282	330
All Participants (n=20)	1050	688	732
All Participants Percentage	**42.5%**	**27.8%**	**29.6%**

The sum of the adjectives for the three categories of meaning was 2470, which is more than the value of 1845 which is obtained by multiplying the 615 indicated meanings by the 3 adjectives which were requested for each meaning. This suggests that many participants provided more than three adjectives with respect to each of the categories of meaning which they had indicated.

Figure 4 presents an example which illustrates the frequency and nature of the adjectives which were provided by the participants. Figure 4 contains three representative artefacts which might be expected to span part of the spectrum from the purely instrumental to the purely symbolic, chosen from among the twenty which were used in the study. For each of the three artefacts the adjectives are shown under the artefact image, subdivided by the participant group (designer or consumer) and by the category of meaning (function, ritual or myth).

From the examples of Figure 4 it can be noted that the three primary categories of meaning can occur individually or can be co-present to some degree. Further, it can be noted that there was a propensity for a greater number of meanings and a greater number of adjectives among the group of consumers with respect to the group of designers. Among the examples shown in Figure 4 it can be noted that the picture frame, in particular, appeared to be viewed in mostly instrumental terms by the group of designers while the same artefact was assigned a wide range of instrumental and symbolic meanings by the group of consumers.

Discussion

The research hypothesis of the current study was that the previously identified three primary categories of meaning would be commonly encountered in practice, and that statistically significant differences would occur between designers and consumers. The results suggest that all three categories of meaning, i.e. function, ritual and myth, do occur in practice, individually or in co-presence. The results further suggest that statistically significant differences occur between groups of designers and groups of consumers in both the indicated categories of meaning and in the adjectives used to describe artefacts. The results would thus appear to support the research hypothesis.

A point of note in relation to the results is the prevalence of functional attributions. For both the group of designers and the group of consumers, functional meanings were the most frequently attributed and functional adjectives were the most statistically prevalent. The results suggest a greater facility, or at least a greater propensity, for instrumental judgements.

Nevertheless, as Krippendorff (2007) and Siefkes (2012) have advocated, the functional meanings are not the only ones which people associate with artefacts. The meaning attributions and the adjectives collected in the current study suggest that the group of consumers, in particular, viewed many of the artefacts in a hedonic manner. Adjectives which were frequently encountered included such examples as “attractive”, “desirable”, “fun” and “exciting”. The current results provide empirical evidence in support of those who advocate “The Semantic Turn”, i.e. the paradigm shift from an emphasis on how artefacts should function to what they should mean (Krippendorff, 2007). The current results also provide empirical evidence in support of those who advocate “Human Centred Design”, i.e. the design process involving of a series of questions and answers which span the spectrum from the physical nature of people’s interaction with the product, system or service to the metaphysical (Giacomin, 2014).

A finding of the current small exploratory study was that some divergences in meaning may be occurring between designers and consumers. For most of the artefacts used in the study there were a greater number of ritual and myth meanings indicated by the group of consumers than by the group of designers. The situation is understandable given the difficulties in imagining all the possible semiotic and hedonic meanings which an artefact might take on for an ethnographically diverse public. Nevertheless, the current results seem to highlight the need for carefully executed ethnographic and user testing activities.

The large number of meaning attributions and the large number of meaning adjectives found in the current study would seem to suggest the potential usefulness of the framework suggested by Giacomin (2017) for distinguishing between meanings when organising the design of artefacts. Further research is therefore underway to extend the existing study to larger random samples of artefacts from selected commercial sectors.

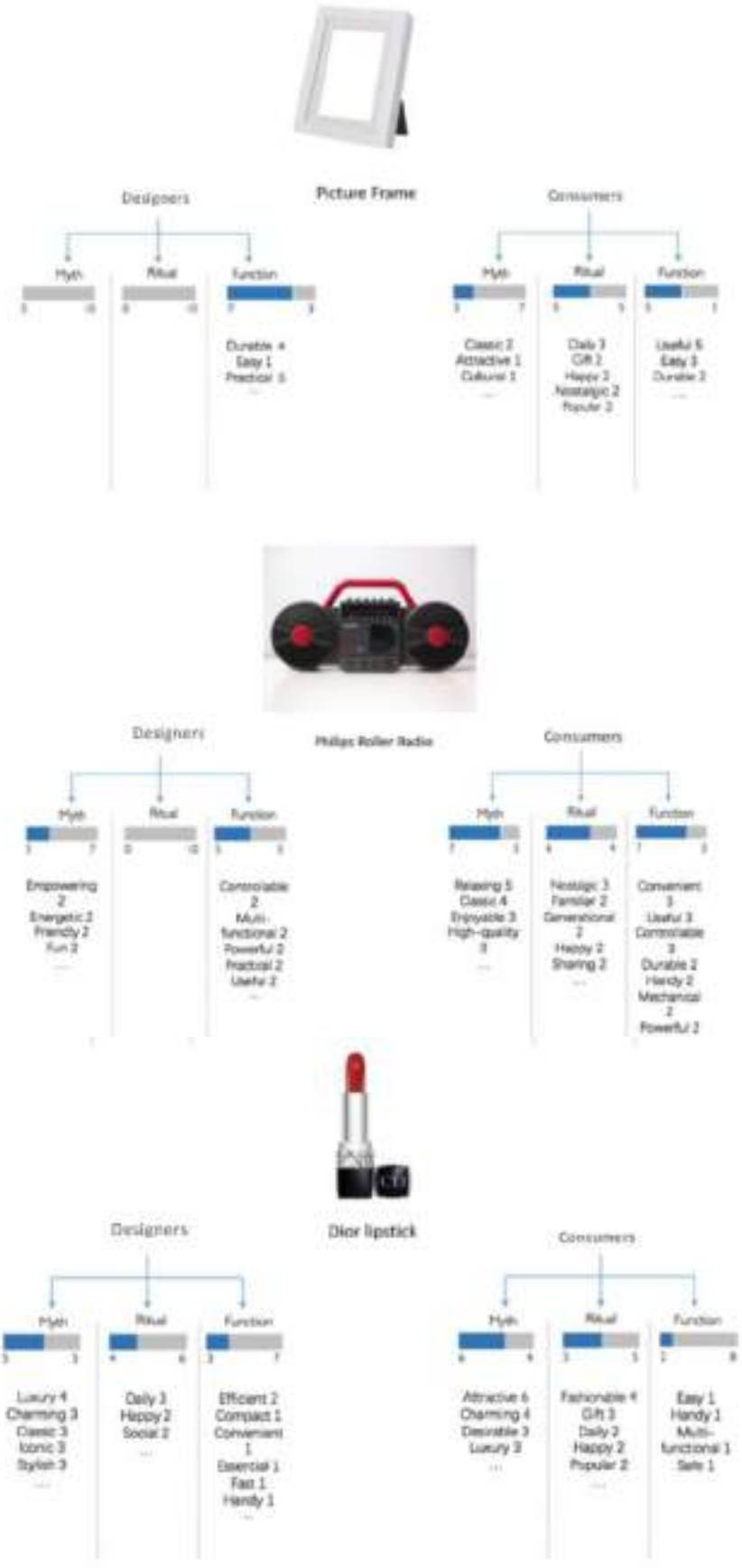

Figure 4: Adjectives provided by the designers and the consumers for three representative artefacts

Conclusions

Previous research has suggested three primary categories of meaning which designers should consider during their design processes, i.e. function, ritual and myth, which cover a spectrum from the purely instrumental to the purely symbolic. The research hypothesis of the current study was that the previously identified three primary categories of meaning would be commonly encountered in practice, and that statistically significant differences would occur between designers and consumers.

A semi-structured questionnaire was deployed with ten designers and with ten consumers using a set of twenty photographs of designed artefacts. The results suggested that all three categories of meaning, i.e. function, ritual and myth, could occur individually or could be co-present to some degree. The results further suggested that statistically significant differences occurred between the group of designers and the group of consumers in the indicated category of meaning and in the adjectives used to describe the artefacts. The results would thus appear to support the research hypothesis.

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Research Perspectives IN THE ERA OF Transformations

Design for Meaning of Smart Connected Products

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This paper tackles the topic of meaning-driven innovation from a Product Design perspective. It focuses on the design of Smart Connected Products: internet-enabled phygital products that blend hardware and software. This category of products represents a positive field of exploration for meaning-driven innovation. The paper highlights three kinds of meaning that are relevant for Smart Connected Products: the meaningful identity of the object as product category, the meaning of the product in relation to its shape and functionality, and in relation to a phygital ecosystem. The paper reflects on the methods that can support designers in the development of meaningful smart products and presents the "Mapping the IoT" Toolkit, a downloadable tool that guides in specific activities aimed at framing the product's meaning. Tests with the Toolkit proved the effectiveness of using cards with critical questions as a way to deepen design concepts and reach a common, meaningful vision.

Keywords: Meaning-driven innovation, Product Design, Smart Connected Products, IoT, Design Tool

Types of innovation and meaning driven innovation

There are two main kinds of innovation that concerns products: incremental and radical.

Run-of-the-mill, incremental innovations represent a progressive improvement of certain parameters of the product. Norman and Verganti (2014) compare it to a "hill climbing" activity, since it tries to modify iteratively few product's characteristics to achieve newer, better versions, and gain more quality over time. It is not known in advance where is the peak of this hill to be climbed. The techniques of Human Centered Design, with fast iterative cycles of research, prototyping, and user testing, are proved to facilitate in the path towards incremental innovation.

Radical innovation instead, aims not to climb the same hill, but to find a new one with a higher potential. This kind of innovation has been labeled in different ways such as radical, discontinuous, generational or breakthrough innovation. Interest in radical innovation originated with Schumpeter (1934) and was seen as a way to challenge the power of monopolists.

Dahlin and Behrens (2005) defined three conditions to allow ex-ante identification of potential radical innovation and ex post evaluation of its impact. To be defined as radical, an invention must be novel and unique, hence dissimilar from prior inventions, and finally, it must be adopted and influence the content of future inventions: this transforms it in a successful change agent for the industry.

Radical innovation can be driven by technological epiphanies, that open up to new possibilities and promote different visions, and by deliberate changes in the meaning of product (Verganti, 2017; Norman & Verganti, 2014).

For example, when unspoken dynamics in sociocultural models arise, new meanings can re-align the industry to people's aspirations. This may be achieved by addressing new performance needs with attributes that are currently not valued by existing customers (Bowler & Christensen 1995): a cited example is the Nintendo Wii, that radically innovated the market of gaming consoles because it focused on immersivity instead of on realistic graphic quality, the performance that was more valued by previous consoles.

For Norman & Verganti (2014), radical innovation is seen as comparable to technology-push innovation: to reach it, it is crucial to develop a strong internal vision, rather than applying the iterative HCI methods.

In the next section the concepts of meaning and meaning driven innovation are deepened.

Meaning and Meaning-driven Innovation

In a simple way, it can be said that the "meaning" of a product is the "reason why" behind it, "the profound psychological and cultural reasons people use a product" (Verganti, 2011, p.384).

Going deeper into the nature of meaning, it has been widely accepted that is composed by a "bundle of components" that include both objective and subjective elements, such as experiences, feelings and images.

Meanings can be categorized in three types: lexical meaning, philosophical and psychological (Friedman and Lessig, 1986). Psycological meanings in particular are those focusing on a person's subjective perception and affective reactions (Szalay and Deese, 1978).

The meanings of a given object can be characterized by three dimensions: tangibility, emotionality and commonality. These dimensions have been discussed for example by Friedman (1986) and Hirschman (1980).

Tangibility concerns whether the attribute at the basis of meaning is tangible, in the sense that is objective and verifiable through the senses, instead of being subjective. It reflects if the meaning is located in the object itself or in the mind of the user.

The emotional side of product meaning is an important component of the meaning of an object, that cannot be detached from the objective side. Emotional responses to products can range from low to high intensity, going from simple affective reactions to true emotional experiences such as enjoyment and excitement.

The third dimension of meaning is that of commonality, that identifies the degree to which meaning is shared by members of the culture, or if it has a more individualized and personal character. It is linked to the source that is more responsible of the assignment of meaning to the object. For example, it is a cultural source if the meaning is assigned by advertising and shared media opinion. It is a personal source if meaning is created by the user through time, experience and interaction, such as an object received as a gift from a dear friend, your most comfortable pair of shoes, or your favourite toy when you were a child.

Different researchers focused on framing and categorizing diverse kind of meanings in order to deliver meaningful customer experiences. For example, Fournier (1991) defines eight categories of customer meanings: objects of utility, action, appreciation, transition, childhood, ritual enhancement, personaly identity, and position and role. While Diller et al. (2005) suggest fifteen categories of meaning: accomplishment, beauty, creation, community, duty, enlightenment, freedom, harmony, justice, oneness, redemption, security, truth, validation and wonder.

Product meanings have many connotations, depending on which theoretical perspective is hold, for example Affordance Theory, Product Semantics, Product Emotions. Thanks to the highly sociological nature of meanings, they can be shaped and in a sort of way controlled by designers (Giacomin, 2017).

This is a topic of study in the field of product semantics: while semiotics is the study of signs, semantics is the study of their meaning, and applied to design, it concerns how designers encode meaning into their products to communicate with the user.

Design is seen as a form of communication (Krippendorff & Butter, 1984) in which the symbolic qualities of products are the messages to the user. The meaning of a product must be imagined connected from its contexts of use and in relation to the user's cognitive models (Krippendorff, 1989).

Meanings can be attributed to artefacts through a process of semantization. Siefkes (2012) proposes seven principles of semantization: function, style, iconic associations, individual experiences, cultural allusions, connection to social groups, and connection to specific contexts.

Giacomin instead proposes a framework diagram of design for meaning that identifies if an artefact should adhere to an existing societial stereotype of if there is the possibility to define a new function, ritual or myth. He calls this "meaningfication" and defines it as

> *the use of data, ethnography, real fictions and co-creation for the purpose of designing artefacts based on new meanings that emerge from the interconnection of evolving patterns of technology, experience, personal identity, societal identity, value assignation and consumption.*

The next section applies the topic of meaning to the design of smart products.

Design for Meaning of Smart Connected Products

In this paper the term "design" is used referring to the industrial design practice:

> *Design is a strategic-problem solving process able to drive innovation through innnovative products, systems, services, and experiences (World Design Organization, 2015)*

Design is an activity of meaning creation. As said by Krippendorff, "Design is making sense of things".

The term "Smart Connected Products" identifies tangible products with computational capabilities, conneced to the Internet and - possibly - to other objects. Their characteristic feature is being cyber-physical (or "phygital"): it means having both a tangible/physical form and a digital/intangible part. This digital counterpart is what Greenfield (2006) calls "Informational shadow" and what Semmelhack (2013) defines as "Digital Avatar", and is one of the two states in wich the product exists.

Smart connected products are *IoT products* because they are part of the Internet of Things, "a world-wide network of interconnected objects uniquely addressable, based on standard communication protocols" (INFSO D4 & RFID INFSO G.2, 2008), a network "Available anywhere, anytime, by anything and anyone (ITU, 2005).

This paper discusses why smart connected products are an eccellent field of application and exploration for meaning-driven innovation. The insights presented derive from the authors' academic and professional experience. In particular, the analysis of case studies of smart connected products (Vitali, 2015; Arquilla & Vitali, 2016) led to the definition of a Toolkit to support designers and their teams in the development of IoT products (Vitali, Rognoli & Arquilla, 2016; Vitali & Arquilla, 2018). The Toolkit is later described as a case study in this paper.

There are three kinds of meanings that are specifically relevant in the design of smart connected products.

- The meaningful identity of the object as product category
- The meaning of the product in relation to its shape and functionality
- The meaning of the product in relation to a phygital ecosystem

1. The meaningful identity of the object as product category

The suffix "Smart" is often abused to call attention to those products with relevant technological features, or that try to solve a specific problem in an intelligent way.

There is no univocal definition of what a "smart product" is (Gutierrez, et al, 2013), but the term is used to identify objects able to gather and process data (Kiritsis, 2011), with an autonomous and adaptive behavior (Maass and S. Janzen, 2007) providing a natural product-to-human interaction (Sabou et al, 2009) and active communication with users, environments or other products and systems (Venta, 2007).

Smart products suffer from identity crisis. They are not strongly culturally semantized. Their smartness is often translated in the ability of being controlled by a smartphone. This label of being "products with an app" links to meanings that don't communicate efficiently their worth and innovative elements: they are oftenseen as tech gadgets. What smart connected products need, is a well-designed identity and specific value proposition. "Focused, divergent and with a compelling tagline", like an effective blue ocean strategy (Kim and Mauborgne, 2005).

Analyzing the consumer electronics market, three macro-categories of smart products emerge:

1. In the first case, the object is the technological, connected version of an analog product. For example, a smart water bottle that tracks how much water is drunk during the day, and that sets reminders for the user. Adding connectivity and technological features for this category of products can be seen as a radical innovation.
2. In the second case, the object is smart because it is the "smarter" version of an electronic/digital product. For example, an internet-connected weight scale that lets users record their weight in time. Adding connectivity for this category of products can be seen as an incremental innovation of its technological features.
3. In the third case, the object is smart because it combines new and existing functions, resulting in a new product category in the market. This kind of intervention tries to satisfy user needs in a radical new way. An example is the Roomba vacuum cleaner, that offers a new vision for home cleaning, combining initially unrelated topics of "home robots" and "vacuum cleaners".

The semantic dimension is a powerful source of competitive advantage (Battistella, Biotto, De Toni, 2012).

For all three categories, there is a need of semantization, or what Giacomin interprets as meaningfication: *"customers are implicitly invited o think differently about the opportunities and value propositions which are on offer".* (Giacomin, 2017). Innovative aspects of the products must be framed with new meanings.

In the first and second categories of smart products, there is also the need to clarify if the meanings of these smart products still align with the pre-existing meanings linked to their unconnected counterparts.

A successful example of this is represented by Nest, a connected thermostat, that through technology was able to shift the identity/meaning of the thermostat from a static, passive, and hard to personalize element of the house, towards an active and reactive element, that automatically answers to user's presence and habits. This shift from the pre-existing values led to a new vision for the market of thermostats.

Another example concerns the creation of new visions in the market of Smart TVs. Samsung reflects on the role in the room of large, wall-mounted TVs, trying to suggest new meanings. Samsung proposes "The Frame" a TV that when switched off becomes a personal piece of art displaying selected high-resolution images from a curated art gallery. In this way the TV acquires a meaning in the room, even when is not switched on. Another innovation is the "Samsung Ambient Mode", that lets the TV screen disappear, simulating the texture of the wall on which it is mounted. Complementarily, LG presented at CES 2019 "Signature R" a rollable OLED TV, that lets the screen physically appear only when needed.

In these examples the new meanings and visions redefine the architectural role of the TV, trying to anticipate future user whishes.

Figure 1: From left to right: Samsung "The Frame", Samsung "Ambient Mode", LG "Signature R"

The communication of the new values is crucial to redefines the smart product's identity and its position in the marketplace.

An exemplar case study of meaningful communication is the Apple Watch video series "Real Stories" (Apple, 2018, link in bibliography) that documents stories in which the functions of the smartwatch were able to deeply impact its users, for example by saving their life thanks to the heartbeat alarm notification, by calling an

ambulance after a car accident, by calling for help for being rescued when lost at sea. With the interviews in the video, the smartwatch shows that it can be a meaningful device for health and safety, and not only a product aimed at sport athletes.

2. The meaning of the product in relation to its shape and functionality

The second level of meaning concerns the meaning in relation to the product's shape and functionality. This kind of meaning is traditionally addressed by the field of Product Semantics.

A short digression about analogic artifacts highlights what electronic products lack.

The shape of analogic artifacts is expressive. Through its affordance, the object "offers what it does because of what it is" (Gibson, 1977) and communicates how it could be used (Maier, & Fadel, 2009), and the action through which interaction takes place (You & Chen, 2007). Through shape and materials, the artifact communicates signs and messages that will be interpreted by the user in a subjective way. A successful design manages to communicate effectively and consistently to the receivers what the designer wanted to express. Therefore, the ability of the designer is to make the design comprehensible to the receiver/user by presenting qualities that will cause and fulfill certain expectations (Kazmierczak, 2003).

In electronic products, the link between shape and function is often lost. Electronic products are able to perform multiple functions which, however, are not evident, traceable or geometrically comprehensible in the shape of the artifact. Often this leads to anonymous shapes that do not communicate or invite interaction. Additionally, many smart products can't even be manipulated, since interaction takes place through external interfaces and via smartphone.

These aspects are the first three of what Krippendorff and Butter (1984) define as the four semantic infelicities in design: the product is undistinguishable or unidentifiable by the user, the product does not promote the correct way to manipulate it, it lacks transparency and it is not clear how to use it.

Therefore, a designer dealing with smart connected products should try to reduce these infelicities. One possible strategy is to design a shape that highlights and expresses the way of interaction with the product. Another strategy is to use metaphors to bring the meaning of the product closer to its primary function, and make it more comprehensible by aligning with the mental models of the user.

For example: what shape should a wireless router have? What is its archetype? Technically, a router is an antenna that transmits a signal, that is why many routers have visible antennas, for a better perceived performance. Instead, the wi-fi router "Asus Blue Cave" has a characteristic shape with a circular hole, marked by a blue finishing (Fig 2). This product doesn't show any antenna, and its shape is more similar to an air purifier. The shape uses the metaphor of "airflow" to relate to the flowing of data. In this way the shape is more meaningful, according to the product's function.

Figure 2: From left to right: Asus "Blue cave" wi-fi router and three smart speakers/home assistants. Amazon Echo 2nd gen. with Alexa, Apple HomePod with Siri, Google Home with Google Assistant.

Following the same perspective, there is also the stimulating challenge to reflect on new metaphors and formal archetypes for emerging product categories such as the home assistants (Amazon Echo, Apple HomePod, Google home…), that currently materialize as cilindrical smart speakers.

3. The meaning of the product in relation to a phygital ecosystem

Connected objects can be categorized according to their ability to process information, functionalities, and degree of interactivitiy. Rowland et al (2015) for example distinguish between multipurpose computer devices with powerful processing capabilities and rich interaction (e.g. smartphones, smart TV, game consoles ...), embedded devices specialized to answer to specific needs with less processing power (e.g. smart thermostat, smart weight scale, smart bottle …), and connected sensors in which the gathered data is more important than the physical interaction with the product (e.g. flood sensor, air quality sensor …).

Due to their phygital nature, connected products can be interacted with in a tangible and digital way. This blurs the line between product and service (Breschi et al, 2018). Analog products are “finished” once manufactured and sold, but connectivity allows the physical connected products to become avatars, physical stand-ins, for services.

Due to their dual nature, connected products follow more the dynamic logic of apps and software, rather than the static life of physical matter and hardware. “Design is never done” quotes Google, and so are IoT products.

The connected product and its functions need to be framed in an ecosystem. The object is not isolated but social, and in relationship with physical and virtual things, data, and processes. The ability to position a smart product in a compatible ecosystem is crucial: ecosystems are “the competitive unit in the battle to establish leadership in IoT” (Agrò, 2018). Objects can be augmented by services, or be included in the customer experience offered by a service provider. The more connections it has, the more the product could be considered as valueable and meaningful.

From the point of view of product design and UX design, this implies the need to design and manage a multiplicity of touchpoints, both physical and digital (Rowland et al, 2015). Therefore, when designing the product is important to define a balance between the tangible and digital aspects, in relation with its functions, and with the user’s expectations. This will deeply impact the meaning of the artifact. For example, the choice of making a key feature of the product only accessible through an app rather than with physical interaction will create a different user experience. In many cases, such as for connected sensors, the object can’t be interacted with directly and its meaning depends on its ability to provide a meaningful interaction with data.

At a more technical level and linked to the intangible, digital part of the product, few considerations need to be made regarding its ability to "work" even in the absence of an internet connection. The object may be internet-dependant to perform its primary function (e.g if it requires cloud connection to operate), or may perform part of its functions even in the absence of connection. This kind of technical choices can also have a great impact on the user experience.

> *The user experience of all these connected objects is simultaneously the Achilles’ heel and the possible golden key for what makes IoT devices like wearables meaningful to people (Adobe, 2017)*

Practical case study: designing meaningful connected products with the “Mapping the IoT Toolkit”

Reflecting on the meaning of Smart connected products with the “Mapping the IoT” Toolkit

Designing smart connected product is a complex task that requires effort from multidisciplinary teams. There are multiple aspects that designers need to be accounted for; in particular the design of the service offered by the product, the physical and digital interaction touchpoints, and the architecture of the product with its components.

The initial phase of the design process is crucial to frame the problem that the product is addressing, identifying possible user needs/desires, and envisioning new meanings, trying to go beyond superficial solutions, and to outline a coherent vision. This phase can also be called metadesign (Giaccardi & Fischer, 2006). The aim of a metadesign process is to define the reason why of the project from the point of views of the user, of the market, and of the company itself. It is a phase of meaning creation.

The “Mapping the IoT” Toolkit (shortened as “MTIoT” Toolkit) aims at giving support during the design and metadesign process of smart connected products, helping multidisciplinary teams to discuss and work

together, framing the problem, and creating a common vision. It is mainly intended for designers, but it can be used by whoever wants to approach the design of IoT products. The Toolkit is distributed with a Creative Commons license and is free to download. The Toolkit helps designers and teams during 4 main phases of the design process, described by 4 activity guides. The activities supported by the guides are:

- "I want to start a new project" helps setting the research phase at the beginning of a new design project, identifying sources and selecting case studies
- "I want to analyze smart products" introduces a guided research exercise, exploring and comparing case studies
- "I want to brainstorm ideas" describes brainstorming exercises with the MTIoT Deck
- "I want to make my concept better" offers an exercise to focus on the concept and its meaning

All activities exploit a set of cards - the "Mapping the IoT" Deck - and may be used in conjunction with fillable canvases.

The cards of the deck and are divided in 7 different topics: user & context, design, technology, interaction, experience, strategy, meaning. Cards are two sided and provide questions: the horizontal side of the card introduces a topic with one main question, while the vertical side deepens it with specific "what if" questions. Each topic is identified by a colour and a letter on the bottom of the card (Figure.3).

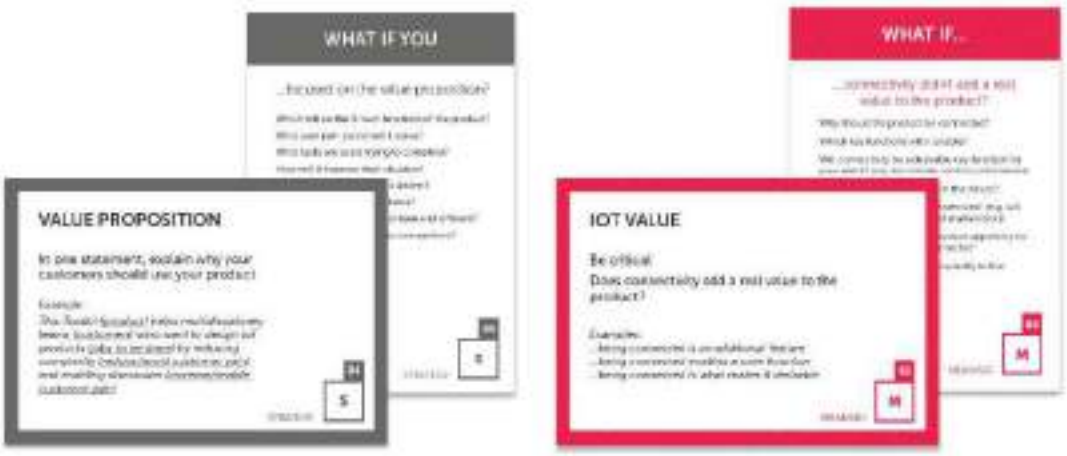

Figure 3: Example of a strategy card and of a meaning card of the "Mapping the IoT" Deck

The cards are a knowledge repository to remember many of the features that need to be designed in complex smart products. They can be used as an input for reflection, and as diverging inspiration. The questions are an input to discuss the idea and the meaning of the product, therefore the cards have more impact at the beginning of the design process, between problem framing and concept definition. (Define, Develop, Deliver in Figure 4) (Vitali & Arquilla, 2018).

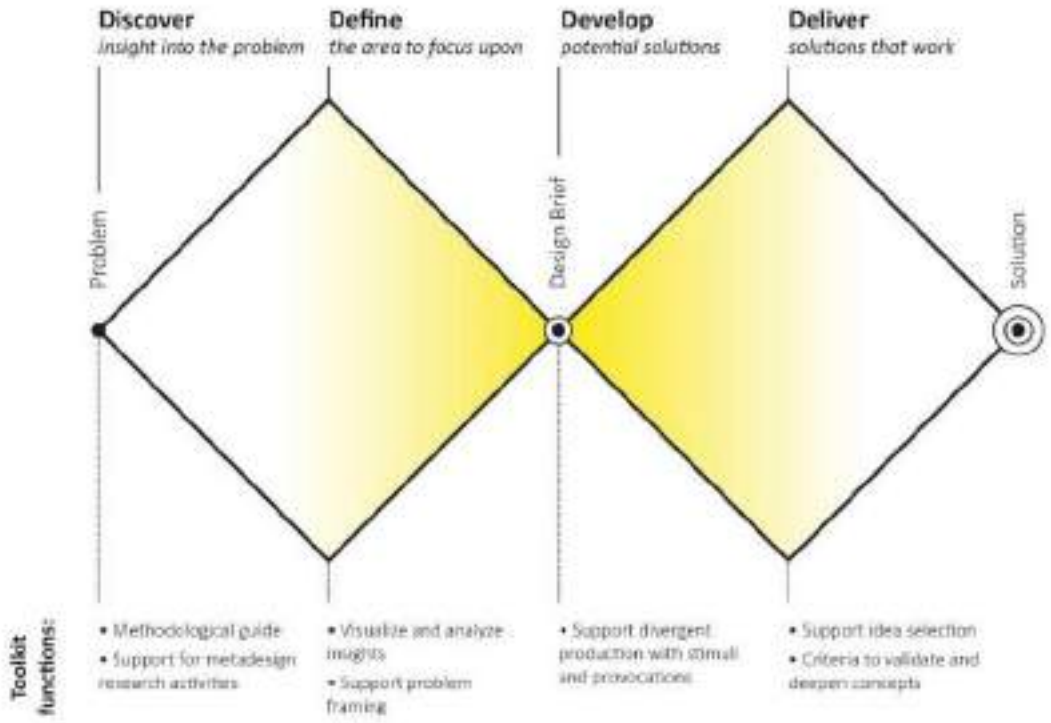

Figure 4: The "Mapping the IoT" Toolkit functions positioned in relation to the double diamond representation of the design process.

The subdivision of the deck in topics pushes the team to concentrate on specific aspects of the product.

Group activities, facilitated by the Toolkit, are aimed at defining a clear vision for the smart product definition.

The elements of the MTIoT Toolkit that mostly focus on framing the meaning of the project are three: Meaning cards, Strategy cards, and the Activity guide "I want to make my concept better".

1. "Meaning" cards (the cards with fuchsia edges in Fig.3) propose critical questions that want to challenge the designer in observing the concept in an objective way, evaluating strengths and weaknesses.
2. "Strategy" cards (with grey edges in Fig.3) reflect on the uniqueness and market positioning of the concept, with a focus on its business model and competitor analysis. They want to support the development of the product's value proposition. These help to frame the meaning of the product for the market.
3. The Activity guide "I want to make my concept better" introduces an activity to be done in conjunction with the deck cards and the "sum up your smart-product idea" canvas (Fig.5). The canvas is split in 7 areas, that follow the cards'subdivision. It is printed and used to summarize the initial design concept of a smart product. Then the cards of the deck are used to discuss and deepen the initial idea with the team, by asking and answering questions. The exercises "forces" the designer to frame the idea and its meaning for the user/context, and for the market.

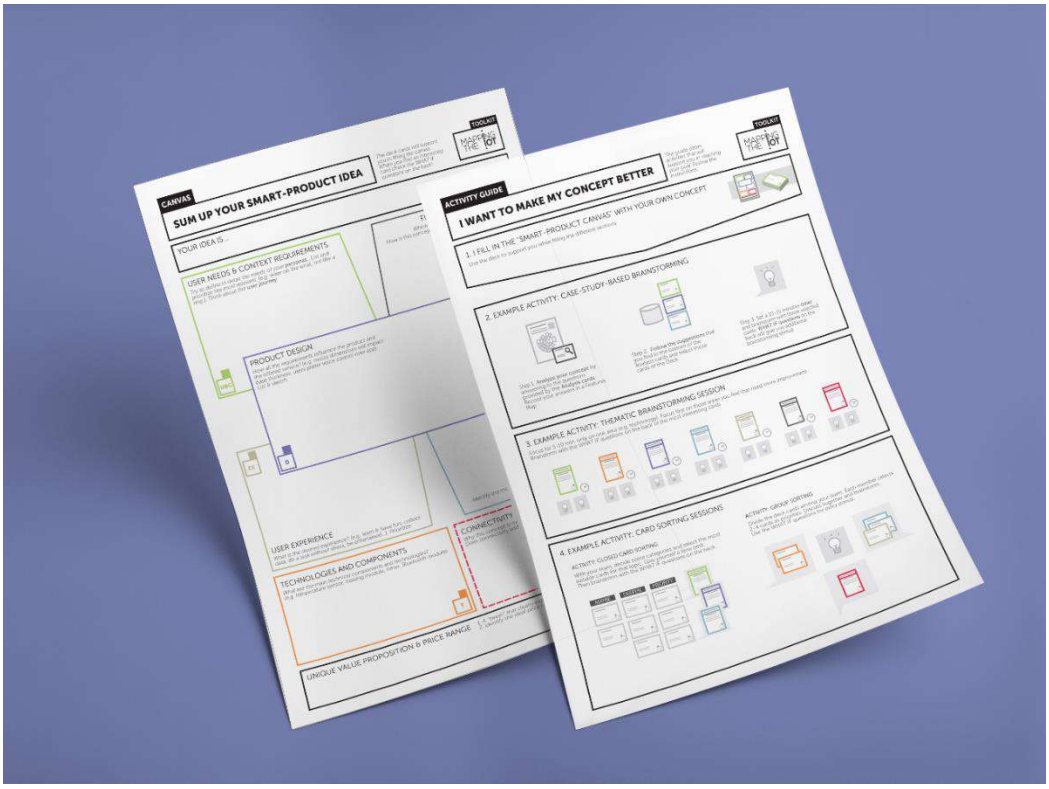

Figure 5: The Activity guide "I want to make my concept better" (on the right) describes an activity that uses the MTIoT deck cards and the "Sum up your smart-product idea" canvas (on the left)

The Toolkit has been tested and presented in different occasions, with academic peers, professionals and design students and is being formalized as a teaching support at Politecnico di Milano.

Among the recent tests and presentations:

- Academically: test at Miteinander at Chemnitz University of Technology 2018, DRS conference 2018, NordiCHI conference 2017
- Professionally: "Product of Things 2018" in Tel Aviv, "IoT Connected design event 2018" by IoT Italy in Treviso, "Workshop Explore Innovation and design trends 2017" in Milan.

Test A and Test B following the "I want to make my concept better" Activity guide

The MTIoT Toolkit is a kit that evolves constantly, following user insights: like smart connected products, it is upgradeable and is currently at its 4th version. Recent structured tests focused specifically on the dimension of meaning generation.

This paper describes two Toolkit tests that involved students at their second year of Master's Degree in "Integrated Product Design" and in "Design and Engineering" at Politecnico di Milano Design School. In both cases students were designing smart products for their final course (Final Synthesis Studio) in collaboration with different companies (Braun, Midea, Enovia-Yape).

Test A involved students of the Master's course in Integrated Product Design. The aim of the course, called "Smart/Design Lab." was to develop innovative appliances that reflected on the topics of food, drinks, clothes care, and beyond-the-screen interaction.

27 groups of students tested their own initial idea by following the Toolkit activity "I want to make my concept better". They summarized their starting concept on the "sum-up your smart product idea" canvas, then used the cards to analyze and deepen their idea according to the areas proposed by the cards (user & context, design, technology, interaction, experience, strategy, meaning).

Cards were used as a discussion tool inside the team, to identify the weaknesses and opportunities of their concept, to make choices and give it a stronger identity. The activity with the Toolkit was done without a

facilitator, but the course staff was available for clarifications. The MTIoT Toolkit was used like a cultural probe: groups could discuss freely, and they were asked to self-document their process. The day after the activity each group received a survey aimed to evaluate in a qualitative way what was the impact of the Toolkit on the project.

The limits of this test were:

- All groups were working on different projects, so the starting point for the use of the Toolkit wasn't exactly equal: some groups started with a more advanced concept than others.
- The activity in class lasted an afternoon, but the Toolkit was also used independently by some groups.
- The survey data were collected anonymously, unrelated to the individual group projects. Data are qualitative and represent the subjective point of view of the participants of the test.

Test B involved 32 students of the Master's course in "Design and Engineering". In this case all 9 groups of students started from the same brief: redesign an existing self-driving robot drone, by finding new use cases, meanings, identities.

The 9 groups of test B performed the same activity proposed to test A group: work with the team and summarize the starting idea in the "sum-up your smart product idea" canvas, then use the card to discuss together. In this case the activity lasted an afternoon, and at the end of the day the students received the survey.

The limits of this test concern the fact that the Toolkit was used in a more advanced moment of the design process. Few groups already decided some formal/functional elements of the product and were beginning the engineering process. In this test, the survey was administered individually and not filled as a group.

Test results

As mentioned before, the survey was anonymous and was aimed at probing the perceived impact of the Toolkit during the design of smart products. The survey employed closed and open questions. Closed statements were rated through a linkert scale ranging from 1 (strong disagree) to 5 (strong agree). In total, 60 surveys were collected.

The Mapping the IoT Toolkit received a positive response. In particular, the cards were appreciated, and many participants stated that they would use them again for their project. "Did you like the Toolkit approach" received an average response of 4.1 and "Would you use the cards again" an average of 4.0.

> *"The cards are a great medium; the questions are really well thought of and very helpful"*

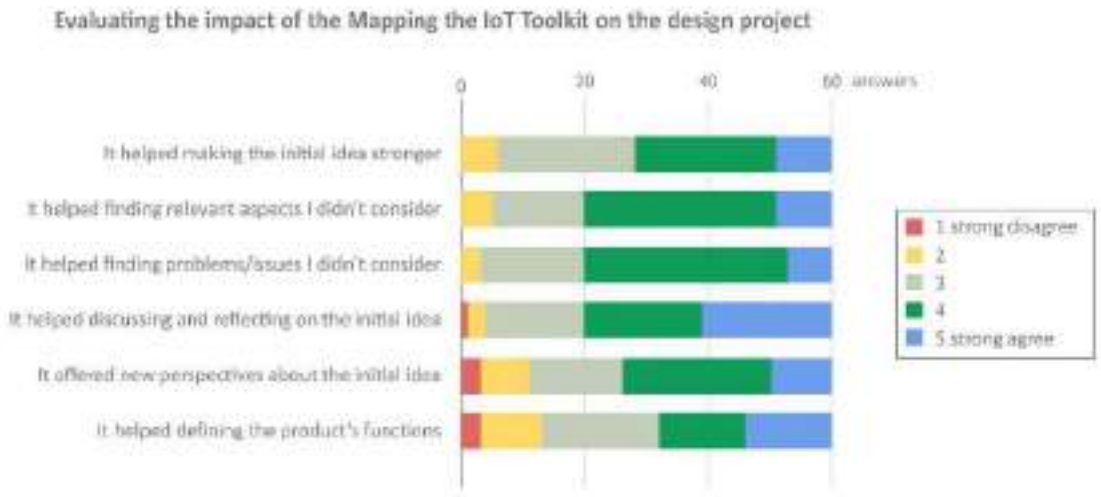

Figure 6: Summary of survey responses, evaluating the impact of the Mapping the IoT Toolkit on the design project

The MTIoT Toolkit was mostly appreciated as a support for discussing and reflecting on the concept with the design team (avg. rate 3.9). The tangible cards facilitated the development of personal visions that through discussion merged in a single common vision. They assisted in clarifying the purpose and direction of the product, while maintaining a ludic approach: for some participants, the whole exercise was seen as a game.

The critical perspective offered by the cards was aknowledged. The questions were a continuous push to deepen and inquire the concept. They were recognized as useful to identify new elements of the project, and to spot possible issues. "It helped finding relevant aspects I didn't consider" and "It helped finding problems and issues I didn't consider" were both rated 3.7 in average. "*It is like a continuous review of the project*", said one participant.

> *"Useful for group discussion. It let space for everyone to express their thoughts and allowed to think about aspects that we hadn't deepened - such as problems concerning technical-technological components and feasibility"*

The MTIoT Toolkit helped also students that weren't designing a technological product.

> *"We used it to improve our project, that wasn't a smart product, but still some cards were very useful for the discussion"*

Questions were also appreciated as source of inspiration (avg. rate 3.6) during the brainstorming phase. *"Questions can stimulate and enrich, steering the brainstorming"* commented a partecipant.

The tangible aspect of the Toolkit was seen as a positive feature, liked by 30 participants out of 60 (50%): 10 participants said that they would prefer a digital version, while 19 said that they would use both versions.

> *"The physical aspect is very important. Touching the cards and exchanging them through the group is very useful"*

In some cases, the Toolkit was able to make the initial idea better/stronger (average rate 3.5 out of 5) and helped to define the product's functions (avg. 3,4). Overall the cards were considered useful (avg. 3.8), and the canvas too (avg. 3.7). Participants considered positive the methological aspect of the Toolkit and the exercises guiding the design process of smart products.

> *"I would use it again. I think it is a tool for students, professionals and for whoever wants to design following a guide during the different phases"*

Although it was decided to test the toolkit with groups that already had a concept, the tool was considered relevant to be used during the initial phases of the design process, when there is more freedom of action on the project.

> *"It was very useful, I wish we had it presented before in the concept ideation phase" said a participant in test A. "We used it in an advanced stage of the project, we should have used it also before" said a participant of test B*

Some negative aspects of the exercise with the Toolkit were:

- The lenght of the exercise: it can get quite long when a group deepens too many cards
- Some questions in the cards were perceived as repetitive
- The tool didn't help in defining the product's shape (average rate 2.3 out of 5), but it was useful to design the interaction.

Conclusions

To summarize: the change in user's lifestyles, new sociocultural models and technologies are drivers of meaning-driven innovation. They lead to the demand of different meanings, a divergent "why" for products to exist. This is particularly true for smart connected products, that are technological objects with a physical and digital component (hardware and software).

This paper outlines three different kind of meanings that are relevant in the design of smart connected products:

1. The meaningful identity of the object as product category: smart products are not strongly culturally semantized. Designing a smart version of an existing product (analogic, or already electronic), or designing a new artifact that results in a new product on the market (e.g. the Roomba vacuum cleaner) requires an alignment with user's lifestyles. Connected products should have a strong identity that differentiates them from -or relates them to- the pre-existing meanings of their unconnected, "less smart" counterparts. Their role in the market needs to be clear, otherwise they will be labeled as smartphone accessories, "products with apps".
2. The meaning of the product in relation to its shape and functionality. For electronic products the link between shape and function is often lost: the functions can't be perceived, nor are geometrically comprehensible. Designers have the opportunity to reduce semantic infelicities by producing shapes that express the way of interaction, and that use metaphors to bring the meaning of the product closer to its primary function.
3. The meaning of the product in relation to a phygital ecosystem. The phygital nature of IoT products blurs the boundaries between products and services, and leads to the need to design multiple touchpoints, both tangible and digital. IoT products should be social, in relationship with a compatible ecosystem of physical and virtual things, data, and processes. It is important to frame the role and meaning of the different phygital touchpoints and features, in relation to the user's expectations, while being aware of technical limitations.

The paper explored the notion that to achieve meaning-driven innovation is important to start from a strong vision coming from the inside-out of the company, rather than relying on HCD methods (Norman & Verganti, 2014). A meaningful personal vision can be reached through critical thinking, discussion, and with a drive to deepen and challenge the design aspects of the product.

The tests with the "Mapping the IoT" Toolkit saw that in action. Two classes of Master's degree students at the Design School of Politecnico di Milano were challenged in the design/redesign of smart products. They used the "sum up your smart-product idea" canvas and the "Mapping the IoT card deck" in a group activity with their teams, to summarize and deepen their initial concepts.

The results emerging from the two described tests are:

1. It was appreciated to have a support for critical discussion with the team, as it helped to develop personal visions and to achieve a common one together.
2. The questions on the cards were a constant challenge for the initial idea. By answering and discussing, the concept was deepended, especially in terms of technical/technological aspects, and interaction.
3. Tangible cards were acknowledged as a good tool for teamwork, with a ludic approach.
4. Participants considered positive the methological aspect of the Toolkit and the exercises guiding the design process of smart products.

Therefore, the tests positively evaluated the use of question-cards to challenge the vision of the product and create a shared, more meaningful one.

> *The point is not that they miss ideas. they are overwhelmed by ideas. But they keep going in the same direction" (Verganti, 2007)*

The Toolkit is published with a Commons License, and freely downloadable on its website (mappingtheiot.polimi.it). It wants to facilitate the design process of smart connected products, helping to design a meaningful product/service offer. It has been tested and presented in many occasions, both academically, and with companies and professionals.

Now, the aim is to make the "Mapping the IoT" Toolkit grow: the team is open to collaboration to make it evolve. The discipline of product design can positively contribute to the area of smart products. Complex connected products require a renewed culture that takes elements from different design fields, such as product design, interaction design and service design, to generate new and coherent meaning ecosystems for positive and evolved user experiences.

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Research Perspectives IN THE ERA OF Transformations

From Hype to Practice: Revealing the Effects of AI in Service Design

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With the rise of artificial intelligence (AI) in the past decade, AI has become known in everyday products and services. One of its application forms is that of AI assistants, such as voice assistants and chatbots. While new types of customer service channels have been introduced through these assistants, until now, the intelligence of AI has mostly resided in the backend systems of services. Studying a service design process and practices focussing on AI-enabled services, the present research draws on a multi-method approach involving seven expert interviews and five use cases on AI assistant projects in industry. The authors evaluate the datasets through coding cycles aiming at identifying the shifts AI brings to service design. The results present and discuss the emerging fields of change in service design, namely, the application of AI, service design process with AI and role of the service designer in the creation of AI-enabled services.

Keywords: Service design, artificial intelligence, design process, role of a designer

Introduction

This article discusses the current and even hyped topic of artificial intelligence (AI) in the context of service design. It introduces the emerging fields of change in service design, namely, the application of AI, service design process with AI and role of the service designer in the creation of AI-enabled services. The paper discusses not only what AI enables for the front and back ends of service delivery but also the practical role of the service designer and service design process in the context of AI-enabled services.

Regardless of the rather long history of AI (Steels, 2007), its application in the fields of service design, design management and design research is still in the early stages. The full potential and implications of AI in service content and delivery may not yet have been fully discovered. The development indicates that AI is taking a role as an orchestrator for personalised service content (Reavie, 2018), and it is becoming an enabler for value creation in digital service channels (Vargo & Akaka, 2012). While user interactions are shifting away from single interfaces towards the widening range of possible user touchpoints, the variety of provided service functions is increasing the complexity of service systems. Services are increasingly built through networks and various channels. Thus, the interactions between humans and large-scale systems are increasing and need to be inquired further (Kile, 2013).

In the 1990s, Krippendorff (1997) already introduced design principles for the context of artificial artefacts that are produced and consumed in a multi-user context supported by virtual environments. In this work, he

emphasises the interactivity of artefacts and suggests design becoming 'language-like'. With the shift towards the application of natural language processing (NLP) tools, services and products go beyond the conceptual and semiotic language that Krippendorf (1997) refers to. Here, machine-generated spoken and written language becomes the means of providing content and creating service value for users. The *Design in Tech Report 2018* (Maeda, 2018) also suggests that conversational design is becoming one of the key areas in computational design. The Institute of Electrical and Electronics Engineers (IEEE, Global Initiative on Ethics of Autonomous and Intelligent Systems, 2017) also points out the relevance of the design, distribution and usage of AI-enabled systems in their standard for 'ethically aligned design' for autonomous and intelligent systems.

Through its application in everyday products and services, the visibility and awareness of AI have grown in society in recent years (Kile, 2013). Although AI often resides in the invisible backend systems, as one category of AI-enabled services, AI assistants are visible for users as a service channel. Divided into the two modalities of text-based interaction and voice interaction, AI assistants can take the forms, for example, of chatbots and voice assistants like Apple's Siri, Microsoft's Cortana, Amazon's Alexa or Google Assistant. In addition to the rise of AI-enabled interfaces in the consumer market, the topic of AI assistants has been increasingly addressed in academic research in different fields.

Recently, the research discourse focussed on AI assistants has shifted from the technical feasibility (Chen, Yu, & Fong, 2018; Yan & Zhao, 2018) and architecture (Hauswald et al., 2016) towards more value-oriented topics. While AI assistants introduce a shift of service interactions from graphical user interfaces (UIs) towards conversational interactions (Allen et al., 2001) and natural language, the research investigates the realm of assistant performance as it is connected to the real customer needs (Brandtzaeg & Følstad, 2018). To learn more about the acceptance of the new interaction form, research has been conducted to elucidate how AI assistants are perceived by human beings (Harris, 2004; Loi, 2018; Zamora, 2017).

Studies on the individual elements of AI assistants, such as character design (Arafa & Mamdani, 2000) and the representation of emotions, empathy (Shi, Yan, Ma, Lou, & Cao, 2018; Vögel et al., 2018; Yang, Ma, & Fung, 2017) and social awareness (Zhao, Sinha, Black, & Cassell, 2016), support the formation of a comprehensive understanding on the user experience with AI assistants (Moussawi, 2018). As AI assistants function through digital channels, it is easy to involve the user in early testing and feedback loops. The technical setup and widely available tools for creating AI assistants encourage the co-creation of solutions with users (Lee, Lee, & Lee, 2017). Beyond the design of functionality, content and representation, the creation of AI assistants also requires ethical considerations (Schlesinger, O'Hara, & Taylor, 2018) and reflection on their social impact (Følstad et al., 2018).

Explorations on design approaches for AI assistants have been presented in previous research and guidelines from various perspectives have been created, from the design (Shevat, 2017) and practical implementation of chatbots (Janarthanam, 2017) to the design of voice user interfaces (VUIs; Cohen, Giangola, & Balogh, 2004; Pearl, 2016). Previous research has also suggested solutions for specific design phases, such as ideation and prototyping (Moussawi, 2018) and introduced overall design principles (Chefitz, Austin-Breneman, & Melville, 2018) and strategies for examining the effects of the design solutions in AI assistants (Jain, Kumar, Kota, & Patel, 2018).

Based on systematic literature research, this paper discusses AI assistants as a form of AI application. The authors consider the implications that the use of AI brings to service design practice. We draw special attention to the current application of AI in services, phases of the service design process with AI-enabled services and work of a service designer. This research responds to the research gap and need to produce new knowledge about the changes AI brings for the practise of service design. It asks the following research question: What are the implications of the change AI brings to the practice of service design?

Theoretical Background

Service Design: History, Process and Activities

Service design is an interdisciplinary field with the goal of providing a comprehensive understanding of the challenges it focusses on, whether they are systems, products, processes or services (Stickdorn, Hormess, Lawrence, & Schneider, 2017). Starting with a human-centric view, service designers aim to build understanding and engagement with all the actors connected to a service system to find the real needs and expectations that should be addressed in the design process and solution (Buchanan, 2001; Miettinen &

Koivisto, 2009). As service systems are varied, with multiple layers of complexity depending on the context, service designers aim to make the overall system visible and perceivable so that it can be addressed and taken up in the development of new solutions (Patrício, Fisk, Falcão e Cunha, & Constantine, 2011). Through co-creation and the engagement of key stakeholders and users, service design facilitates collaboration and innovation (Steen, Manschot, & De Koning, 2011).

Although service design is still a young academic discipline and just recently evolving in industry, the changing interdependency between the role of a service designer and the application of service design practices is affecting its disciplinary understanding. Until now, service design practices have mainly been applied by professional service designers. After the rise of service design in industry and beyond, which has resulted in the growth of agencies in the intersection of service design and business (Maeda, 2018), designing services no longer solely belongs to service designers (Sangiorgi & Prendeville, 2017). With similar tendencies in design research, the concept of silent design, stated by Gorb and Dumas (1987) in the 1980s, needs to be considered for today's and tomorrow's understandings of service design. Gorb and Dumas (2011, p. 56) point out that products, services and systems are designed by so-called silent designers, meaning 'by individuals who are not called designers and would not consider themselves to be designers'. Especially in the adoption of service design in industry, where our case studies have been conducted, the role and practices of service design are still fragmented and blurred. This suggests the need for research at the intersection of service design and industry.

Some researchers already claim that the role of designers is becoming more diverse (Polaine, Løvlie, & Reason, 2013; Stickdorn, Hormess, Lawrence, & Schneider, 2018; Tan, 2012; Yee, 2013). Next to becoming a specialist in service design methods, tools and practices, the role of a service designer in industry is often associated with both the management and facilitation of projects (Miettinen, 2016; Minder, 2019) and the collaborative orchestration of different human perspectives in the design process of services.

Although embedding technologies and digital channels in service solutions is not new to service design (Rytilahti, Rontti, & Miettinen, 2015), AI-enabled services are bringing a new element to the design process via new forms of communication between humans and machines. However, with the new type of service channels that AI-enabled services bring to the market, the delivery of services needs to be rethought. On the one hand, the service systems are becoming broader, with additional data sources and connections to service networks. On the other, the provided service content and interaction through the voice or chat interface should remain intuitive and approachable. When content delivery no longer depends on one type of interface, a broader understanding of service systems is needed to successfully place interfaces to meet users' expectations and needs. This is where service design can bring knowledge and inform the ways of working (Følstad & Brandtzæg, 2017) for creating AI-enabled services, such as AI assistants.

AI: History, Forms and Application

Although AI has only become more known among consumers in the past decade, the development of AI technology had already begun in the 1950s in the field of computer science (Lungarella, Iida, Bongard, & Pfeifer, 2007). The aim of AI is developing technology and machines that can perform intelligent tasks that otherwise only humans would be able to do, such as making predictions, recognising patterns in data and behaviour, processing and producing natural language and carrying out optimisation and automation (Smith & Neupane, 2018). The advancement of technology, access to increased computer power and large amount of available data have made it possible to use AI in more meaningful ways in consumer products and services (McCarthy, 2017).

AI is a large field that can be divided into two main sub-areas, which are as follows: machine learning (ML) and deep learning (DL). ML employs algorithms that learn from data to carry out actions, such as predictions or decisions, and its performance improves over time as it accesses more data. DL has higher complexity in its systems; for instance, it can include neural networks that are employed for building algorithms that can perform tasks independently. Instead of writing code, data are fed to the generic algorithm, which then builds a logic based on the data (Russell & Norvig, 2016).

In the context of services, the application of AI can be divided between the front and back ends of a service. In the case of the back end, the actions occur behind the scenes, when, for example, ML and DL provide tools for analysis, prediction and optimisation, automation of mundane tasks and processes, personalising content and forming a loop of continuous learning and improvement. In the service front end, AI is commonly applied through NLP, which enables human–machine interaction, for example, as an intelligent assistant. In previous

literature, intelligent assistants that utilise AI skills to provide service content and functions are mainly described according to their interaction forms. Assistants using text-based interfaces are defined as chatbots (Paikari & van der Hoek, 2018), while assistants using voice can be characterised as VUIs (Cohen et al., 2004). In this article, the term 'AI assistants' is used for both chatbots and VUIs.

Broadly defined, AI assistants are computational systems that utilise natural language (Shawar & Atwell, 2007) to understand the input from users, either as written text or voice, and perform tasks based on the recognised intents of the user. The front end of an AI assistant, beyond the text or voice interface proper, is built through a character with the definition of personality, tone of voice and background story. In the context of digital customer services, an AI assistant can be considered a new form of customer interaction channel. Due to their rather wide appearance in current services, this paper considers AI assistants as an example for applying AI in services.

Research Approach

The presented inquiry was conducted as a practice-based study in industry between 2017 and 2018. The dataset consists of five use cases accompanied by seven expert interviews. As the use cases represent the application of AI in the form of AI assistants, the expert interviews contribute individual perspectives and future tendencies of AI in service design, as well as the status quo of AI application in design agencies. The cases and interviews complement each other to elucidate the connection between service design and the use of AI in the design and development of AI-enabled services. The research analysis has been done using a qualitative mapping methodology in three coding cycles.

Research Data

The five case studies result from one corporation under different functions and brands in Germany. They have been documented through project deliverables, reports, design outcomes and participant observations from one author acting as a design researcher in the firm. The length and scope of the projects vary, as does the composition of the project teams. The projects have been chosen to complement each other with different priority themes, project lengths and provided insights into the service design process.

Table 1: Description of Case Studies

Case Study	*Topic*	*Pursued Customer Value*	*Design Phases*	*Service Interface*	*Deliverable*
1	Service sales	Access to information, connection to retailer	Content definition, character design, conversation flows, UI design, prototyping, testing and implementation	Chatbot on website	Customer-facing pilot
2	Customer support	Find information quickly and easily	Content definition, conversation flows	Chatbot on website	Customer-facing pilot
3	Mobility services	Find the right service solution for current need and situation	Content definition, UI design, prototyping	Smartphone application	Prototype
4	Product support	Find information quickly and easily	Content definition, conversation flows, UI design	Chatbot on smartphone	Proof of concept
5	Service orchestration	Proactive personalised services	Content definition, conversation flows, UI design, prototyping	Smartphone application	Prototype

The case study approach was identified to be the most adequate research strategy, as it allows for investigating 'a contemporary phenomenon within its real-life context, when the boundaries between the phenomenon and the context are not evident' (Yin, 2011, p. 23). A purposeful sample of cases was selected to provide material rich in information and diversity, focussing on the role of AI in (service) design processes of innovation projects. The selection criteria were as follows:

- Specific application forms of AI (e.g. AI assistants, chatbots, VUIs);
- The inclusion of designers, AI experts and data scientists in the process;
- The flexible role of the designer in the project; and
- The project representing different group sizes and applications of design methods.

The semi-structured expert interviews aimed to gather opinions, experiences and reflections on service design and AI through predefined themes (Flick, 2009). All seven experts were selected due to their knowledge level at the intersection of design and AI and their work experience of more than 10 years at a design agency. The interviewees act as designers, data scientists and directors in Germany, Finland or the United States (Table 2). The interviews were conducted face to face except for one, which was conducted via Skype; each interview lasted 60 minutes, and it was recorded and later transcribed word by word.

Table 2: List of Interviewees

Interviewee	*Role*	*Country*
1	Chief digital officer	Finland
2	Data science lead	Finland
3	Creative director	Finland
4	Service architect	Finland
5	Senior consultant	Germany
6	Service designer	Germany
7	Senior service designer	United States

Analysis Methodology

The research analysis consisted of a three-stage (visual) mapping process inspired by different coding stages (Saldaña & Omasta, 2017) and pattern-matching approach introduced by Yin (2011). The authors collaboratively applied open coding for the first cycle, followed by versus coding in the second coding cycle to define the occurring fields of tension. This was done using the Atlas.ti program. The last cycle defined thematic clustering of the main themes and formed implications around the research questions; this was done non-digitally. Both datasets were approached using the following questions for the first and second cycles:

First cycle:

- How is the role of a service designer described and perceived by the interviewees and in the projects?
- How do the interviewees perceive AI? How is it connected to their daily work?
- What are the future opportunities and challenges when involving AI in service design?

Second cycle:

- Where is AI changing the existing practices in the design process?
- Where is AI adding something new?
- How is the add-on affecting its direct context in projects and beyond?

From the third coding cycle, three main topic areas emerged, which were as follows:

- The application of AI in service design;
- The effect of AI in the service design process; and
- The role of a service designer within an AI-inclusive service design process.

Empirical Findings for Revealing the Role of AI in Service Design

The analysis of research data revealed three main topic areas of insight, which are as follows: the application of AI in service design, effect of AI in the service design process and role of the service designer in the AI-inclusive service design process. The empirical findings are discussed under these three topics in the following sections, combining the results from expert interviews and use cases. The interviewees are referenced in the text by their identifying numbers (see Table 2).

The Application of AI in Service Design

The analysis demonstrated that the application of AI in service design is still in its early stages. In 2018, many application forms of AI, including AI assistants, were still at the peak of inflated expectations in terms of Gartner's hype cycle (Panetta, 2018). This also affects consumers' expectations of the applications of AI in everyday products and services. Behind all the hype, often, the real results are not yet appropriately addressing the user's expectations and real needs (2). Design agencies investing in AI first explore where AI adds value to the service design process. While doing so, they are also aware of the challenges and gaps between the status quo and the effective use of AI (3). Aspects like access to good quality data and useful technological tools are some of the challenges faced when considering AI in designing services. So far, the application of AI has mainly been decided case by case according to the goals of the service, user needs, available resources, knowledge, tools and data. None of the interviewees mention an already established process that they can conduct, iterate and adjust when designing AI-enabled services.

Concerning the potential value AI could add to service design, the dataset shows consistent results. The interviewees claim that using AI in service design should start from the purpose and user needs instead of a technology-first attitude: *'Not every possibility is a good possibility, and it needs to be evaluated before it is established in a service. We shouldn't implement AI in a service simply because we can'* (5). When AI is taken as a part of a service design solution, it is important to manage the user expectations and remain realistic about what can be done with good quality (4). As interviewee 6 noted, *'An AI-enabled service has to be based on a business model. It has to have an economic purpose. Then there has to be user need, and of course, it has to be technically feasible'.*

According to interviewee 4, currently, AI is mostly used in the back end of services. For example, AI is doing analytics and providing quantitative information about the use of a service. This type of information can be used, for example, in the personalisation of service content by proactively recognising the needs and behavioural tendencies of users. Such self-learning systems are becoming more common and increase the accuracy and usefulness of the content to users without engaging AI in the service interaction (5). By collecting and analysing quantitative data, AI can fill the knowledge gap on user behaviour that otherwise would only be learned about through qualitative data, such as interviews and user studies (1,4).

In the front end of services, the current application of NLP has shown most potential in the form of AI assistants by providing new forms of service channels through voice and text. Herein, AI technology is already advanced enough to prove its benefit in language-based interfaces. However, according to the interviewees, the crucial aspect of the frontend application is still its situational adaptation. The fit of technology to the changing human behaviour depends on the time and context of usage. Through proactive data analysis, detection of user behaviour and profiles and prediction of user actions, AI can reveal the user behaviour patterns and adjust the service output accordingly (4).

The interviewees expect that, in the future, AI will take a bigger role as support for the service design process proper through data analysis, as well as in the form of new tools for automating some of the tasks using generative models. In service interactions, AI already offers possibilities for improving human–machine interaction, but the interviewees still draw on the importance of real human-to-human interaction in the services. They point out that, in cases that are either urgent or complex, users still often prefer interacting directly with a human service agent. According to the interviewees, it is not really a question of either human or machine, but instead, providing multichannel services where both possibilities are available.

The Effect of AI in the Service Design Process

The service design process model introduced in this research draws on the analysis from the use cases and is reflected through the interview results (Figure 1). The use cases showed regular patterns in two areas, namely, in terms of the activities performed in creating AI assistants and regarding the definition of the service scope.

The double diamond model was used as a reference for pattern matching. It was observed that the four common phases of 'discover', 'define', 'design' and 'develop' are insufficient for communicating the main activities in designing AI assistants. Jylkäs and Borek (in press) propose a seven-phase model for the design of AI assistants. In this paper, the authors extend the process to 10 phases identified through the present analysis.

The 10 process phases—'discover', 'define', 'ideate', 'design', 'prototype', test', 'develop', 'implement', 'operate' and 'scale'—form five diamonds representing the diverging and converging thinking inspired by the original double diamond model (Figure 1). Between each pair of diamonds, a deliverable is produced as a base for the next phase. Although the service design process is rather iterative and can be made to go back to a previous phase at any time, a general structure for the process phases can be identified through the analysis of use cases. In addition to looking at the usual targets of service design in the service content and service front end, the model includes the perspectives of business and technology as essential parts of the process.

Using AI in a service design process also requires knowledge and expertise about AI in the team (4). The involvement of data engineers (DE), data scientists (DS) and information technology experts (IT), such as developers, is also shown in the model in each of the process phases. Since many DS, DE and IT teams are working on an agile workflow (Abrahamsson, Salo, Ronkainen, & Warsta, 2017) that supports short cycles and iteration, having shorter cycles in the service design process also makes the connection to other organisational processes easier.

Figure 1: Service design process for AI-enabled services. Created by T. Jylkäs.

Discover and Define

The phase of discovery consists of understanding the customer needs and expectations, exploring the technical possibilities for realising the service, discovering the available data sources for training the service and understanding the business requirements and context. Here, AI provides a way of collecting large amounts of quantitative data and analysing them rapidly (1). Analysis of the quantitative data through algorithms gives a new channel to the service design process to obtain user information without human bias. Through consistent analysis, AI can reveal the needs and expectations of users and find patterns and connections that are otherwise difficult to identify from a large amount of data (2). Data mining and data analytics can also be used for scouting high-level trends in the beginning of the process to give an overall direction and validation for the design challenge.

In the definition phase, the scope of the service is defined in terms of functionality, service content and interface requirements. It also includes the selection of technological tools and the set of data used for designing and developing the service. In the use of AI, it is important that a human understanding is combined with the technological approach to ensure that the results will fit the user expectations, fulfil the purpose of

the service and create concrete value (2,4,5). According to the interviewees, in the beginning of the process, the produced ideas may often become too broad, fuzzy and unfocused to be realised due to still existing technical or data-related limitations. On such an occasion, dividing the ideas into a long-term plan and smaller short-term solutions is helpful. Focussing on solutions with a narrow scope and lower complexity first will lay the foundation for the future solution by building on knowledge, collecting data and improving the solution over time.

Ideate and Design

In the ideation phase, the functionality's scope is converted to a list of concrete actions and tasks that the service carries out. The separation of 'ideation' from 'design' in this model lies in the recognition that ideation is still open for exploration and generation of a large number of ideas, while the design phase focusses the work into creating design elements that fit into the defined design brief. In the design phase, AI may have a greater role in automating mundane tasks, such as translating hand-drawn sketches into interface designs or analysing existing services and data to give suggestions on design decisions (2,3) in the future. A common trait for the design of AI-enabled services is the inclusion of technology in the process in an early phase. During the ideation and design phases, first versions of algorithms are already generated to give an idea of the possibilities and boundaries of the solution. The concept description resulting after the design phase includes a technical description and requirements that can be used as a guide in the prototyping phase.

Prototype and Test

Prototypes have an essential role in creating AI-enabled services. They not only help in determining the technical possibilities, but they also display the functionality and value of the service (5,6) in a concrete form. Although the tasks and actions where AI is involved may be intangible and complex, concrete prototypes make it possible to present and test the service features with users and stakeholders. The test phase also reveals the gaps that may have been overlooked during earlier phases in terms of the identified user intentions. Using real technology already in the prototyping phase differentiates the approach from today's service design processes, where prototypes represent the look and feel of an interface without the real functionality behind it. The use of real technology provides an emotional experience about how AI is involved in the final service interaction.

Develop and Implement

The development phase focusses on the realisation of the final version of the service at a level of quality acceptable for go-live and usable for users. In this phase, the service content and interface are finalised, and the final algorithms are developed. The development phase continues as implementation. Although these two phases often occur in parallel, they have been separated in the process model to illustrate the importance of the role of implementation in the process. As an AI-enabled service like an AI assistant often combines several service functions and orchestrates a large range of content for the user, it may be connected to many existing services and platforms in the backend system. Therefore, the implementation and integration effort may be extensive and may include the official approvals for quality and legal matters set by the business context.

Operate and Scale

When the implementation is completed, the service can go live, and the phase of operation starts. AI assistant projects typically start with a small scope of functions and content. They collect feedback using qualitative and quantitative data to improve the service over time. Establishing a continuous learning and improvement loop is part of the operational effort. The data collected from user interactions serve as a valuable source of information for the service design process. For instance, they can be used to identify possible areas for scaling the service functions, which becomes relevant after the first version is functioning steadily. The team can consider adding further functionality to the service, or alternatively, adding further languages and market areas to increase the service coverage.

The Role of a Service Designer in an AI-inclusive Service Design Process

AI evolves the changing role of a service designer in two respects. It nudges the application of technology in the service interface and to the service design process; in addition, the roles and tasks related to the process face some changes when AI-enabled services are co-designed. Experts like DS, DE and IT provide technical knowledge to the process. A substance expert from a business unit contributes knowledge about business requirements. A service designer remains the voice of the user and translates those requirements into the

design solutions (4). In an AI-inclusive service design process, the tasks of a service designer may include user research, ideation, creating design concepts, UI and user experience (UX) design, prototyping, and testing the solutions with users. In the case of designing AI assistants, language plays a relevant role in the communication between the user and service. Thus, the tasks of screenwriting and copywriting may also partially be taken by a service designer.

In the researched use cases, the team constructs vary, but all the cases are united through the role of a service designer as an interdisciplinary facilitator. Interviewee 6 states, '[B]eing a service designer means that you always have to understand the requirements and the possibilities that are there, and then you have to include them in designing a solution'. Interviewee 5 would 'see the role of a service designer to consider the perspective of [the] customer and business, and to translate them into something tangible'. Collecting the requirements, needs and possibilities of users, business and technology positions the service designer as the connection point among team members and stakeholders. This may also be one reason why, in several use cases, the service designer also had a role as an overall project manager.

The role of technology is significant in designing AI-enabled services. This leads to an earlier inclusion of technology in the process, taking different roles throughout; further, it requires a certain level of understanding about the technology among all the team members, including the service designer. A facilitating service designer should also have basic knowledge about the AI technology used in the service to succeed in meeting all the requirements and needs through a solution that is realistic to develop and implement. This allows a service designer to interpret the technical possibilities and boundaries in the design solution, as well as to communicate user requirements to the technical team members appropriately.

According to the interviewees, one of the most prominent and challenging aspects of embedding AI in the work of service designers is the possibility of including quantitative data and numeric tools in a meaningful way in the design toolbox. Through AI, service designers access larger amounts of data in an efficient way when parts of the analysis are done by a machine. The automation of data collection and analysis is an asset that can support the design decisions by adding a second opinion next to the qualitatively gathered insights. The combination of qualitative and quantitative data may also affect how the process of designing services is structured in the future, especially in terms of forming the understanding around the design challenge, user needs and affecting circumstances around the service.

Although AI can provide information and suggestions for the direction of the design work, it lacks the ability to interpret the information. Therefore, the service designer retains the role of a sensemaker (Weick, 1995; 2). Herein, the numeric methods from AI are combined with the creative reasoning of the designer (3). With access to information from various sources, in a sense, service designers become curators that utilise the results of computational models to form design outcomes that fulfil the user needs, fit into technical boundaries and create business value.

In addition to the previous aspect of information, automation through AI may also take over some of the tasks that otherwise would be done by a (service) designer. This may concern, for example, the tasks in UI and UX design when ideas are translated into prototypes and final designs. The reduced amount of tasks for designers enables them to focus on the more complex questions around the service, such as its purpose, value creation or ethical implications (3). While everything becomes measurable through AI, it makes standardisation, optimisation and automation of services easier, leaving out the frictions that make the products and services unique. The differences that define the identity of the service are those where the service designers' informed intuition is needed, both today and in the future.

Discussion

This paper discussed several aspects of service design for AI-enabled services. It introduced both the role of service designer and the service design process proper. It is already clear that the context of AI changes the paradigm in service design; however, this needs further research. The introduction of AI changes the role of the service designer, facilitating more diverse skills and capacities throughout the design process. AI-enabled services demand a service designer's broader technological orientation and ability to adapt.

AI-enabled services add a concrete technological design perspective to the service design process, differentiating it from the typical frontend-oriented processes (Miettinen & Koivisto, 2009; Sanders & Stappers, 2008). Further, the question of service scalability needs to be addressed in a systematic way. The research indicates that there is a need for more study on how service design can contribute to the scalability

of not only manufacturing and product service systems (Koren, Wang, & Gu, 2017) but also AI-enabled service delivery systems.

Since the research is drawn from one type of application of AI, namely AI assistants, further research needs to validate the findings in various application forms and design processes of AI-enabled services. As the number of real-life use cases and expertise for the use of service design expand, the knowledge base for the use of service design in the AI context increases. The limitation of this study is constructed through the selection of use cases and number of interviews. As the body of data increases, the role of the service designer and the service design process model will become more precise. Yet, the research already shows the first implications of possible changes AI may bring to the practice of service designers and the discipline of service design through new ways of working. In this way, this paper already responds to the need to know more about AI in service design.

Conclusions

The research introduced three main areas in service design that are affected by the involvement of AI—the application of AI in service design, effect of AI in the service design process and role of the designer in an AI-inclusive service design process. Although the application of AI technology is in the early stages in practice, the research shows the two following main areas of current application: in the back end of service as a new channel for quantitative data supporting the analysis and in the front end of services as a language-based interface for users in the form of AI assistants. In the future, the automation of tasks, standardisation, personalisation and support for decision making may bring further value out of AI to the service design field.

The change AI brings to the service design process comes through the use of technology early in the design phases, starting from data collection and analysis, exploration of algorithms in the ideation and design phases and prototyping and testing the solution with real technology. The inclusion of AI in the service design process implies several short iterations that can easily be connected to the agile workflow of DS, DE and IT.

The changing role of a service designer comes through the access to larger amounts of information combining qualitative and quantitative data. This allows the designer to act as a curator of content, making sense of the information and translating it into a design solution that simultaneously meets the user needs, business requirements and technical possibilities. The research analysis has shown that the service designer remains a facilitator in the design and development of AI-enabled services, requiring a holistic understanding of all fields connected to the service design process.

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Track 6.a Introduction: Materiality in the Digital Age

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The initiative to this track was taken by the Norwegian research group Materiality, Technology, Sustainability (MaTecSus), and professor Ingvild Digranes at the Western Norway University of Applied Sciences.

In art, design and craft education at different levels, the digital and the material meet, either as integrated wholes, as collaborations or as violent collisions. In such collaborations or collisions, the existence of materiality can be understood differently depending on the viewpoints of art, design and craft educators. Some educators move seemingly effortlessly across digital and physical materiality in their practice (Nimkulrat, Kane, & Walton, 2016). For other educators the concept of materiality exists as something separate from the digital, while others speak of digital materiality as a space where the digital becomes "something" and gains materiality (Bratteteig, 2010).

Dunin-Woyseth and Nilsson (2013) deems the linkages between 'design research connoisseurs/critics' and 'design practice connoisseurs/critics' vital for understanding practice-related disciplines. In this new orientation towards research, practitioners are also researchers, including educators in theory-led studio practice in universities and colleges. The practitioners not only own the studio but also the research on professional practice and education. Consequently, a new stage in what can be coined the 'professionalization project' has been reached, where designers and design educators have come quite far in establishing their jurisdictional boundaries (Nolin, 2008). The next natural step is to start discussions on a common value base and establish a stronger professional identity.

This track extends its discussion to how the coexistence and collision of the digital and materiality transforms societies and impact people's ways of experiencing things. The educational field is bound to be dealing with value laden questions from several ideological positions (Dewey, 1997). However, avoiding turbulence of questioning different positionings is unhealthy, and bold thinking often emerges from turbulence. We see a need to open the discussion into the topic of materiality in the digital age. It is a start in a discussion regarding how educators from kindergarten and onwards work with, through or even against the digital in relation to materiality, i.e. how digital practices transform the research and education dealing with the topic of materiality.

The aim of this track was to raise questions such as;

- How will we in a world that is so rapidly changing educate for all the ethical and aesthetical aspects, and how do we address the topic of materiality in the digital age?
- How will educators from kindergarten and onwards work with, through or even against the digital in relation to materiality?
- How will digital practices transform the research and education dealing with the topic of materiality and sustainability?
- How can education address the balance or imbalance of the intangible, of culture, atmosphere, pedagogy and ethics, in the meeting between the digital and materiality?

- How can we challenge the dichotomy of digital/material, that can exist symbiotically and in endless ways, and
- How can we address ensuing tensions between social innovation and education?

The ensuing discussions might transform how art, design and craft educators prepare for the meeting between the digital and materiality.

Six papers were accepted to the track, and they show a broad approach to this track, with rich discussions in regards to topics.

Peter Haakonsen and **Laila Belinda Fauske** (Oslo Metropolitan University, Norway) authored the first paper *Learning to create images with computer code.* They address the fact that programming is becoming a part of the school curricula in Norway both in lower and upper secondary education in subjects such as art, design and craft. The as questions regarding what programming can to the learning processes of these subjects. The concept of 'Tinkering' is introduced, to describe a creative phase in a learning/working process, emphasising both creation and learning. In the project that they present, visual images are created via computer programming to enhance the main author's learning. The paper discusses tinkering as a learning process that is relevant and motivating in relation to programming within art, design and craft education.

Ingvild Digranes, Jon Øivind Hoem and **Arnhild Liene Stenersen (**Western Norway University of Applied Sciences, Norway) has co-authored the paper *Learning about materiality through tinkering with Micro:bits.* This paper discusses two pilot projects in Art and design education at the teacher training at Western Norway University of Applied Sciences. As a point of departure, the pilots try to address the new curriculum of Art and design, where digital knowledge is described as stretching from using simple digital resources to master and shape your own digital products. In general design education the digital is no longer limited to two dimensional visual modelling as previously practiced. This new approach in a subject where making and materiality is central, tinkering and designing allows for explorations in both 2D and 3D. The pilot case studies demonstrate the importance of bringing coding and the material aspects of tinkering, making, and creating into play in combination.

Francisco Zamorano, Catalina Cortés, Mauricio Herrera, and **María Elena Errázuriz** (Universidad del Desarrollo, Chile) authored the paper *Designing an intuitive interface to enhance trigonometry learning.* They show how in the last three decades, the application of TUIs (tangible user interfaces) in education has demonstrated its positive influence on performance and learning of students. At Universidad del Desarrollo in Chile, the monitoring of diagnostic tests over time has pinpointed difficulties and challenges in the teaching-learning of trigonometry in first-year Engineering education. This study consists of several steps, designing and validating a tangible interface to learn trigonometry in the classroom setting. Principles of the theory of Embodied Cognition and Blended Interaction is applied to model an intuitive, collaborative and meaningful learning experience. During the design process, three Intermediate Models were tested with several types of users, and two Prototypes were tested with an experimental group. User-testing highly contributed to the design of the interaction experience and the interface, progressively defining the functional and pedagogical aspects.

Delane Ingalls Vanada (University of Florida, United States) authored the paper *Engaging in Materiality: Issues in Art and Design Education.* The paper shows how in the training of art and design educators, modes of engagement that can build capacities for connecting theory to practice through creative research and connections to the physical materiality of art, must not be overlooked. Whether online or on-the-ground learning, artist-teachers must not disconnect from the power of engagement with and the materiality of art. This paper places a focus on ways that teacher training programs can anticipate and activate attitudes of new materialism and design thinking, providing a much-needed anchor in the digital age. With a contemplative view of art practice as research, projects in an art and design education program elevate opportunities for exchanging understanding, promoting dialogue, and approaching learning and research as relationship. Intentionality in the ways that the practice of teaching itself is also materiality, as a living practice, along with the training teachers as designers and facilitators of cultures of making, thinking, and learning are discussed.

Ingvard Bråten (Western Norway University of Applied Sciences, Norway) authored the paper *Experiencing (from) the inside – Mediated perspectives in kindergartens.* His paper presents a case study of preservice kindergarten teachers' use of new form of digital imagery. The paper introduces spherical cameras and digital microscopes and discusses their affordances when introduced in practical use in teacher education and in kindergartens. The use in kindergartens was introduced through a class of 34 teacher students in kindergarten

education. The students were specializing in Arts and design at Western Norway University of Applied Sciences. The use of images from spherical cameras and digital microscopes were analysed based on data from student responses through two questionnaires, group presentations and discussions in class, and an analysis of various media material produced by students.

Liv Mildrid Gjernes (Western Norway University of Applied Sciences, Norway) authored the final paper of the track, *Aarup 1960 and the poetics of materials.* It has as its premise that all design has its own conditional modes of expression; however, these are realised through the maker's sense of the possibilities of materiality. The essay takes inspiration from a reclaimed piece of 1960s furniture designed in the modernist idiom, and is based upon autobiographical experiences, original works from own and contemporary aesthetic practices, and associated thoughts in the present. A completely new artistic expression is developed, questioning the strict, use-defined style ideals and letting shape reveal other values and statements than function. The essay succeeds in putting into words how some of the cognitive processes in which creativity, critical reflection and the senses' experience-based insights may bring up something new. It highlights that in creative work, the goal is not to reach a single result; every little discovery made by examining something specific could open up new worlds.

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Learning to create images with computer code

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Programming is becoming a part of the school curricula in Norway both in lower and upper secondary education – this includes subjects such as art, design and craft. What can programming contribute to the learning processes of these subjects? 'Tinkering' is a creative phase in a learning/working process, emphasising both creation and learning. In this project, visual images are created via computer programming to enhance the main author's learning. The process is structured into stages. The important phases of the learning process are realised as a result of tinkering with existing codes. An important discovery for the learner, and one key aspect of programming images is that, as a mode, it opens up ways to create repetitions effectively, resulting in various patterns. This turned out to be motivating for the learner. This paper discusses tinkering as a learning process that is relevant to programming within art, design and craft education.

Keywords: Processing, programming, tinkering, learning, digital images

Introduction

Programming is a skill that is connected to the term 'computational literacy': It is often defined as a 21st-century skill which is increasingly relevant for children to learn in the schools of today (Bocconi, Chioccariello, & Earb, 2018). In Norway, programming has been an elective subject in lower secondary schools since 2016 (Regjeringen, 2017) but it is eventually going to become a compulsory part of the new curricula in both primary, lower secondary and upper secondary schools (Bocconi et al., 2018; European Schoolnet, 2017). This new curricula for primary and lower secondary schools will be implemented in 2020. In Sweden and Finland, programming is already integrated into the creative subjects (Bocconi et al., 2018). In Norway, programming will become a part of the school subject of art and crafts in lower secondary schools (Regjeringen, 2018). A new vocational program that will become available within upper secondary education – called ICT and media productions (IKT og medieproduksjon) – is also due in 2020 (Utdanningsdirektoratet, 2018). These changes in curricula indicate an educational shift in Norwegian schools.

This paper reflects on how programming can be a relevant part of creative school subjects such as art, design and craft. We maintain a special focus on motivation and the learning process when learning to create images with a computer code. The examples in this paper use a programming language with a difficulty level that will possibly be applicable to lower and upper secondary schools, but one that also aims to be transferable to easier block-based languages such as *Scratch* (Scratch, n.d.) – this learning process is also relevant to children in primary schools. Using the creative process as a point of departure, this paper specifically aims to examine tinkering (Berland, 2016) as a learning process that is relevant to programming within art, design and craft education.

Programming as an emerging part of art, design and craft education

In the report, *The Nordic Approach to Introducing Computational Thinking and Programming in Compulsory Education* (Bocconi et al., 2018), the authors investigate how programming and other new subjects are implemented – or about to be implemented – into Nordic schools. When commenting on the British situation, the report shows that programming emerged in the British curricula during 2014. This initiative is a part of the process of implementing 21st-century skills into the curricula, a set of skills to prepare today's children with the ability to adapt to their future occupations and social life. This involves 'promoting foundation skills, digital literacies, higher order thinking competencies as well as social and emotional skills' (Bocconi et al., 2018).

One key term in the report is 'computational thinking' (CT), which can be seen as an umbrella term that includes programming. In Norway, the term 'algorithmic thinking' is used instead of CT – it is not a direct translation. There is no need to compare these two terms with each other here. We will say, however, that they are similar in the sense that they are both connected to the modern problem-solving skill set; programming, along with digital competence, are both included in this skill set (Bocconi et al., 2018). The new curricula that are to be implemented into Norwegian schools in 2020 are the result of a comprehensive process that was carried out over several years. *Ludvigsen-utvalget* (English: The Ludvigsen Selection) made two public NOU (English: Norwegian public statement) reports, the first in 2014 and the second in 2015. In these reports, 21st-century skills and in-depth learning are both emphasised (Ludvigsen, 2014, 2015). These two reports were the starting point from which the ongoing process aiming towards the new Norwegian curricula originated. The Norwegian process illustrates a common trend in Nordic countries:

> *A common trend emerging from analysis of policy documents and interviews with experts is that Nordic countries have included CT and Programming as part of a broad and evolving definition of digital competence, one that embraces key 21st century skills like problem solving, logical thinking and creativity.* (Bocconi et al., 2018, p. 9)

This paper argues that programming as a subject in compulsory education may prepare children not just to be digital consumers but also to be digital creators. This argument is formulated in the light of Richard Sennet's statement warning about the dangers when people let the machines do the learning and the people become passive consumers of an expanding competence (Sennett, 2008). With this in mind, this paper aims to contribute to the knowledge-building discourse (Scardamalia & Bereiter, 2010) on programming and 21st-century skills in art, design and craft education at different levels.

Tinker

There are many different programming languages. Some are text-based while others are block-based. What they have in common is that the programmers get instant feedback from the material when creating codes: Either the code works, or it doesn't. Making things with a programming language presupposes computational literacy. Berland (2016), following diSessa (2001), describes material literacy as one of three component aspects of computational literacy:

> *This kind of material literacy can come in many forms: through facility in making a complex spreadsheet in Excel; from the ability to pack your luggage using the most efficient procedure; or through evaluating various data structures in program code. Most of what is considered to be material computational literacy is simply the ability to write and craft program code to express oneself and build usable artifacts.* (Berland, 2016, p. 197)

Berland's description can be interpreted in relation to the 21st-century skills and upcoming curricula that are soon to be included within Norwegian schools. Digital competence has a place in art, design and craft subjects at all levels; for example, children in primary schools making stop-motion animation with an iPad app and plasticine and those in upper secondary schools manipulating photographs in *Adobe Photoshop* or 3D-models in *SketchUp* or *Tinkercad* – these examples combine the material with the digital. Tinkering, according to Berland, Martin, Benton, Smith and Davis (2013) and Berland (2016), is a way of playing with a material without necessarily knowing the outcome, thus enacting itself as distinct from experimenting. Tinkering can be defined in various ways. However, Berland and colleagues claim that there are certain common benefits to be drawn out of the various definitions:

> *Tinkering describes both (a) an orientation and (b) a set of activities. […] The set of activities described as tinkering include trial and error, messing around or fussing, finding and using feedback mechanisms (such as testing), or combinations of those activities*. (Berland et al., 2013, p. 568)

This paper illuminates the process of producing digital images created by computer codes through tinkering. A basic assumption is that tinkering can enact itself as a good learning process when introducing programming into creative subjects within school. In this paper, programming language becomes the only tool in a creative process, excluding all elements of physical materiality: It becomes digital imaging within its own premises, with tinkering embodying the mode through which the learner engage with programming.

Approach

This paper illuminates a case where the main author (who has taught digital design software at university level for several years) explores the learning process that stems from creating images through computer programming. His prior knowledge includes a deep understanding of how digital colours behave on a screen with red, green and blue (RGB) as values between 0 and 255. Together with other basic understandings of what a digital image is and how it contains a given number of pixels, this knowledge works as a foundation when starting to program images. Within *Processing*, dealing with these numbers is common and they make sense to a learner of programming in an environment where everything else is new and unknown.

The main author's practical experiences and reflection on actions (Schön, 1991) are articulated through a dialogue between a colleague and the co-writer of this paper. The case is retrospectively divided into stages, where the main author's 'basic textbook learning' started in stage one. In stage two, playing and tinkering with advanced codes led to new learning outcomes for the author. In the third and current stage, he goes deeper into a function that the programming language accrued.

Processing

Processing is a text-based programming language developed for artists and designers. As its founders, Casey Reas and Ben Fry (2009), describe, it is easy to start with – anyone can create an image – and it has been developed with artists and designers in mind. It could have been interesting to write about block-based coding (e.g. *Scratch*), which is suitable for younger children, but the inherent possibilities of *Processing* make it more applicable to this case.

Roger Antonsen (2018) uses *Processing* to visualise complex mathematical phenomena. A recent example of how one might use *Processing* is his creation of eight images which visualise different card shuffles. Antonsen's example shows that *Processing* holds many possibilities in terms of creating images that act in ways that are different to what you may achieve in other image-editing programs such as *Adobe Photoshop* or *Illustrator,* as these programs have a visual approach to image editing. Processing is designed to create and modify images, and it has the potential to create complex and generative art through coding.

Stage one: Basic textbook learning

Driven by his ambitions to create complex interactive images, the main authors' learning of *Processing* started by reading the different handbooks as well as examining *Processing'*s own online resources (Reas & Fry, n.d.). It began as a hobby or leisure activity for the first few years of usage but later he began to implement *Processing* into his professional work. From creating simple rectangles and ellipses on backgrounds, a basic and well-known illustration (of how three circles of RGB colours mix into cyan, magenta, yellow (CMY) and white as they overlap) was drawn. This was a simple illustration based on the foundations that were established through the textbooks – for example, how to place the circles on the background with given *x* and *y* coordinates related to the canvas's size in pixels. These foundations also included how to write the three RGB colours. To make the colours mix and achieve the CMY palette, a function telling the colours to blend according to additive colour mixing was included. The blend mode (ADD) was also similar to software such as *Photoshop*. As in *Photoshop*, it is important to use a black background colour when mixing colours additively: Avoiding white is a key part of this process.

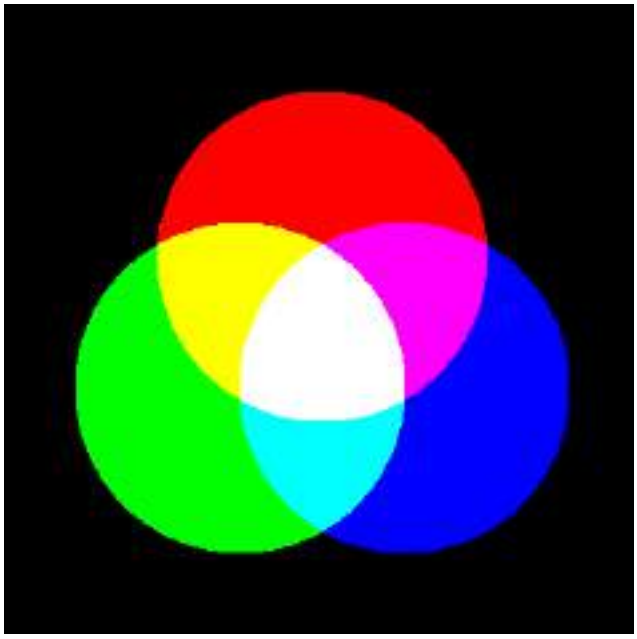

Figure 1: RGB circles with a blend mode set to additive colour mixing creates CMY and white.

This is an example of the practice and testing stage. The goal was to write codes such as this without looking at recipes or textbooks. This kind of visualisation is based on additive colour systems (Kuehni, 2004). As a teacher of digital media at university level, the main author had made such visualisations using *Photoshop* in the past. At this stage, there is very little creativity involved. The focus is on learning how to use *Processing* and to gain a fundamental understanding of what it takes to write simple programs. The target was to let using the blend modes act as a method through which one could experiment with colours. In addition, different ways to create moving images were tested. An easy way to do this was to replace the *x* and *y* coordinates (in numbers) with *mouse x* and *mouse y*, making a shape's coordinates change simultaneously with the mouse cursor. The drawn shapes could then move around on the screen.

Stage two: Playing and tinkering

After a period of learning the basics, it was time to create something more advanced: What if these circles could move and bounce across the screen in different ways? And could these movements be influenced and modified when exposed to stimuli such as sound? Could they first orbit or jump across the screen and then change directions if someone were to shout into a microphone? After searching online, different interactive examples were found that were suitable for modification. Three main products came out of this process, the first of which was a depiction of three RGB circles bouncing across a black canvas, mixing colours additively as they overlapped (similar to Figure 1 but with moving parts).

Advancing from the code for bouncing circles, this project moved into a new stage. At this point, three circles were coloured with RGB contours but without a fill colour. They were bouncing across the screen in the same way as in the previous figure. This time the image became successively lighter as the circles overlapped because the background colour was not in the looping part of the code – which means it is only 'played' once in the loop. The circles were also allowed to change size and proportions when moving the mouse: Both *mouse x* and *y* had an impact on both size and shape. Finally, a reset function for when the mouse button was clicked was created, making the screen darker when it started to become white (Figures 2 and 3). The mouse actions were quite basic and easy to replace with fixed *x* and *y* numbers.

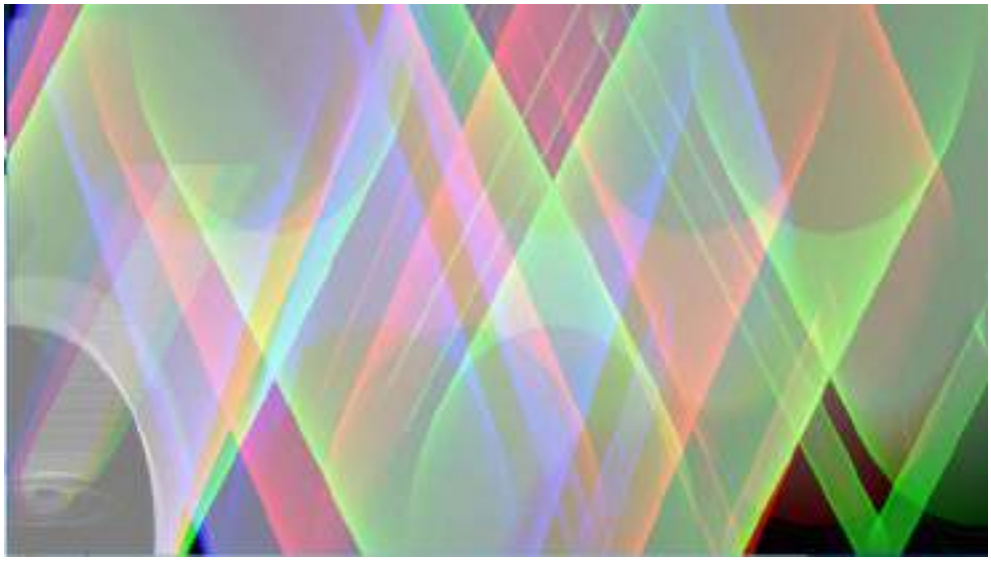

Figure 2: RGB-contoured circles on a black canvas, creating secondary colours (CMY). The canvas gets successively lighter as the circles move across the screen. The different RGB shapes move diagonally and you can alter the pattern by moving the mouse.

Figure 3: Screenshot from Processing showing parts of the code for Figure 2.

At this part of the second stage, a search was conducted online for 'fancy' code scripts with the goal in mind being to combine the RGB colour mixing with complex movements and interactivity – this resulted in the described examples. Here, tinkering with the codes and not always knowing what would happen was an important part of the approach. Testing (instead of reading) the theory was a crucial working process, advancing the work's progress several steps further.

Soon, however, the process stagnated. The code making the circles bounce automatically was too advanced to understand. It was easy to modify the circles to bounce slower or faster, but it was not easy to write new lines of code that would make the circles move automatically and exactly as was wanted. This experiment was put on hold so as to try out a new approach. Figure 4 is based on the available codes that were found online while looking for a way to create transitions between two colours. The code was tinkered with to change the colours

and the principles behind this function – called *lerp* (Reas & Fry, 2006) – which was also learned by the main author through this process.

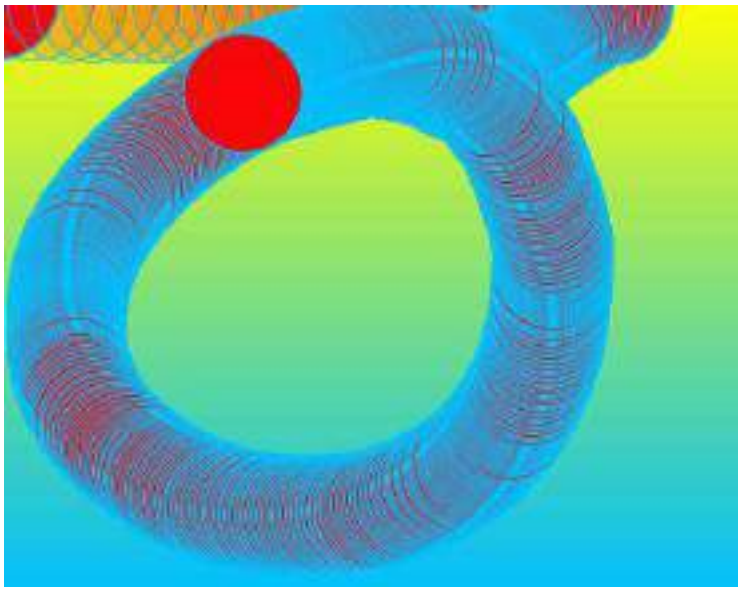

Figure 4: Colour transitions in the background and a circle controlled by the mouse (the background is not in the loop, so the circle leaves a track).

A milestone in the learning process was thus achieved. Other parts of the code started to become interesting. Another function in this code was *easing*, which could make the red circle move more elegantly across the screen as one moved the mouse along the *x* and *y* axis. Without understanding this function well enough, a closer look at a part of the code revealed the *for* structure. This structure seemed essential within different settings but had not been explored by this point. By the end of this stage it seemed possible to start to learn how to use it. Now it was time to go back to the books and the online resources (the reference guide at processing.org), reading and trying to understand the logic behind it.

Stage 3: Back to basics: Going deeper into a function in the programming language

The last experiments may look 'fancy', but they were mainly products that stemmed from modifying and playing with existing codes to mix colours in different ways to try different colour transitions and to play with movement and interactivity. Here, tinkering (Berland, 2016) was the main approach. A motivating element during this stage was to play with something advanced. The main author employed this approach instead of continuing to learn programming systematically (as in the approach in stage one).

The original web resources and the textbook (Reas & Fry, 2006) began with exercises where one drew lines in order to understand the fundamental basics. This was achieved early on in stage one but, as the aim was to learn fast, this approach was abandoned in stage two. By stage three, going back to the basics was essential for further development. It was crucial to look closer at the *for* structure. The logic behind *for* is explained like this: *For* (*i* = init, test, update) (Reas & Fry, 2006). This means that the variable *i* is initiated (e.g. set to a specific value), then tested (stop if this value is higher or lower than a certain number) and then updated (if the test was positive, update with a specified addition). With this structure, it is possible to let a shape copy itself in a specific rhythm, thus making it possible to create patterns. Apparently complex images can be made with just a few lines of code. By this point we were getting closer to formulating the essence of how programming can be an incredibly useful tool in certain situations; its effectiveness. The next example is the first independent exploration of this function, written from scratch and without looking to references. It shows a small ellipse, copied and enlarged in a specific rhythm.

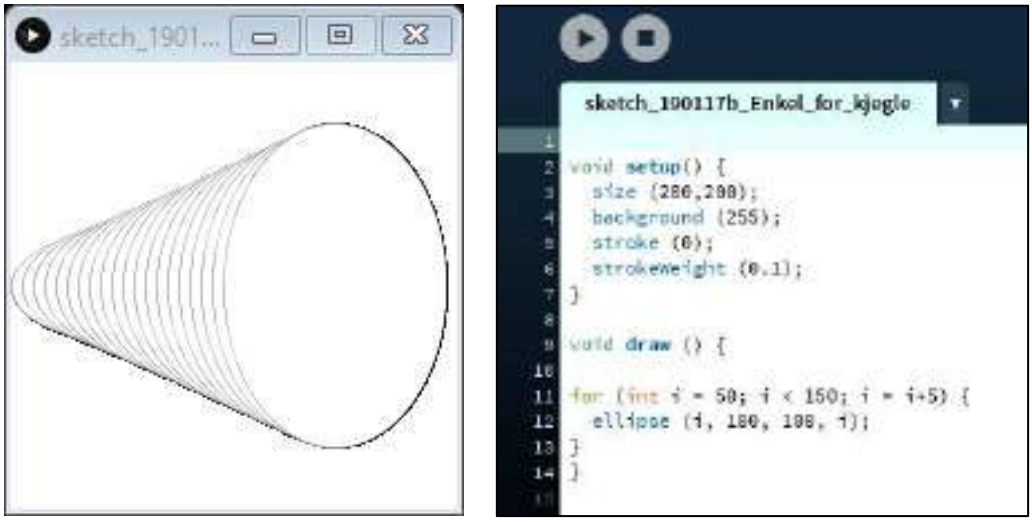

Figure 13: Duplicating an ellipse with a few lines of code.

Figure 5 is an example of an effective way to create different patterns with a few lines of code. This was a milestone in terms of the learning process. It was interesting to write such codes and to experiment and tinker with them, creating new patterns – as opposed to tinkering with advanced code scripts that were found online. After some testing in regard to how to repeat lines according to the *for* structure, the ability to create a grid with a little twist was discovered (Figure 6).

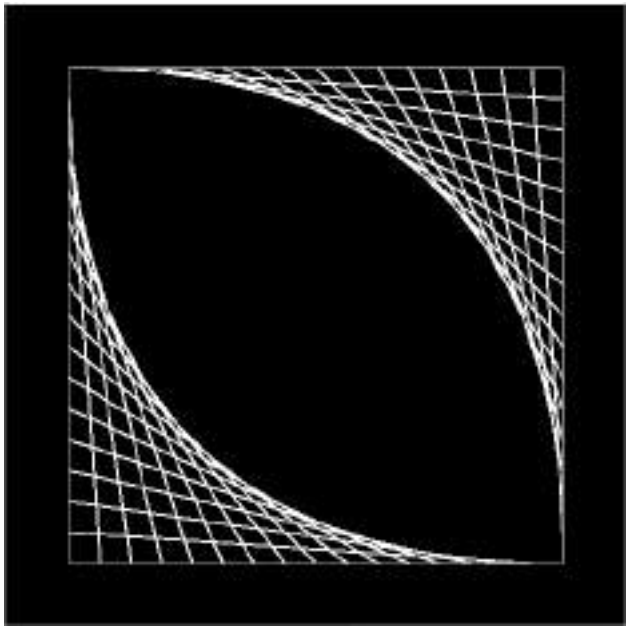

Figure 6: A grid with a twist, achieved after experimenting with the for structure.

At this point, the motivation that stemmed from gaining new knowledge and examining the possibilities became important. This entailed not being so concerned with ambitiously creating fancy interactive images (they could wait). This new mode of learning was fun. It was a decisive moment in the learning process. This resulted in several patterns, exploring different possibilities with one or two variables in the *Processing* code.

After making patterns with one variable, the main author began testing out two variables. The next pattern (Figure 7) is made with two variables: It is a circle placed in a fixed position on the *x* axis. The first variable makes the circle copy itself along the *y* axis at a given rhythm. The other variable makes the circle occur in different sizes, starting at a given number and increasing until it reaches its size limitation (which is defined in the code).

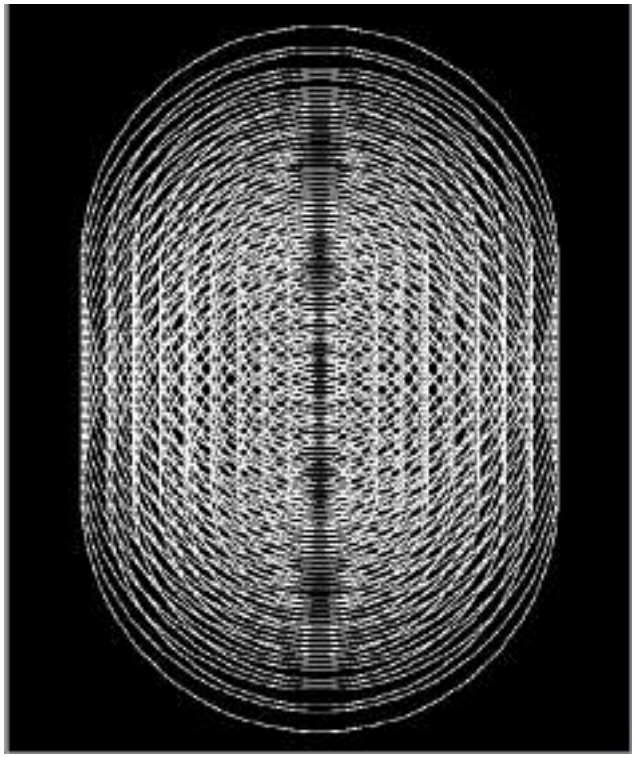

Figure 7: Testing two variables in the for structure: An ellipse duplicating its position and size.

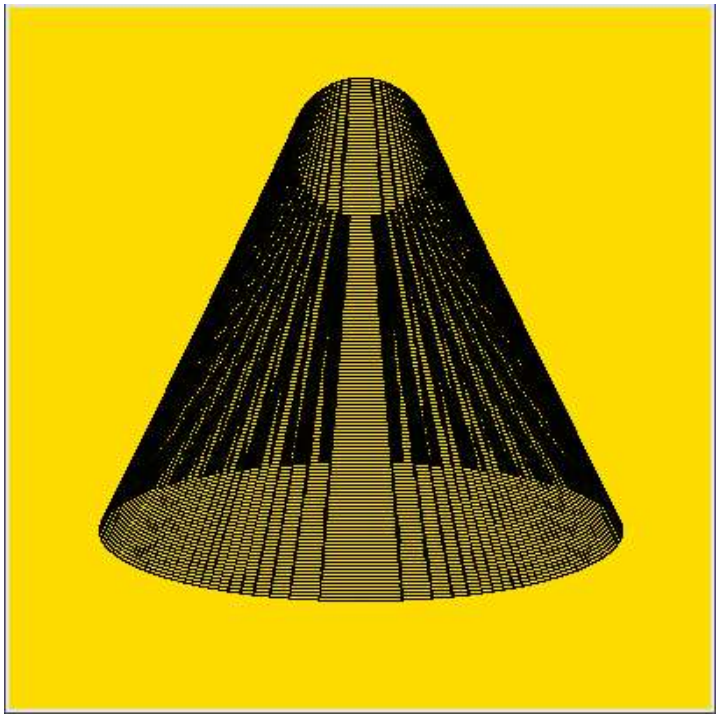

Figure 8: Based on the first cone created with the for command, this is another way to make the ellipses multiply both the x position and the y part of the shape. The yellowish background is there for the variation (the exact colour is RGB 255,220,0).

Figure 8 has two variables (*i* and *j*), both of them increasing at a specified rhythm. The cone is a result of a variable *y* position, increasing with a specified value until it stops at another specified value. The shape has a fixed *x* radial but the *y* radial increases gradually until it stops at a specified point.

Figure 9 resulted from going back and tinkering with the code from Figure 7, without necessarily predicting the exact outcome. The goal was to play with one's own code which was written from scratch, taking it further, working intuitively and seeing the visual results right away rather than trying to understand everything in advance. This was combined with the additive RGB colour mixing from stages one and two. Some of the meeting lines create new colours as a result of additive colour mixing (CMY and white).

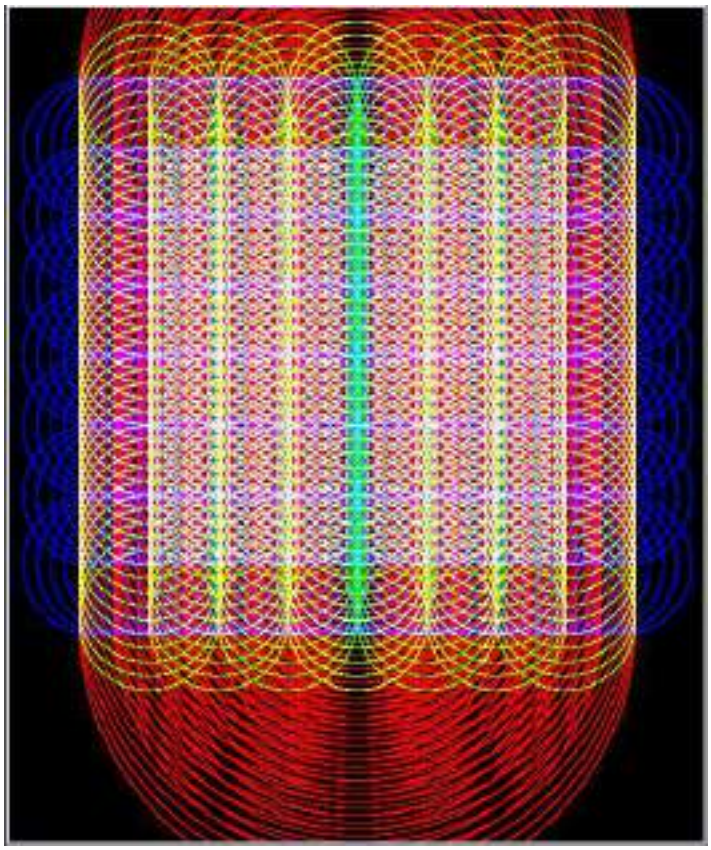

Figure 9: Result of playing with the codes in Figure 7, combining it with the colour-mixings from stages one and two.

By this part of stage three the dialogue between the creative tinkering and the learning process became interwoven with new ideas that arose from the new findings. Practical exercises and reflections on actions (Schön, 1991) drove the working process forward. The *for* structure is a complex function to a beginner but it gradually became simple with practice, making it possible to create patterns. Within the third stage the focus had been to explore this one function, examining its possibilities through many different tests. They started out as simple patterns written from scratch, then both playful tinkering and structured analysis became involved in order to modify the patterns. An effective way to make new things happen in the patterns is to tinker with them without predicting the exact results but while still being able to understand the results after the changes occur on screen. In other words, the process contains a series of alterations between writing codes, seeing the results, taking them further with intuitive tinkering and then analysing the results later. Afterwards it is important to transfer the knowledge gained from the outcomes into new versions, creating new codes analytically. The learning process is not over: It would be ideal to deeply explore another function, advancing further by conducting a new stage.

Discussion

This paper offers a perspective on programming within art, design and craft education with a special emphasis on tinkering as a learning process. The case reflected in this paper has shown that tinkering has been a crucial element throughout the learning process in terms of advancing the main author's knowledge of programming. After using textbooks in stage one, tinkering with existing codes in stage two made it possible to freely play, unconcerned with the systematic learning of advanced programming. This boosted the motivation to enter stage three, developing new codes based on newly achieved knowledge. As a part of stage three, the patterns

created were further developed through 'happy accidents' that stemmed from tinkering. These results were then analysed and refined into new patterns.

When first discovering *Processing* and upon hearing of its potential and opportunities, the main author had high ambitions in terms of what he could create with this software. It held a variety of new possibilities (compared to *Photoshop* or *Illustrator*) and it made it possible to combine digital imagery with interactivity: It may even be possible to learn how to combine images on a screen with a microcontroller kit with censors to create images that respond to physical stimuli. This project started with high ambitions and an even higher level of motivation. However, it also started with a lack of skills and knowledge in regard to programming. Despite this, after learning the basics, it became interesting to play and tinker with existing codes to investigate the software's advanced possibilities. After a period of tweaking and tinkering with several code scripts that were found online, new visual effects were made but without necessarily consolidating how to write similar codes from scratch – motivation decreased as the high ambitions began to seem unreachable. Still, it was interesting to play with these codes, modifying them or creating errors that only left a blank screen.

As Berland and colleagues (2013) describes, tinkering is about messing around and meeting the material's feedback mechanisms. *Processing* gives you instant feedback on whether the code works or not. Either you have created something visual or the program tells you what part of the code needs to be fixed. If you cannot fix it, you may delete the code line (or hide it by writing two dashes in front of the lines). After looking for interesting codes that could be modified through small systematic steps, through playing around until new things happened or until they failed, a part of these codes began to seem slightly familiar as it had been present in several of the projects: The *for* structure. After a period of reading about this structure, the learning process reached a new stage. It had made a small and yet important leap. Now it was possible to see more clearly how some of the more advanced code scripts were built and even how they could be written from scratch. The motivations of the main author increased slightly, and the ambitions were adjusted to a more achievable level. This does not mean the learning process is over; many more phases such as this are needed to achieve proficiency at *Processing*. But at this stage, creating images with code is great fun and because the main author is a teacher of digital media at university level, this enthusiasm may reach (and hopefully influence) his university students.

After working on the third stage, after denouncing the main author's original high ambitions (or at least after putting them on hold), the learning process had to return to a phase that was similar to the very first steps of stage one; the online resources and textbooks (Reas & Fry, n.d., 2006). It was a step back to the basics. But stage two was necessary in order to get there; it was necessary to play with codes and to have fun with the higher ambitions before it felt natural to take this step backwards. After stage one, many of the structures and functions (such as the *for* structure) described in the textbooks seemed incomprehensible. Between stages one and two, looking for existing codes seemed more motivating.

This paper does not claim that computer coding should always be present within art, design and craft education, but it is an attempt to look at how and why it might be relevant to use programming to create digital images. There are many more possibilities that arise from using *Processing* and other such programming languages. This paper gives some examples of how programming images can create other kinds of outcomes than what you can achieve in known imaging software such as *Adobe Photoshop* or *Illustrator*. The learning process described in this paper may serve as an example of how to use programming to create images and how to learn computer coding step by step. However, further research on the topic is needed.

When programming becomes a part of the curricula in lower and upper secondary schools in Norway, creating images with computer coding might become increasingly relevant in art, design and craft subjects. Why should we learn this and at what level of difficulty should an art, design and craft teacher be teaching programming? They are not IT teachers and the students are not attending an IT class. Nevertheless, programming can be used for many different things and it opens up new possibilities in terms of creating visual digital images. You can generate patterns, iterate with small changes in code scripts or even make something interactive.

This paper has shed light on the learning process. Tinkering has proven to be a good way to learn because it combines a playful approach with the instant feedback that *Processing* provides from the materials. This may apply to different programming languages suited for different children at different ages. On the website, Lær kidsa koding (English: Teach the Kids How to Code) (Lær kidsa koding, n.d.), there are different online resources for *Scratch*, *Processing* and other such software, with step-by-step recipes spanning across varying difficulty levels, from kindergarten to upper secondary and beyond. Many of the instructions end with tasks where the users are encouraged to find out the next steps on their own and take the codes to new levels. A

good thing about tinkering with codes is that it is not 'dangerous' to fail. Failing is a fruitful and often necessary part of the learning process. After the initial playful steps, one might have learned something new and become ready to write codes from scratch. Based on the experiences drawn from this project, tinkering is regarded as a fruitful way to introduce programming to both teachers and children in art, design and craft subjects. As the new curricula will be implemented in 2020, further research on this topic is crucial. This includes classroom studies at both primary, lower secondary and upper secondary schools, as well as teacher-training programs.

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Learning about materiality through tinkering with Micro:bits

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This paper discusses two pilot projects in Art and design education at the teacher training at Western Norway University of Applied Sciences. In the second round of drafts for the new curriculum of Art and design digital knowledge is described as stretching from using simple digital resources to master and shape your own digital products. It is no longer limited to two dimensional visual modelling as previously drafted. This is in our view a new approach in a subject where making, tinkering and designing allows for explorations in both 2D and 3D. Given that we want to encourage the use of the digital together with the use of physical materials, the pilot case studies demonstrate the importance of bringing coding and the material aspects of tinkering, making, and creating into play. The BBC Micro:bit was used to make coding and mechanical control part of projects made with traditional material. Further research and development should be undertaken to bring such practices into classrooms in primary and lower secondary schools.

Keywords: Art and design education, materiality, programming, Micro:bits, citizenship

Introduction

For many years, UNESCO has advocated the idea of citizenship education, which it describes as educating children from an early age to become clear thinking and enlightened citizens who participate in decisions of importance to society (UNESCO, 2010). In Norway Art and design is a compulsory subject throughout the ten years of primary and lower secondary school education. One of the aims explicitly stated for the education is that it should enable the children to take part in society , develop social and professional adaptability, and a democratic understanding.(Kunnskapsdepartementet, 2016). Digranes and Fauske (2010) links the term to Art and design education and describe reflective citizen as a citizen who is capable of promoting a sustainable future through choices and actions. Design is increasingly seen as a one or the avenues or a way of thinking that can contribute to significant changes in the future (European Commission 2012).

The concept 'design literacy' is often used to explore and address the complex matter of objectives and content in design education from primary to university levels (Nielsen and Digranes, 2012). There has been a move in the professional field toward understanding design products and processes as composed of symbiotic hybrids between design products, media types, services, architecture, technology, programming, communicative spaces, networks and modes of creation, production, and exchange (Knutsen & Morrison, 2010). The challenge will be to define the content and secure the implementation in existing and future practice in schools, when these thoughts are brought into the education at lower school levels.

The Curriculum Renewal 2020 - Developing Art and design in Norway

In Norway there is an ongoing process of renewal of the curriculum for primary and secondary schools meant to be finalised in 2020. In the white paper concerning this renewal; *Fag – fordypning – forståelse: En fornyelse av Kunnskapsløftet. Meld. St. 28 (2015-2016)* (Kunnskapsdepartementet, 2016). Several aspects, such as technological development in different professions, enhancing diversity, new forms of communication, the challenge with too many pupils not finishing secondary school, and the general development in the society, forms the basis for change.

In the drafts for the new curriculum of Art and design, the concerns voiced from the education milieus has been addressed. A highlighting of workshops and studio practice, as opposed to a more theoretical orientation, will serve to bring the focus back to *making, designing* and *creating*. Some of this will be anchored in more traditional craft processes and materials, however coding has been included and will be part of the new and wider concept of materiality that Art and design education will have to incorporate into the curriculum. Still without a clear definition coding can be understood as a higher level, more abstract way of working with the same concepts that characterise programming. But where programming tend to activities that produce new functionality, which a computer can use, coding is more about utilising existing functionality. As of now in the first draft, coding in Art and design is limited to two dimensional visual modelling in lower secondary school (Udir 2018-utkast). However, considering The Professional Digital Competence Framework for Teachers in Norway (outlined below) and the understanding of the reflective citizen that is design literate, to confine the digital or coding to the two dimensional picture plane is in our view a too limited approach in a subject where making, tinkering and designing allows for explorations in both 2D and 3D.

Tinkering in Design Education

The more traditional areas of Art and design, i.e. craft in wood and textiles or drawing, are well established in the school practice. Introducing programming and more intangible artifacts or products requires new approaches. In the introduction to his book *Mindstorms* (Papert, 1980) Seymour Papert reflects upon how computers can be a general tool for children to create for themselves. This view of creation is grounded in what Papert calls constructionism. This is an approach to learning where design experiences result in "objects-to-think-with", which are material objects that can also be internalized mental structures (Keune and Peppler, 2018).

In the future tinkering with computers might be an addition to the traditional tools: the "gears" for the new generation. The same is the case for a large variety of products and services – the digital transforms what was once mechanical into hybrid constructions, controlled by computers. The idea of tinkering (Resnick, and Rosenbaum, 2013) has followed humans as long as we have had a relationship to tools. Tinkering, playing with the possibilities given by available tools, has always been a winning strategy for innovation. We may, however, argue that tinkering has become increasingly important, in a world characterized by rapid change.

Education is never static, rather it is fluent, flexible and diverse. A lot depends on the teachers and the day to day practice in both formal and non-formal education, and the policy that binds them. A EU report from 2012 named *Design for Growth & Prosperity. Report and Recommendations of the European Design Leadership Board. European Design Innovation* provides 21 recommendations for the future development of design and design education in Europe (European Design Leadership Board, 2012). Recommendation 20 is to: "Raise the level of Design literacy for all the citizens of Europe by fostering a culture of "design learning for all" at every level of the education system" (European Design Leadership Board, 2012, p. 73). In some newer educational research within Art and design education the focus has been on what makes it meaningful for the pupils, an as such in teacher training. Approaching design in schools, educational theory of the students' design process emphasizes their ability to carry out a whole creation process, from idea to finished product. Randers-Pehrson's research into Norwegian upper secondary school in Art and design education addresses something similar in her concept of"thing-making". She sums it up as: «The Experience and mastering of the material seems to be one of the driving forces for the students' work. /../. As such, the "thing-making" is a meaningful activity, because it is given shape and becomes "something"..." (Randers-Pehrson, 2016:280). The one factor we aimed to hold constant was that the focus would be on problem-solving, designing solutions, and the aesthetics rather than just the coding. Designed artifacts can be seen as a type of communication and storytelling in itself, and youth move seamlessly between the divide that the curriculum coins analogue and digital (Mäkelä, 2011). However, knowing that pupils value the traditional crafts highly we also need to acknowledge that student engagement and motivation are enhanced through integration of new technologies

in education (Smeda et al., 2014). As the pilots unfolded, we saw several areas of discussion in regards to reaching this further ambition, and a plan for improvement emerged.

Strategy and Method

This paper discusses two pilot projects, fall 2018 and spring 2019, in Art and design education 101 at the teacher training at Western Norway University of Applied Sciences. In both pilots we used the BBC Micro:bit to make coding and mechanical control part of projects made with traditional materials. One of the strengths in doing a case study is that it is a strategy more than a set of methods for gathering data. “As a form of research, case study is defined by interest in individual cases, not by the methods of inquiry used” (Stake, 2000 p.86). From what Yin (2003) and Stake argue, if you manage to identify the case, the methodology will follow as a result of your focus and what you would like to study about that specific case and in light of your chosen theory. A case study gives the frame of context, when your question deals with how and why in the present, and allows for a deeper understanding of a specific area, in this case how tinkering with micro:bits can strengthen the digital *and* material knowledge the student teachers and how and why this approach in itself can be useful in meeting challenges in their future classroom practice. One of the dilemmas in this study is that we would be researchers as well as the educator. We were focusing on being aware of our different roles in the project at all times. To not force our expectations on the situation or other stakeholders did not pose to much of a challenge, as we also went into the pilots without really knowing what to expect. Working within the known boundaries of teaching design studio, programming was introduced as a new factor. Not limiting the approach, but keeping it an open case approach let the involved parties to gather several avenues of data, from teacher logs, student logs, observation notes, photos of project drafts and student works, we let the case inform the data collection (Yin, 2003).

Pilot 1a, 1b and Pilot 2

The study consists of two pilots.The pilots were short projects to see how coding through Micro:bits could be part of an aesthetical exploration in art and design rather than just a technical introduction. The purpose of the pilots was to find out appropriate ways for how the future teachers in Art and crafts could get experience with coding and programming in a task that was placed in the context of traditional methods, issues and thinking of the subject Art and design.There were no clear expectations to how the student teachers might perform, or if the framework would work, or the hardware would perform. It was a test of what we would work with in terms of resources on all levels, human, knowledge, hardware, code, etc.

Pilot 1 was completed with students in their third year of teacher education. It was split into two parts. The first phase (1a) was a short introduction where they only used some basic functionality on the Micro:bit working with “artist books”. Abandoned books were transformed by the students, changing their physical attributes and adding visual, tactile and digital components, all part of a story made of fragments from Alice in Wonderland. As part of their books the students were told to use a Micro:bit and a battery pack as an integrated part of the book (Figure 2 & 3). This approach was designed to be relatively simple, only an introduction to the Micro:bit and how it can be coded. Most students chose to display some kind of message, related to the Alice-narrative, using the LED-display that i integrated into the Micro:bit. The time frame given was six days. The assignment did, however, include a number of digital tools. Every student was working with their own book and the physical integration of the Micro:bit, but they could cooperate when it came to the development of the code.

This group of students were given a more complex assignment a few weeks later (Pilot 1b). This time the students were introduced to different ways of approaching meaning in works of art. The students were then divided into groups of three and the assignment was to create a situation / object in a public place where a viewer can be included in interaction with an “artist robot”. The students were given to following assignment: Use one or several Micro:bits to control a “robot” that take part in the creation of an artistic expression. This expression should be produced over time, through an interaction that either facilitate an artistic experience or manipulate an artistic material”. The time frame was six days, but the students did only get guidance from teachers the first two days.

The second pilot, pilot 2, was completed with students in their first semester. They had both the introduction and a more complex assignment in a continuous period. The assignment was to: “... design a kinetic sculpture for a wall. Through problem solving you will construct a wall hanging sculpture that can be activated by a spectator. You will consider these aspects: volume - it is three dimensional, movement - actual or alluded,

programming will be a part of the movement, and you will consider the spectator role in activating the sculpture. Inspiration has to be taken from organic forms or Sami craft". The timeframe was 3-4 days, with teachers involved mainly in day 1 and 3.

The data in the pilots consists of reflection notes from the lecturers, logs written by students, discussions and photos/films of student works. The student teachers become valuable sources of knowledge. Even though the pilots had a limited scope in terms of time, data, and problem framing, they provided valuable insights towards the design of the main projects to come.

Working with the BBC Micro:bit

The BBC Micro:bit is a handheld, programmable micro-computer, introduced in 2015 and given to 7th graders in the UK. The device has a lot of different functions integrated in a small unit (see Figure 2). The device do also have a large number of connectors, which makes it possible to use the Micro:bit in a huge variety of projects.

The Micro:bit is considered useful for several reasons: it is cheap, all coding can be done online, and no installation is required. The projects can be kept simple, or easily be made more complex through more advanced code and by adding perifer units that can send and receive signals through the Micro:bits edge connector-pins.

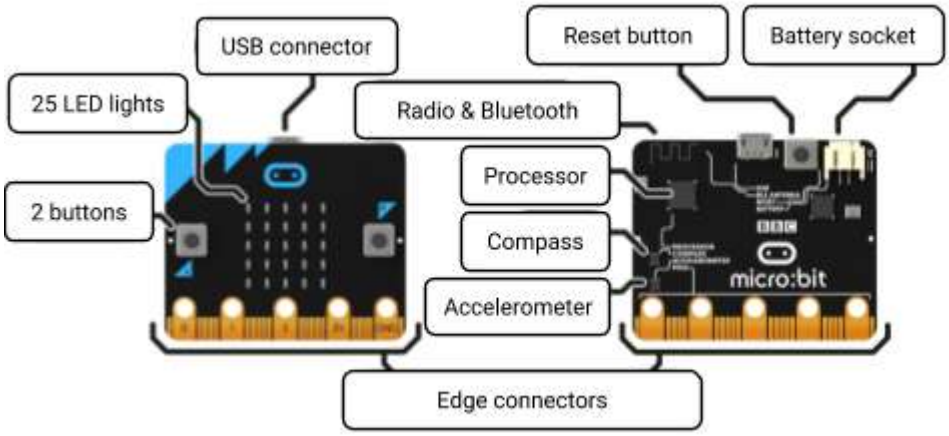

Figure 2: The BBC Micro:bit, a small computer using components developed for mobile devices. The row of edge connectors at the bottom makes it possible to integrate the Micro:bit with a large variety of external devices.

The Micro:bit is programmed through a modified version of Microsoft's TouchDevelop platform, a web-based service hosted at www.makecode.org that allow programming from many devices, including smartphones and tablets. Makecode.org provides an interface that is very similar to and makes skills learned in e.g. Scratch easily transferable, and vice versa.

Figure 3: An example of code developed in project 1a when the students worked with integrating the Micro:bit in books. This script was used to write different messages into the LED-display when the book is turned.

Analysing the pilots

The first introduction to Micro:bits (Pilot 1a) was related to the students working with inspiration from artists books. The coded messages were mostly activated by using the Micro:bit's buttons, but some used the light sensor, the accelerometer or the compass. The scripts were, however, short and straightforward, and most of the students limited their coding to minor modifications of existing code. However, this pilot fulfilled its purpose by introducing the Micro:bit's possibilities, the concept of coding online and transferring the program to the Micro:bit, as well as integrating the device into an existing physical object (Fig 2 and 3).

Figure 4: Several visual elements playing along with the Micro:bit (inside the speech bubble that is going to be all black). The QR-code is used to trigger information presented as Augmented Reality.

Figure 5: A highly decorative element, which in addition to communicate meaning can also serve a practical purpose: in this case a hiding place for the battery pack that power the Micro:bit.

Pilot 1b involved experiments with the possible interaction between the Micro:bit, the code, the material, the site of the performance and the viewer(s). In this project we saw how the Micro:bit, also have material qualities of their own. Working with digital tools can be said to have its own language and materials, including physical interfaces like wires, buttons, connectors, lights, switches, sensors etc. The material that come from the digital domain may contrast the more traditional materials we are accustomed to in Art and design, but the different materials do also blend and sometimes merge into unity. In this project we saw how the new materials meet and contrast the old, familiar materials and some of the groups saw their existing practical knowledge in new light through the encounter with Micro:bits.

At first glance the Micro:bit is a device with some significant limitations. However, the versatility of coding introduces a level of flexibility that made the students able to come up with very different solutions to the assignments. In Project 1b they were to produce a "robot" capable of assisting in the production of artistic

expressions. An example is a group that came up with a solution meant to mechanically transfer paint through soap bubbles, from small cups on to a canvas. The physical setup and coding was relatively straightforward, and the students had a working prototype after a few hours. However, when the digital materials met the traditional, physical materials the students faced several challenges. The group did a long series of experiments with various mixtures of paint and soaps. Because they had to make the interplay between the mechanics and the physical material work, there was no quick fix, and the students explored the materials in a way that is very unlikely to have happened with a more traditional approach to painting.

Figure 6: Several Micro:bits used to control servos that are connected to various physical extensions, each designed to make an instrument play.

Figure 7: Another creation made during project 1b. This group was tinkering with the interplay between gravity and viscosity of paint. They also had to figure out how to construct a lever to make the servo(s) strong enough to control the small paint buckets.

It is worth noting that the code used to control the servos for the music playing project, shown in figure 6, was very similar to the soap bubble machine. Still the final expression is very different. In the music playing project one of the major challenges was to make three different servos move in a way that created a consistent rhythm. This was difficult because the servos did not perform exactly similar, and drifted out of sync. Still, this drifting created new sound patterns that, at least from the teachers' point of view, became more interesting than a monotonous rhythm.

Out of several interesting projects the one shown in Figure 7b may serve as another example to how the material challenges was handled by the students. This group did a good job when it came to the concept and the early prototyping, and they had a clear vision for the final result. Here there is a lot of physics in play. The students had to attaching a small leveler to the shaft to transfer the servo's movement into a rotating motion. In this case the design failed a little, as the prototyping was done without paint in the small cups attached to the shaft. When the cups were filled it became evident that a longer leveler was needed to make it easier to pull by the servo, something that would require a slightly different construction. Again, a lot was learned about the different material qualities during the process.

In Pilot 1, the Micro:bit is interesting out of a number of reasons. First and foremost it promises to bridge a gap between artistic expressions and coding – allowing the computer to take part in artistic expressions. Even though concepts like algorithmic art goes back several decades, arguably as long as we have had digital computers (Verostko, 1994), there is still a weak connection between most art made with digital tools and coding, done by the artist.

Various ways of so called creative production draw heavily on re-use existing material and ideas from already existing works. One can argue that the information society do favor those who are able utilise existing works to develop strategies to collect and process existing information and reformulate it in order to meet personal needs (Hoem & Schwebs, 2005). Re-use is a common practice in all creative work. However, among professionals like "filmmakers, visual artists, photographers, architects and Web designers /../ this is not openly admitted, and no proper terms equivalent to remixing in music exist to describe these practices." (Manovich, 2002).

Almost all authoring and editing software comes with a large number of predefined functions. Therefore, substantial parts of "creative" production become a direct result from selection among predefined functions.

The Micro:bit is different and provides another, yet relatively simple, approach to creative creation. Code can easily be found and copied, and the remixing of code becomes one of the essential parts of the creative process. This was clearly demonstrated when some of the students in this case study brought their newly acquired skills into their internship.

Pilot 2

In Pilot 2 the students had three to four days to work with the tasks at school, where they received guidance from the teachers. This group, students in their first, year had an introduction and worked on their more complex assignment during the one scheduled period.

To focus of the assignment in pilot 2, was to see if the students could produce a design where the Micro:bit and programming could enhance the aesthetic qualities of a kinetic sculpture. The focus on volume, movement and interaction with an audience was the primary focus, and there brief also stated the source of inspiration as organic forms or Sami craft. The motivation for this was to frame the exploration in a way that would challenge through boundaries. This brought some contrasts to view.

The first year students had worked throughout semester with more traditional introduction assignments in different modes of drawing, painting, sculpting and visual narrating. There was a marked resistance to risk taking, and they all had expectations to the assignments in terms of "what I have seen before and would like to be able to do". They kept measuring themselves and their solutions to the known, and getting them to explore materials and play with solutions proved demanding. Even as the brief in Pilot 2 can be seen as "traditional" in Art and design education, i.e. playing with form and composition, volume, materials, inspiration, and addressing a spectator or user etc., the fact that we introduced an unknown material and tool, the Micro:bit with add-ons, it freed the students from desiring a specific outcome. In the idea phase, the groups were willing to explore several different sources of inspiration, different ideas on activation and movement, and kept going back and forth between ideas, sketches, prototyping and adjustments.

Figure 8: One of the groups that played back and forth with form, movement, inspiration, and materials.

Among the more unexpected findings were how the students did explore different physical materials to make this work with the digital material – including the physical Micro:bit, the servos and the code. In his book *The reflective practitioner: How professionals think in action,* design theorist Donald Schön characterise tinkerers as people who have a conversation with the material (Schoen, 1983). We could clearly observe such conversational among the groups of students in our case studies, when students were working back and forth between code, servos and the various building materials.

Even though the individual elements can be considered simple, the students were working with assignments that they developed into solutions that became quite complex. They should learn how to program the Micro:bit, sometimes make several Micro:bits work together, and figure out how to make the elements of the artefact do the movement(s) the way it was intended by the design. The students should also deal with the formal aesthetic means, and in some cases they also integrated a message in their work with creating an artefact. Most of the students also worked with physical materials that they had not, or just to a small extent, previously met.

Figure 9a and 9b: The length of an arm (a) had to be a tradeoff between the distance the plaster face (b) could be pushed and the strength of the servo. The weight of the face and the material the face is pushed into, also have to be considered.

Figure 10: Three related shapes, drawn as vector graphics and cut on a laser cutter at a nearby makerspace. In this case, the students had to adjust their original concept with servos off center and put the shaft as close to the center of gravity as possible.

A limitation that influenced on the students' work were the selection of artistic materials. One of the projects, the branches of a tree were meant to rotate horizontal, but the servos could not manage it because of the total weight of the textile leaves and friction towards the back wall. If these textile materials were changed with lighter materials, the servos could have managed the rotation. There were also other examples that showed the need for a greater selection of materials in the students' process, and more time to get familiar with the limitations or possibilities of the materials. One of the student projects wanted to rotate a spiral to create an illusion of moving colour, but because of the format and the weight of the chosen material the spiral became too heavy to successfully rotate as planned. With another choice of a material the movement in the spiral and the aesthetic form itself, could have been clearer, and also made the rotation easier for the servo.

However, these trial and errors show that the students took the challenge given in the assignments, which was to to learn something new about integrating Micro:bits as a material element. It was also allowed the making of kinetic sculptures that didn't end up working as the students planned in the beginning of the project. The students had been through a problem solving process, a learning process regarding the materials' limitations, and reflections on what would, and would not, work teaching coding in primary and lower secondary schools

Another, unexpected finding was in regard to the finished student work, the students' attachment in light of the work process, and the execution of the finished work and effort to match the brief. One of the challenges in general education is that if the projects become to conceptual, pupils fail to see the value in the finished product. As one of the fundamental challenges facing the subject is sustainability, the idea of creating waste in the classroom is not pleasant. Though learning process, risk-taking, play, experimentation, and knowledge of both materiality and the digital is valuable, when considering what the pupils, and the student teachers' find as meaningful works. Looking at the student work in Fig. 9 and 10, the work in Fig. 9 did not really originate as much from the inspirational sources listed in the brief. The approach was similar to one where the students locked themselves in one idea, and the process of design was connected more to the technical aspect than the aesthetic solution. However, the student work in Fig. 10 was based almost solely on organic form, and every choice, in a very complex back and forth process, was made to enhance this aspect. At the end of the exhibition, the group Fig 9. threw their work out first chance they got, while the other carefully wrapped the pieces and discussed how they could be used as concrete models in later educational practice. This is something to consider in framing the assignments in terms of introducing them into the overarching topics of sustainability in Fagfornyelsen 2020 (Kunnskapsdepartementet).

Given that we want to encourage the use of digital tools across topics and involving the use of physical materials, we do believe the pilot case studies demonstrate how the importance of bringing coding and related activities out of the data lab. When teachers are able to turn their classroom into something that becomes more like a makerspace, where the digital and the material aspects of tinkering, making, and creating with new technologies come into play. The further research, not undertaken as of yet, will be a collaboration

with Bergen municipality, where we bring the project to the practice with classroom teachers, student teachers, and pupils in their internships in primary and lower secondary schools.

Summing up

Future teachers need to be confident in their relationship with and use of technology. As with any material and/or tool this requires training and the individual development of new skills. However, the most important skills are not directly related to individual knowledge and the ability to master technical features. From our point of view, seen from Art and design education, what is most important is to give students an overall confidence towards tinkering – experimenting with technology in ways that do not always need to fulfill a specific goal.

When observing the use of Micro:bits in schools and among our students, most examples are very simple when it comes to the actual code. On the basis of previous observations of practices in schools we initially assumed that students would find existing resources and copy code. This assumption turned out to be the case among all the groups in our case studies. Only those working with very simple code did all the coding by themselves. The vast majority found example code and did modifications – a kind of remixing, as known from computer culture in general. However, this does not mean that the Micro:bit only allow relatively simple coding. We see the students' use more as an expression of the Micro:bit's ability to raise awareness of material qualities in objects that surrounds it. What is really nice is that it provides a point of entry, into coding, even for students that have no previous experience with this way of using computers.

In the process of working with complex problems there is an interplay between a variety of materials. As a result the process will lead to solutions that teachers and students were not at all aware of at the beginning of a project. Thus, the design process becomes most important and the ability to reflect upon how the various materials constantly influence and change each other, as well as the understanding of the initial problem.

The practical educational solutions to secure learning outcomes in interplay with the knowledge aims of *Fagfornyelsen 2020* (udir.no, 2019) lies within the every-day execution of subject content, as implemented by classroom teachers, the next generation student teachers, and the educators in teacher training. In this study we have shown several approaches towards anchoring the new knowledge aim of *coding* in the subject Art and design. When looking ahead, the tinkering with digital technology and physical constructs, to solve design problems, can be seen in a larger context, related to the overarching themes i.e. citizenship and sustainability through design. To manage these tasks teacher education needs to facilitate tinkering and encourage students to experiment. In a sustainable manner, teacher training must let students develop their knowledge to make them more capable of taking part in shaping the use of software and related technologies. The ability to define problems, explore different solutions and come up with a functional design, and finally implement a working prototype becomes a skillset that can prepare students for problem solving in general. The students learn that solutions are not something they can get from specific sources, but something they have to actively engage with through the combination and adaptation of information and knowledge from several sources.

To an increasing degree we develop a more dialogical relationship with digital technology. This has consequences for almost all technical devices, because they are controlled by software. In the future, those who learn to master these dialogues with digital machines will have an advantage. At the same time technology must be managed, mastered and controlled. Increased civic insight and ethical perspectives are seen as important elements in education, and Art and design education is in a position where we need to face the challenges within teacher training (Udir.no 2018). The teachers we educate today will be among those who educate children and young people into this future. We need to equip these students for what is coming, and teacher education must therefore develop a greater practical understanding of how software affects our physical surroundings. The material focus and awareness Art and design can promote in regard to consumption, innovation and entrepreneurship in an ethical setting, becomes one of the arenas that we will have to strengthen. In doing so we have to fully acknowledge the increasing influence and integration of the digital and traditional materials.

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Research Perspectives IN THE ERA OF Transformations

Designing an intuitive interface to enhance trigonometry learning

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In the last three decades, the application of TUIs (tangible user interfaces) in education has demonstrated its positive influence on performance and learning of students. At Universidad del Desarrollo in Chile, monitoring of diagnostic tests over time evidences difficulties and challenges in the teaching-learning of trigonometry in first-year Engineering education. This study consisted in designing and validating a tangible interface to learn trigonometry in the classroom setting. The methodology used was a quasi-experiment with first-year students from the Schools of Design and Engineering at Universidad del Desarrollo in Chile. Principles of the theory of Embodied Cognition and Blended Interaction were applied to model an intuitive, collaborative and meaningful learning experience. During the design process, three Intermediate Models were tested with several types of users, and two Prototypes were tested with an experimental group. User-testing highly contributed to the design of the interaction experience and the interface, progressively defining the functional and pedagogical aspects. Comparative analysis of Pre and Post-Test results, demonstrate that students' performance increased by 37.1% after two sessions using the interface.

Keywords: Design, learning, tangible user Interfaces, interaction, trigonometry

Introduction

Traditional education systems have rapidly changed in the last twenty years, incorporating not only more collaborative and inclusive methodologies but also new tools and technologies that encourage participation and interaction. This evolution has gone from the development of software applications, websites, etc. (Camilleri & Camilleri, 2017; Dooley, Ellison, Welch, Allen, & Bauer, 2016; van Loon, Ros, & Martens, 2012), to learning interfaces that provide direct and "tactile" interaction between the user and the interface. Numerous educational initiatives have relied on the benefits of tangible user interfaces (TUIs), especially in primary education, demonstrating the variety of its possible uses. Nevertheless, in mathematics education, and more specifically in the teaching-learning of trigonometry, there is an unexplored potential or gap in the use of tangibility to understand and relate abstract concepts (Marshall, 2007). For example Geogebra, a software to learn mathematics (https://www.geogebra.org) enables simultaneous visual, graphic and numerical representations of mathematical objects that are explored interactively, supporting an intuitive "learning by doing" approach (Kepceoğlu & Yavuz, 2016). However, it is mainly supported only by vision and the corporal interaction is reduced to the individual use of the mouse. The interface designed in this study used the benefits of TUIs in combination with the intuitive and visual learning aspects of tools such as Geogebra. This combination enables to have low entry limits, use multiple senses, approach intuitively, and encourage collaborative learning through social interaction.

Purpose of the research

The main objective of this study was to investigate the formal, perceptual and technological variables to be considered in the design of a tangible educational interface to learn basic concepts of trigonometry.

Four specific objectives were defined:

13. Determine the content and progression of the didactic experience to facilitate learning through an interactive interface.
14. Iteratively design a multisensory interface to facilitate the understanding of concepts of trigonometry in higher education students.
15. Investigate the optimal interactions needed to operate the interface correctly and understand the subject properly.
16. Measure the impact of the experience on student learning.

Theoretical framework

Tangible User Interfaces

Tangible User interfaces (TUIs) are human-computer interfaces that give physical form to digital elements, enabling the user to directly manipulate digital information with their hands (Ishii & Ullmer, 1997). The first approaches to TUIs appeared at the end of the nineties, attributable to the seminal work of Iroshi Ishii in the Tangible Media Group of MIT. Today, TUIs are increasingly accessible (due to the democratization of technologies) and its fields of application have diversified into the public and private sphere: kiosks in science museums, pieces of interactive art, collaborative tables in offices, and more recently in wearable interfaces. In the field of education, several examples can be found in material designed for young children, such as Cubetto (https://www.cubetto.com), assemblable blocks to learn the basics of programming.

The use of TUIs positively influences the cognitive process of the user, enabling agile opportunities of individual and collaborative discovery, supporting the formation of hypotheses, improving understanding through the combination of different senses and supporting the rapid evaluation of diverse alternatives (Jetter, Reiterer & Geyer, 2014). TUIs influence the thought processes supported by experimentation (Resnick et al., 2005) and enable a better use of haptic resources that we develop when manipulating everyday objects that surround us (Ishii, 2007). All of the features described above make TUIs suitable to enable natural and multisensory learning experiences.

This study was centered in the design of a TUI capable of hosting collaboration among multiple participants, who build their interaction experience using and enhancing their pre-existing skills (motor, spatial, social and cognitive). By escaping from the traditional interaction paradigms of the so-called WIMP interfaces -Windows, Icons, Menu, Pointer- (Gentner & Nielson, 1996), the interface fosters embodied, collaborative interactions and activates cognitive processes stimulated and facilitated by design.

Embodied Cognition, Conceptual Metaphors and Blended Interaction

The designed interface focused on concretizing abstract mathematical concepts through the manipulation of tangible components, appealing to the transfer of conceptual metaphors. Mathematical conceptual knowledge is largely metaphorical, making frequent use of conceptual transfer, as when we conceptualize numbers as points in a line. Since many of our concepts are metaphorical, our conceptual understanding is crucially dependent on the nature of our bodies and the physical environment in which they function (Lakoff, 2009).

The Theory of Embodied Cognition states that the way in which we learn new concepts is based on the previous body of knowledge that we store since childhood. Lakoff and Núñez (2000), explain that human beings internalize abstract concepts in concrete terms using ideas and modes of reasoning based on the sensorimotor system. The mechanism by which an abstract concept is understood in concrete terms is called Conceptual Metaphor, which consists of a transfer or "mapping" of a "source concept" to another "object concept" (target). The source concepts are often concrete and have some kind of "body base" (Johnson, 2013; Dodge & Lakoff, 2005; Feldman, 2008; Pecher, Boot, & Van Dantzig, 2011), while the object concepts are often abstract and cannot be directly experienced or perceived. In the pedagogical context of this project, metaphors can serve to convey a basic understanding of abstract notions of mathematics and to encapsulate

them in a vivid and informative "image", thus facilitating the internalization of abstract concepts (Font, Bolite, & Acevedo, 2010).

The present study took the approach proposed by Jetter, Reiterer and Geyer (2014), which links Embodied Cognition with the HCI field, and names it “Blended Interaction”. The cited authors introduce the term Conceptual Blends to explain how users of an interface rely on familiar concepts and the real world when they are exposed to new experiences of digital technology. The mixtures create a new concept from two inputs (cognitive and physical), in this way, the output results in a new concept with a new emerging structure that was previously not available in the inputs. Several authors have postulated that the appropriate combination of previous experiences of the physical and social world, in combination with those already familiar in the digital domain, enable an interface to be understood and operated more naturally (Hutchins, Hollan & Norman, 1985; Jetter et al., 2014). This enables compromising few cognitive resources to connect evaluation and execution when facing a new system. To achieve this objective, four dimensions defined by the authors Jetter et al. (2014) were considered as fundamental variables to design the interface:

- Individual Interaction: focused on individual capabilities supported by multimodal elements.
- Social interaction: group activities subject to pre-established conventions that come from daily life interactions.
- User Journey or Workflow: definition of a journey that is temporarily ordered constituting the experience.
- Physical Space: the form-function of the interface components and the layout of the physical space to define the nature of the experience.

Teaching trigonometry

In traditional teaching, students are subjected to repetitive procedures (Skinner, 1976), and learning is assessed through cyclical evaluations. The research team believes that this type of learning does not usually stimulate creativity or incorporate the premise that human beings add meanings to the thought process (Johnson, 2013). Thus, in this study, the design of the experience is sustained in a constructivist vision: students learn by constructing something with their prior knowledge (Ambrose, Bridges, Dipietro, Lovett, & Norman, 2010) in combination with new input information to produce significant learning (Vygotsky, 1980). In this approach, students are challenged with a problem and encouraged to work on their own to solve it, promoting higher levels of thinking.

Trigonometry is a fundamental requirement for the study of both advanced mathematics and science. In the United States, the National Council of Mathematics Teachers highlights the importance of trigonometry in the study of periodic functions and emphasizes the usefulness of trigonometry in the investigation of real-world phenomena (Curri, 2012). Moreover, trigonometry is fertile in connecting algebraic, geometric and graphic reasoning (Weber, 2005). Nevertheless, despite its importance in both high school and university, research shows that trigonometry remains a difficult subject for both students and teachers (Brown, 2006; Thompson, Carlson & Silverman, 2007; Weber, 2005).

At Universidad del Desarrollo, Santiago, Chile, high-school level difficulties in trigonometry are evidenced by the results of the diagnostic test applied to first-year Engineering students at the beginning of their first semester. Results have shown systematically for several years that trigonometry is a subject that presents comparative deficiencies. As seen on Table 1, in 2017, trigonometry presented the lowest performance (14%) within all the subjects addressed in the diagnostic test.

Table 1 : 2017 Diagnostic evaluation results of the career of Engineering at Universidad del Desarrollo, Santiago, Chile

Thematic Area	*Total number of answers*	*Total correct answers*	*Global performance*
Perimeter areas of simple figures	916	300	33%
Layout and orientation of straight lines in the plane	687	279	41%
Equations and quadratic functions	229	108	47%

Trigonometric problems with text	**1145**	**200**	**17%**
Recurrences and natural numbers	687	160	23%
Solving Equations and Systems of Linear Equations	458	226	49%
Solving Inequations	687	203	30%
Use of trigonometric functions	**1145**	**163**	**14%**
Absolute values	916	254	28%
Total general	6870	1893	28%

Methodology

The methodology of this study is quasi-experimental and mixed, incorporating qualitative and quantitative data collection to inform the development of the design from the perspective of usability and pedagogical effectiveness (Gilbert & Driscoll, 2002; Jetter et al., 2014). The design process was organized using a modified version of the Double Diamond Model created by the Design Council (2014). It considers an iterative process of four convergent and divergent thought cycles (discover, define, develop, deliver). The divergent cycles consisted of literature review, characterization of intermediate models and prototypes, and exploration of design options for the interface. In the convergent phases Intermediate Models and Prototypes were tested balancing user feedback with observation of participatory processes (Resnick et al., 2005), based on two co-dependent factors: the content to be transmitted and the integration of visual, auditory, spatial and interactive components.

The first set of prototypes ("Intermediate Models") consisted in a sequence of three low-fidelity models that were tested to explore particular aspects of interaction. In the following cycles, two higher-fidelity prototypes ("Prototype 1 and 2") were tested to validate the design decisions taken in the preceding cycle. The two user-testing phases with Prototypes 1 and 2 involved thirty minute-long interactions, guided by a Facilitator who used a pre-established script. Each session was documented in video, photography and an observation spreadsheet developed by the researchers. Additionally, in each session a usability and interface validation questionnaire was applied using a Likert scale from 1 to 9 with criteria taken from the VII version of the Questionnaire for User Interaction Satisfaction (Chin, Diehl, & Norman, 1988).

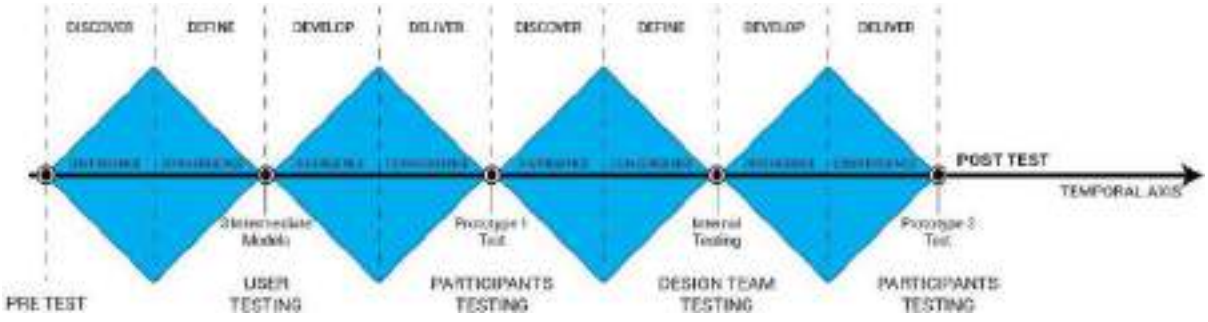

Figure 1 : Adaptation of the Double Diamond model Design Council (2014) that illustrates the interface design process.

Results of a Pre and Post Test were compared to measure the impact of the interface on students' learning. Two groups were established consisting of 119 first-year students from the Design and Engineering careers who carried out the Pre-Test (n=65 in Design and n=54 in Engineering). Within these groups, 31 students (n=13 Design and n=18 Engineering) tested the first prototype, and from that group, 24 subjects tested the second prototype (n=10 Design and n=14 Engineering) and constitute the Experimental Group. The rest of the students constituted the Control Group and carried out the Post-Test without interacting with the interface. The study also considers a third group called "Model testers", students and teachers from both careers who qualitatively tested the Intermediate Models. Figure 2 shows the activities for each group in time.

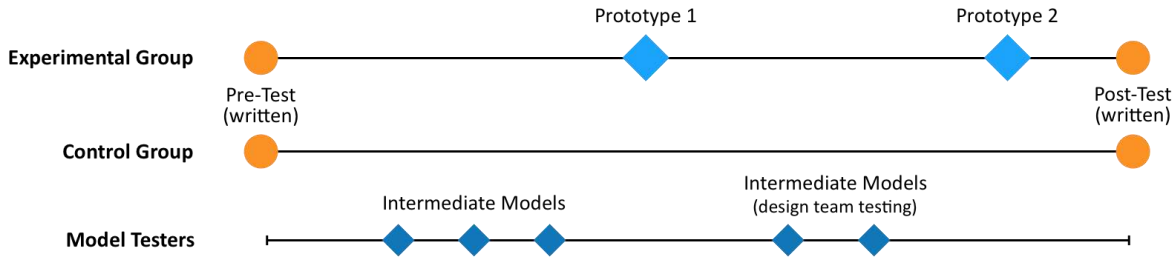

Figure 2 : User-testing, validation and learning assessment activities for each group considered in the study.

Designing the Experience and Interface

To some extent, the flaws in trigonometry learning are due to the fact that students resort to memorization when facing a trigonometric problem (Méndez & Leal, 2018). Studies reveal that learning through the memorization of both concepts and procedures does not lead to a real understanding of the subject and generally only point to the quick solution of a mathematical problem, leaving aside the conceptual understanding and the ability to understand the same concept represented in different ways (Weber, 2005). In contrast, the designed interface considers a multimodal approach (vision, hearing and touch in tandem), thus providing different ways to access the information. The pedagogical experience designed in this study aimed to promote higher levels of thought (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Driscoll, 2000) to activate previous knowledge and/or correct misconceptions and integrate them to the new concepts (Barry, Kanematsu, Kobayashi, & Shimofuruya, 2003).

Pedagogical dimension

At early stages of the design process, five thematic modules were defined to determine the scope of content to be addressed. Having a content framework provided a roadmap for design development and enabled to conceive a coherent pedagogical experience supported by the interface. The contents were defined based on the Pre-Tests, literature review and the previous experience of Engineering professors. The five modules are:

- Module 1 : Cartesian plane and polar coordinates
- Module 2 : Sine values based on an angle
- Module 3 : Cosine values based on an angle
- Module 4 : Periodic functions and sine waves
- Module 5 : Special angles and trigonometric identities

The modules are not necessarily presented in sequence during the experience. To concretize the order of presentation of concepts, a script organized in twelve sequential “scenes” was created to provide a structure for the experience. The script progresses constructively, from the most simple to the most complex. For instance, the first scene is restricted to only understand how the Y axis of the cartesian plane works, and the final scene is about exploring periodic functions and understanding their applications in the physics world. The leading principle that drives the experience is that students are challenged with an open question and encouraged to work collaboratively on their own to find the answer, abilitating students to have clear spaces to err, experiment, explore and discover. It also provides a general guidance for the facilitator that hosts the sessions in respect to the moment in which to ask the participants for specific interactions, what questions to ask, and determining the milestones that require an assessment of the understanding level.

Multisensory dimension

Following one of the principles to create effective interfaces mentioned by Resnick et al. (2005), the interface was designed to provide low limits, high ceilings and wide walls: An effective interface enables novices to participate (low limits), offers experienced higher level activities (high ceiling) and offers a wide range of exploration possibilities (wide walls). In addition, the interface design was built upon the benefits of integrating multiple peripheral senses (vision, sound, and touch) as a teaching-learning strategy (Shams & Seitz, 2008).

The interface provides a graphical and sonic representation of trigonometric concepts, which are explored manipulating physical controllers using different gestures (sliding, pressing, rotating). Some controllers use a

custom design while others are recognizable elements, such as knobs, sliders and buttons. The graphical representation or Graphical User interface (GUI) relies on the Unit Circle model, widely used in trigonometry (Kendal & Stacey, 1996) which is adequate to understand periodic functions and simplifies the calculation of sine and cosine based on an angle (Mesa & Goldstein, 2016). The Unit Circle is drawn on a screen, among other relevant graphical representations: sine and cosine values, the current angle, the cartesian plane, the sine wave and textual and numerical values where needed (Figure 3). Parameters of the Unit Circle are controlled mainly by what we call the "Rotary Wheel", a thirty-two centimeter ring that can be turned in 360 degrees to control the angle that is drawn inside the Unit Circle on screen, consequently modifying trigonometric values (e.g. value of cosine). The rest of the controllers modify additional parameters (e.g. amplitude) and also enable navigating through scenes.

Sound has two roles: First, to highlight relevant information. For instance, when a special angle (0, 30, 45, 60 or 90 degrees, etc) is reached by turning the Rotary Wheel a beep sound is triggered, indicating the user that there's something about that value that is worth exploring and analyzing; The second role is to represent trigonometric concepts as sound (e.g. sine waves represented as a variable tone to understand frequency).

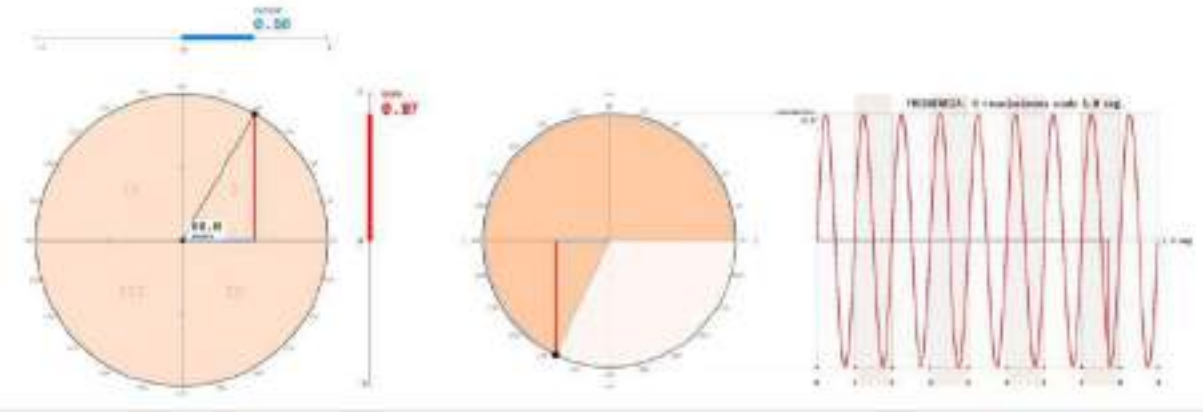

Figure 3 : GUI of the interface (details), where the unit circle, angle, sine and cosine values can be visualized (left). Users can also interact with a visual representation of the sine wave by changing its frequency and amplitude which alters the properties of a tone that is heard through the speakers (right).

Intermediate Models and Prototype development

The design process relied on iterative prototyping and frequent user-testing, a standard method in the field of HCI for interface design that has the following proven benefits: enables to receive feedback from the participants in the early stages of development; guides designers to iterate diverse design options before committing to a particular path; and keeps the design process focused by abstracting the complexities of an integrated design into particular aspects to inform design decisions at each stage of development (Alperowitz, Weintraud, Kofler, & Bruegge, 2017; Dumas & Redish, 1999; Scarlatos, 2002).

The prototypes considered three dimensions based on the model proposed by Houde & Hill (1997): the "role" in respect of its use as a learning mediator; the "implementation" to define the technology and form of the interface; and the "look and feel" to consider the sensory and perceptual aspects.

In all the versions the common technology elements are: a physical device that integrates tangible controllers and sensors, a software that reads and process the data obtained from the sensors, and a 32-inch LCD screen that graphs the GUI and provides visual and sonic feedback based on the data readings (Figure 4).

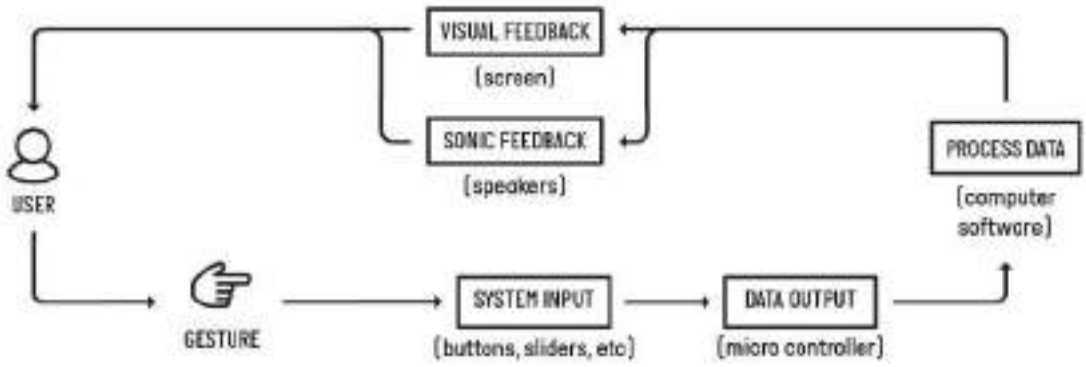

Figure 4 : Information flow diagram of the system.

Intermediate Models

Three intermediate models were designed and tested with 18 subjects, including students and professors from both the Design and Engineering Schools. Each session was twenty to thirty minutes long and included groups of one to four simultaneous participants. The sequence of Intermediate Models enabled to identify unexpected variables and helped resolve aspects such as ease of operation, collaboration dynamics, comprehension level of the content, enhancements of the physical space and progression of the script. For instance, in Model 1 the first iteration of the Rotary Wheel was a control detached from the main screen (Figure 5) and even though it was easily understood and operated, it still remained too close to the "mouse paradigm". It was observed that users had a tendency to touch and indicate with their fingers directly on the screen, performing both deictic and iconic gestures (Rimé & Schiaratura, 1991), which led the team to integrate the Rotary Wheel on the screen for the following model (Figure 6).

Other decisions implemented included: modifying the position and thickness of the Rotary Wheel for better visibility of relevant information on screen, adding additional controls for the users (scene navigation, frequency and amplitude control, visualization of equations), removing/adding scenes and adjusting terminology and style used by the Facilitator.

The analysis of observations and questionnaires responded by users during this phase led the design of Prototype 1 (described in greater detail the following section). A selection of relevant opinions and observations extracted from a general matrix (where all data was transcripted) is presented as a summary in Tables 2 and 3.

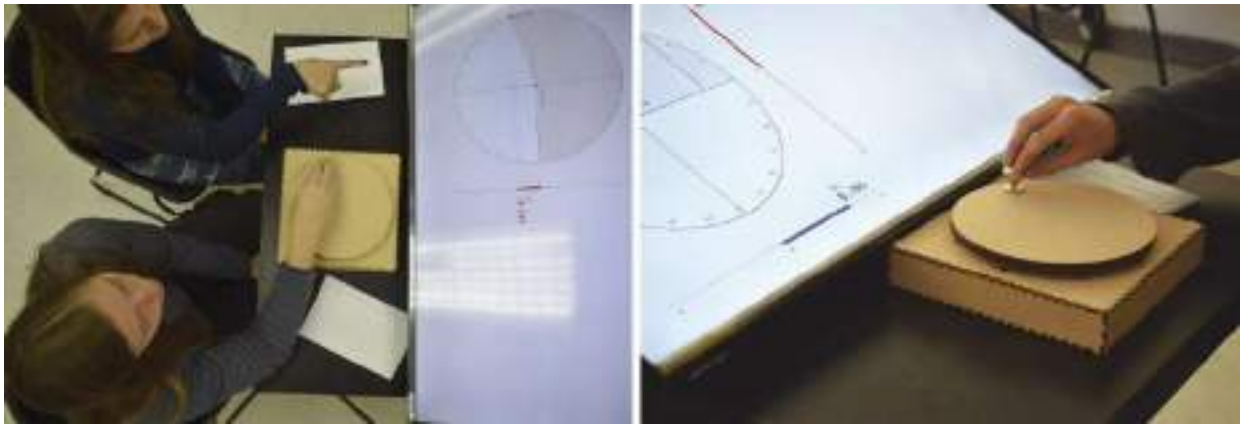

Figure 5 : Intermediate Model 1. Users interacting with the interface during a user-testing session.

Figure 6 : Intermediate Model 2, the Rotary Wheel is now integrated into the screen.

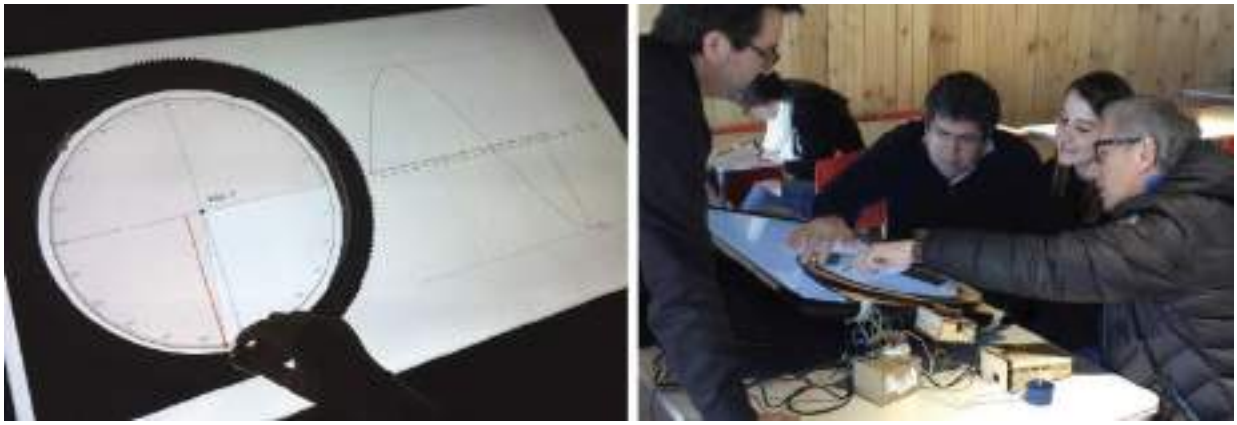

Figure 7 : Intermediate Model 3, user-testing sessions with Engineering professors to collect "expert" feedback.

Table 2 : Summary of relevant observations collected during the sessions with Intermediate Models 1, 2 and 3.

Observation highlights from sessions with intermediate models	
Variable 1 - Interaction	*Variable 2 - Contents*
● Interest in manipulating the interface increases as users understand the operation of the device. ● Users seek for precision in the numerical representation of angles and measurements. ● Users perform unexpected gestures, such as touching the screen to illustrate movement of the elements. ● The experience in standing position leads to a greater use of the body. ● Some students struggle with understanding some concepts when these are influenced by previous misconceptions.	● Users respond automatically to the Facilitator's questions using their prior knowledge and then discard or confirm that response by manipulating the interface: "Oh no! Ah, right!" ● Users tend to verbalize understanding during use: "Now I can only move on the X axis and it goes from 1 to -1". ● As the contents become more complex, the interaction is enhanced using more senses (sight, touch, hearing). ● A productive dialogue is generated with the facilitator and peers. The group combines each member's previous knowledge and new discoveries to articulate a collaborative response. ● The facilitator's script is essential to guide students in the exploration of the interface.

Table 3 : Selected opinions and suggestions from users during the testing sequence of intermediate models.

Users' relevant opinions - intermediate models	
What would you change to make the operation of the interface easier?	• "Add more manipulation controls to handle graphics". • "That the two users could manipulate it [the interface] at the same time". • "Improve accuracy." • "Increase feedback through sounds".
Were you able to understand the contents presented?	• "Yes, it is very well explained and helps to understand the relationships, it creates a mental map." • "If they had explained this to me this way in [high] school, I think I would have understood way better." • "Yes, but I missed an ending as a conclusion."
Was there any aspect that confused you?	• "Trying to explain in simple words the meaning of sine and cosine." • "Determine the radius of the circle." • "None. Perhaps the precision of the values that appear on the screen."
Professors' suggestions - intermediate models	
Regarding the interface	• Incorporate the possibility to visualize equations. • Explicitly display the quadrants in visual form. • Incorporate sound at key moments, for example when curves meet at the same point.
Regarding content	• Deepen the topic of the reflected angles and use the circle to explain Pi and radians. • Incorporate the connection between contents in an associative way.

Prototype 1

Prototype 1 is the culmination of the first process of Intermediate Models and was tested with 31 subjects. The focus of this prototype was to validate the physical configuration, ideal number of participants per group and the progression of the content presented. Prototype 1 differs from the Intermediate Models in the sense that it is an integrated interface and learning experience, whereas the Intermediate Models were more focused on particular aspects and not necessarily on a fully functional device.

The interface consists of an LCD screen (where the trigonometric concepts are plotted) arranged horizontally and slightly angled. Several controls are built into a physical device that wraps the screen, organized by function in two distinct sections, albeit presented as a single integrated device. For this version, laser-cut agglomerated wood was used for its construction.

The main control is the Rotary Wheel (Figure 8), which controls the angle of the Unit Circle represented in the GUI (Figure 3). A series of secondary inputs consisting in buttons and knobs control additional system variables, grouped by function:

- Navigation controls: move forward and/or backward through scenes, change the angle manipulation mode (automatic or manual), activate and deactivate the display of "reflected angles".
- Parameter controls: manipulate frequency and amplitude of the curve that graphs the periodic functions.
- Debug controls (for Facilitator only): calibrate the position of the Rotary Wheel with the digitally drawn angle.

Inside the physical device there are a series of electronic components: two rotation sensors, a microcontroller, pressure sensors (buttons) and a linear potentiometer (slider). The rotation sensors measure angular position: one to measure the angle of the Rotary Wheel and the other to measure the angular position of a knob that controls the frequency. The microcontroller is an Arduino Leonardo that reads the voltage from the different sensors and sends a constant report to the serial port. The Arduino is connected to an external computer (via USB) that receives and interprets the data through a custom software developed in C ++, using the OpenFrameworks library (https://www.openframeworks.cc/). The software is responsible for performing the graphic and auditory output that is displayed through the monitor (Figure 9).

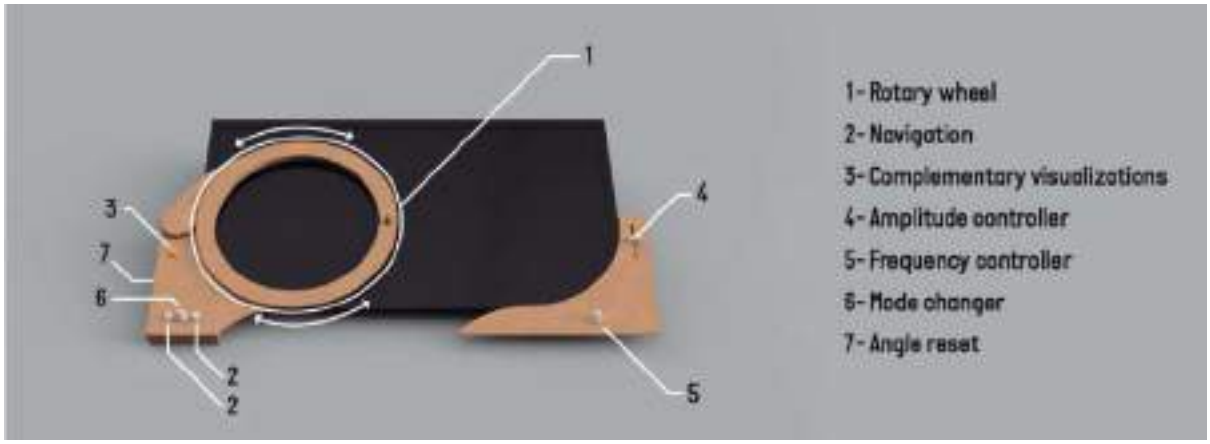

Figure 8 : Schematic render of Prototype 1, showing its configuration and distribution of controls.

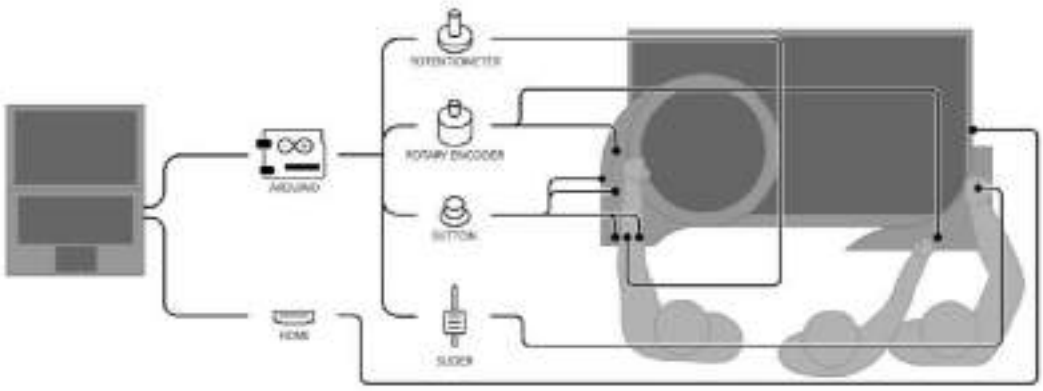

Figure 9 : Diagram of the technology and electronic components of Prototype 1.

Figure 10 : User-testing session with Prototype 1.

Observation helped to conclude that three participants was the ideal number to enable a good field of view of the screen and making decisions based on consensus. An adequate number of users enable a more intimate social interaction (as they are physically close to each other) where nonverbal communication was often observed. It was also observed that on occasions participants had wrong or imprecise preconceptions of trigonometric concepts, which distorted or even prevented the acquisition of new knowledge (Ambrose et al., 2010). To address this issue, it was decided that for Prototype 2 the script would present concepts detached from their technical term at the beginning and introduced progressively throughout the session. For instance, during the first quarter of the experience, the word "sine" or "cosine" are intentionally replaced by "red bar" and " blue bar". This strategy enables participants to understand the meaning of concepts before associating them with their name, facilitating the student to incorporate the new knowledge with less resistance.

Table 4 summarizes the most relevant observations and suggestions collected during the testing sessions with Prototype 1.

<table>
<tr><td colspan="2">Relevant observations of Participants' testing sessions - Prototype 1</td></tr>
<tr><td>Variable 1 - Interaction</td><td>Variable 2 - Content</td></tr>
<tr><td>The use of sound as a pedagogical resource surprises and attracts participants.
The facilitator tends to invade the space of the student when having to operate certain buttons (such as scene navigation).
It is necessary to determine strategies to encourage manipulation of the interface for students who adopt a more passive or observant attitude.</td><td>Participants tend to make predictions of what comes later during the experience.
Participants understand the content progressively and establish relationships between concepts that are intertwined during the sequence of scenes.</td></tr>
<tr><td colspan="2">Suggestions from the users - Prototype 1</td></tr>
<tr><td>What would you change or add to make the operation of the interface easier?</td><td>"An explanation for everyone when finishing each scene."
"Nothing, but it is very necessary that there is someone there to explain."</td></tr>
<tr><td>Were you able to understand the contents presented?</td><td>"I did not understand them well in the beginning but they explained very well in the process."</td></tr>
<tr><td>Was there any aspect that confused you?</td><td>"Some, but seeing the graph again, I would understand."
"No, it was clear how it worked and the fact that sine and cosine had their own respective colors, made it easier for me to distinguish them."</td></tr>
</table>

Prototype 2

Prototype 2 is the culmination of the prototyping process. It was tested with 24 out of the 31 subjects that tested Prototype 1 (seven students could not attend the sessions). Both the content progression and the hardware is similar to Prototype 1, described in the previous section. The goal for this phase was to enhance the interaction experience through a better constructive fidelity and ease of operation. Thus, the main focus was on the redesign of the physical device.

All the electronic components (Arduino, sensors, cables, etc.) were placed hidden inside the structure to facilitate assembly and to achieve a cleaner look and feel of the device. The positions of the controls were reorganized, now providing more control possibilities to the user-end of the interface. A new control zone for

the Facilitator was implemented on the upper side of the interface (where the Facilitator stands) to keep the screen unblocked at all times (Figure 11 and 12). Parts of the Rotary Wheel and the gear connected to the rotation sensor (rotary encoder) were now made out of acrylic (Plexiglas), which performed better under mechanical stress and reduces friction, therefore achieving more precision and smoothness when operated.

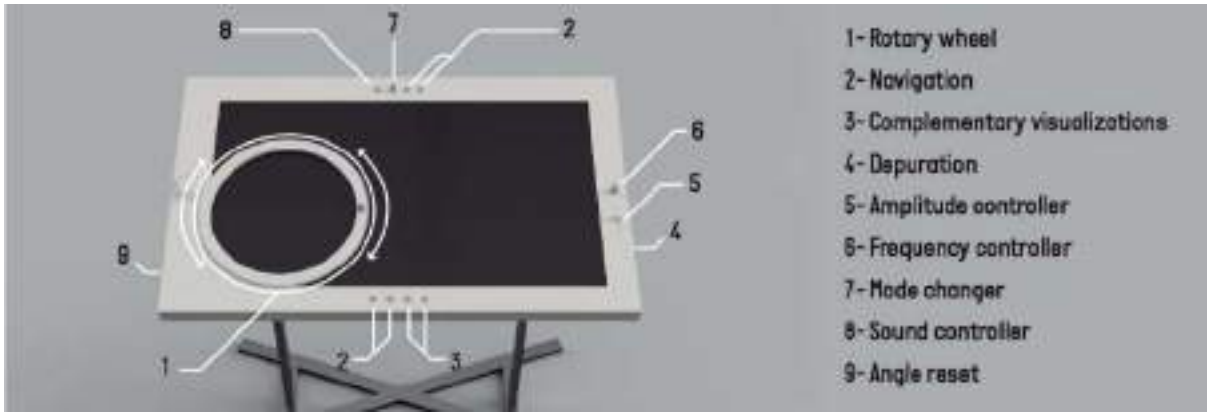

Figure 11 : Schematic render of Prototype 2, showing its configuration and distribution of controls.

The qualitative analysis of data obtained during user testing with the Intermediate Models and Prototype 1 also impacted on decisions regarding the physical space (Jetter et al., 2014). In the previous versions participants were seated in chairs, this limited the users to exchange roles as they had a restricted displacement around the interface. In Prototype 2, a stand for the interface was designed to obtain a suitable height and angle when standing in an upright position, which resulted in a more active, collaborative and fluid interaction, making it easier for participants to take turns when operating certain controls (Figure 12). Overall it was observed that the implemented design changes enhanced the experience as users were more focused on the content and less on the operation of the interface.

Figure 12 : Prototype 2 in use, now in standing position.

Learning assessment results

Pre-Test Results

The Pre-Test was designed and conducted at the beginning of the process of the study, based on the Diagnostic Evaluation of first-year Engineer students (Table 1). It consisted of 12 questions, each one was worth 1 point. It covered the five thematic Modules described previously and included a written introduction at the beginning of the test to even the minimum knowledge level needed to answer the test. It was taken by 119 students: 65 from Design and 54 from Engineering School.

Results of the Pre-Test were low. As seen in Table 5, of a maximum of 12 total points, in Engineering the mean score was 4.35 points (36% yield), and in Design of 2.44 points (20% yield).

Table 5 : Mean scores and performance obtained by Design and Engineering students in the Pre-Test.

Career	*Score (12 max.)*	*Score (12 max.)*
Design (n=65)	2.44	20
Engineering (n=54)	4.35	36

The overall performance in Design was lower than in Engineering (which was expected). However, when analyzing the results by thematic module and by question, the performance curves were very similar in both careers, showing that the difficulties are coincident and that the level of understanding of basic concepts of trigonometry was transversally low (see Figure 13).

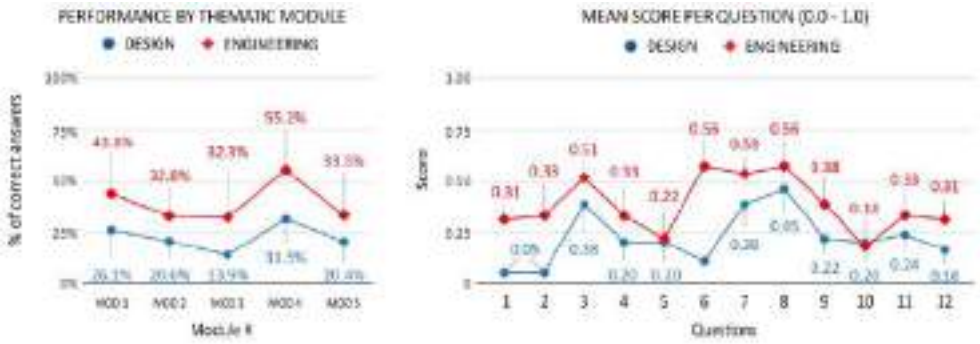

Figure 13 : Pre-Test results by Thematic module (left) and by question (right). As observed, the performance curves are similar in both careers.

Post-Test Results

The Post-Test was identical to the Pre-Test and the same data collection and analysis methods were used. The Post-Test was taken only by the Experimental Group (n = 24, Design and Engineering students) who attended two sessions with the interface (Prototypes 1 and 2). Additionally, a Design Control group (n = 16) took the Post-Test without participating in any session with the interface and without receiving formal instruction.

When comparing the results of the Pre and Post-Test, a significant improvement was observed in the Experimental Group (statistically confirmed by a two sample t-test and a paired sample t-test). In Design, the increase was of 5.0 points, and in Engineering 3.9 (4.46 points when considering both careers). It is noteworthy that even though Engineering students were exposed to additional formal instruction in trigonometry during the lapse of this study (as opposed to Design students) their score improvement was comparatively lower than the score improvement of Design students. Further studies are needed to assess with greater detail the influence of the interface in the case of students receiving additional trigonometry instruction, but the current analysis supports that the interface does have an impact in students' performance overall.

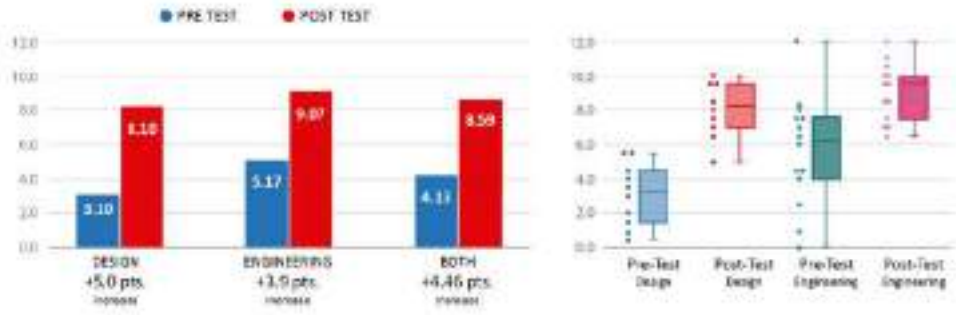

Figure 14 : Comparison of Pre-Test and Post-Test results in the Experimental Group (left). Distribution graph plotting the scores obtained by the Experimental Group on the Pre-Test and Post-Test, disaggregated by discipline (right).

Table 5 shows the comparative performance per question in the Pre-Test and Post-Test for the Experimental Group as a whole. After going through the experience with the interface, performance increased from 34.4% to 71.6%, yielding a differential of +37.1%, which indicates that the experience positively impacted learning.

Table 5 : Performance per question on Pre-Test and Post-Test, both careers.

Question number	*Pre-Test performance (%)*	*Post-Test performance (%)*	*Differential (%)*
1	12.5	91.4	+ 78.9
2	17.5	91.4	+ 73.9
3	39.2	96.4	+ 57.3
4	45.0	92.9	+ 47.9
5	27.5	47.1	+ 19.6
6	35.0	77.9	+ 42.9
7	62.5	77.9	+ 15.4
8	61.7	78.6	+ 16.9
9	40.0	38.6	- 1.4
10	18.3	65.7	+ 47.4
11	30.8	70.7	+ 39.9
12	23.3	30.0	+ 6.7
Average	34.4%	71.6%	+ 37.1%

The performance increase in the Design Experimental Group (n=10) is particularly noteworthy when compared to the Control Group (n=16) of the same discipline. Even though both groups took the Pre-Test and Post-Test, the Experimental Group had an increase of +5.0 points, while the Control Group only increased +0.64 points (Figure 15). This difference strengthens the conclusion that the performance increase is mostly attributable to the interface, and that being exposed to the same test twice did not have a relevant impact on their scores.

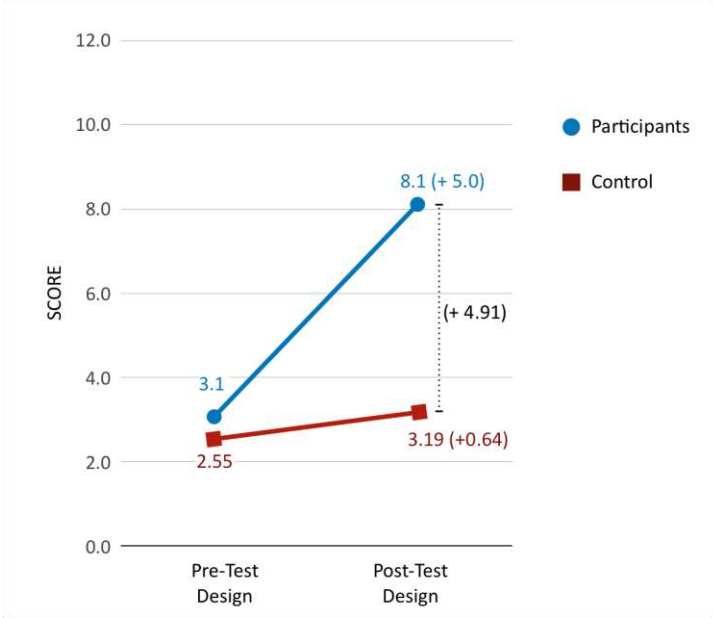

Figure 15 : Score obtained in Pre-Test and Post-Test by the Experimental and Control groups of the Design career. It can be seen that the Control Group does not show a significant improvement, which contrasts with those exposed to the interface that increased their score by +5.0 points.

Discussion and Conclusions

The main goal of this study was to explore the potential of TUIs as a tool to teach and learn basic concepts of trigonometry. Although the fact that trigonometry concepts are hard to teach and learn was justified by the literature, the specific case of students at Universidad del Desarrollo in Chile used as a case study in this research is not generalizable to the Chilean or global context. Nevertheless, results from the study endorse the potential of TUIs as pedagogical tools to enhance learning. Students who participated in the sessions with the interface improved their performance, but most importantly, data analysis showed that their cognitive process was positively influenced individually and collaboratively by experiencing the interface (Jetter et al., 2014). A limitation to these results was not counting with a formal Control Group in Engineering who received formal instruction but was not exposed to the use of the interface. This was due to the loss of Engineering students: some had taken the Pre-Test, but left the career after the first semester, and others failed their first semester and had intensive trigonometry classes during the second semester where they covered advanced trigonometry concepts.

Using multiple senses to transfer the content contributed to diversify the access routes to the information during the learning experience. For example, when participants used the Rotary Wheel, they could see how the angle and values of sine and cosine changed, making the abstract visible in a concrete way. Manipulating a physical representation of digital information proved to be beneficial for students to internalize abstract concepts in concrete terms (Lakoff & Núñez, 2000). Being able to repeat an action as many times as necessary to understand the phenomenon enabled students to reflect and agree on opinions, activating their learning process and making it more participatory. In addition, the use of a simple and non-technical language during the experience, facilitated the construction of metaphors that serve to achieve understanding of abstract notions of mathematics (Font et al., 2010)

It was inspiring to observe the process of co-creation of knowledge among participants from different disciplines when they discussed while using the tangible manipulative attributes of the interface. Students were able to understand concepts that they did not understand before, corroborate or question their previous knowledge, and learn together using the interface.

At the actual point of development, the project could not entirely resolve the design principle proposed by Resnick et al. (2005), to offer low limits, high ceilings and wide walls. Today, the interface offers ideal low limits for novices and partially offers a wide range of exploration possibilities (wide walls) but does not enable more sophisticated interactions (high ceilings). Nevertheless, the research team agrees that the interface in the future could evolve into an educational tool to approach teaching-learning of mathematics for both teachers and students. By appealing more to the understanding of the concepts and less to the direct resolution of mathematical problems, researchers believe that the interface can be a useful ally to facilitate the entry to the abstract approach needed to develop more complex skills in advanced mathematics.

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Research Perspectives IN THE ERA OF Transformations

Engaging in Materiality: Issues in Art and Design Education

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In the training of art and design educators, we must not overlook modes of engagement that can build capacities for connecting theory to practice through creative research and connections to the physical materiality of art. Whether online or on-the-ground learning, artist-teachers must not disconnect from the power of engagement with and the materiality of art. This paper places a focus on ways that teacher training programs can anticipate and activate attitudes of new materialism and design thinking, providing a much-needed anchor in the digital age. With a contemplative view of art practice as research, projects in an art and design education program elevate opportunities for exchanging understanding, promoting dialogue, and approaching learning and research as relationship. Intentionality in the ways that the practice of teaching itself is also materiality, as a living practice, along with the training teachers as designers and facilitators of cultures of making, thinking, and learning are discussed.

Keywords: art and design education, new materialism, materiality, teacher training

Introduction

Drawing from the maker movement and literature surrounding digital media learning, Justice (2015) refers to the relational aspects of digital materiality, a paradox that he calls “decentered embodiment” (p. 6). In absence, there can be a greater ability to be ‘present’ or attentive. He believes that in this digital age, agency is not reduced to a person’s will but is rather dispersed among networked systems.

Digital materialism, as Lankshear and Knobel (2011) argue, is second nature to today’s learners. Even those who acknowledge not being artistic in the sense of drawing, painting, or photography or having formal technology training quickly learn to create collages on their smart phones, use editing software to crop or alter images—all within a series of mouse-clicks. At the same time, Lankshear and Noble warn that “without a change in ‘ethos’ within education, the benefits from addressing ‘the new technical stuff’ will remain seriously constrained” (p. 88).

Thus, within this new ethos of materiality and the maker mentality surrounding technology, there is a concern that we not lose the core dimensions that support an aesthetic relationship to creativity such as, “participation, collaboration, distribution and dispersion of expertise, and relatedness” (Lankshear et al., 2011, p. 68). Mills (2009) suggests:

> *While in the past, viewers were assumed to be present in order to experience the mediated form, now viewers themselves mostly mediate through digital technology. Viewers, as well as the many*

> *works of art they can encounter at the click of a computer mouse, exist in a non-physical state, a state of disembodiment in relationship to the work of art. (p. 35)*

While rapid technological changes of this digital age and the tools through which we perceive art and design could distance us from the created object, we must be purposeful about engaging our senses and desconstructing Western notions of hierarchy that exist between human and non-humans (Hood & Kraehe, 2017).

Material Notions in Training Art and Design Teachers

Particularly in the training of art and design educators, we must not overlook modes of engagement that can build their capacities for connecting theory to practice through creative research and connections to the physical materiality of art and design practices. Artmaking engages our senses through materiality, and we mustn't disconnect from the intangible power of the qualities of artworks as things, or what Bennett (2010) refers to as "thing power"—"the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle" (p. 6). This contemplative view of art practice as research elevates the shared materiality of all things and practices in new materialism (Barrett & Bolt, 2012; Bennett, 2010).

People's capacity to instantly view images online suggests a need for thinking about 'being present' with things (in this case, visual art and artmaking) as more than just objects, and as more of a dialogue. New materialism in art and design education also offers a much-needed perspective on co-creation of knowledge, adopting a stance of 'with-ness,' and adopting artmaking and research as co-creative inquiry—providing a much-needed anchor to managing digital technology (Hood & Kraehe, 2017).

In the training of teachers, we must be intentional about the ways that the practice of teaching itself is also materiality, as its own sort of living practice (Justice, 2015). As described by (Ingalls Vanada, 2013), training teachers as designers and facilitators of cultures of making, thinking, and learning is appropriate for 21st-century education (Ingalls Vanada, 2014, 2016). There is a needed merger between beings and "materiality of 'things,'" as jagodzinski and Walling (2013) argue—toward change and a blurring of the boundaries of arts-based research in the field of art and design education (p. 32).

In what has been called "an age of disembodiment" (Mills, 2009, p. 7), this paper places a focus on ways that teacher training programs can anticipate and activate attitudes of new materialism and the material qualities in art and design practices. Through an action research methodology (Sagor, 1992) that emphasizes opportunities to exchange understanding and approaches research as relationship and knowledge construction, rather than just imparting information, preservice teachers engaged in arts-based inquiry alongside collaborative practices involving design-based problem solving.

Online Learning: Making the Immaterial, Material

Through the lens of a professor of both on-the-ground and online art and design education programs in the U.S., this paper reports on real-world practices that connect theory with practice and allow students to learn more deeply through active engagement with materials and concepts. In developing an online Masters of Art Education course that incorporates design thinking, called "Thinking in Art Education," the researcher also reports on the challenges of creating collaborative, digital learning opportunities for art education candidates that simulate the purposeful encounters or "enacted encounters" of a physical art classroom where making with others supports agency (Justice, 2015, p. 14).

Amidst the challenges of online learning, cohorts of students develop very tight emotional and supportive bonds with peers through the process of their online coursework, discussion board chats, and in live classroom sessions supported by Zoom ©, for instance. In introducing teams of artist-researchers to web-based platforms they could use to create and share 'sticky notes' during a collaborative action research project using design thinking methodologies, they worked together digitally as if they were in a room together. Not surprisingly, these digitally savvy students, comfortable within a new ethos of learning (Lankshear & Knobel, 2011), found many more of their own ways to collaborate online and engage with new digital materials. This is the type of letting go and learner-centered pedagogical practices necessary to teachers of online, art-based classes, as new literacies soon cease to be new. We must empower 21st-century learners to connect digitally, materially and socially. "It's time to shift our thinking from the old model of teaching to a new model of learning," as Thomas and Brown (2011, p. 34) have aptly advised.

Design Thinking and Collaborative Inquiry

With the reality that 21st-century life demands greater interdependence and collaboration, it is important to rethink preparation programs in art and design to better support preservice teachers' hybrid identities and capacities as agents of change, along with developing their abilities as collaborators and facilitators of materiality. In a university course designed by the researcher, undergraduate and graduate preservice teachers (both online and on-the-ground) engaged in collaborative action research assignments as teams through a design thinking model and toolkit called the T-H-I-N-K model © (Ingalls Vanada, 2011). Developed by the researcher, students used the T-H-I-N-K model to investigate real-world educational issues of concern to them in art and design education. The problems they are to solve are not predetermined, as is often the case in project-based or active learning scenarios. Problem finding is in itself one of the most valuable part of the process and provides opportunities for defining educational problems with greater empathy, intention, and depth.

The T-H-I-N-K process (Figure 1) served as a framework and methodological research structure for these new researchers; it guided them to collaboratively identify problems they observe in art and design education, think in more nonlinear ways, and develop empathy. Candidates brainstormed and synthesized ideas, then developed prototypes towards research solutions, all of which encouraged their inductive (thinking wide), deductive (synthesizing), and abductive capacities (using intuition and imagination).

Figure 1: The T-H-I-N-K model ©

As typical of learner-centered processes, there is often push-back as many preservice teachers are somewhat fearful of ambiguous problems to solve, and their skills for ideation are often low (admitting that even in their studio classes very exact parameters determine success). Positive outcomes exist also, as increased motivation and engagement are reported in learner-centered art and design education classrooms that foster personal voice and choice (Ingalls Vanada 2011, 2016). One student commented on their experience with the T-H-I-N-K process:

> *It was energizing and invigorating to know that I can have a hand in change! This process definitely helped me to think outside the box in everyday problems. It also gave me a chance to work with different personalities in a corroborative setting. It was great to hear others' opinions and really listen and discern answers. The skills of thinking, creating, listening and evolving will be used throughout the rest of my career as well as in my personal life (Student participant, personal communication, May 1, 2017).*

In using the T-H-I-N-K model © or any design thinking process (Ingalls Vanada, 2014) art and design candidates may collect both qualitative and quantitative data, based on their research questions. One team in the "Creative and Critical Thinking" class, conducted observations and survey students in art classrooms that led them to realize that "students want to learn about social justice issues in the classroom… sexist dress code[s], offensive words, women's rights, emotions/feelings - developing empathy, LGBTQ, religion, politics,

and gender awareness and equality." They found that a large percentage of the students favored the process of creating over the final product, leading these teacher-researcher to ask:

> *Why? Why do we not engage in more discussion and reflection on social justice issues in our schools today? Why do we take the student voice out of planning and curriculum building? Why do we place such a strong emphasis on the final product and what aesthetic values does that give our students? (Student team 1, personal communication, May 1, 2017)*

Followed by brainstorming and protyping solutions, more questions arose such as, "How can we show teachers ways of using social justice issues in the classroom? How can we develop teachers' skills to discuss social justice issues?" To address these questions—after more mind mapping and ideation—they developed a professional development workshop entitled "*Meaning Matters, An Empathy-Driven Curriculum Symposium,"* creating a website and thinking through the advance planning to allow their ideas to be realized.

Along with the learning to ask better questions, the researcher observed how collaborative action research supports candidates' dispositions, such as: (1) risk taking, "failing forward" and the courage to share one's ideas; (2) self-direction with a make-to-learn approach; (3) managing ambiguity and learning to solve problems along with others and the ideas that differences bring; (4) openness to experience and stronger group trust amidst diversity—race, culture, gender, age, etc. Students self-report these attitudes also (Student team 1, personal communication, May 1, 2017).

Figure 2: Preservice art teachers engaged in design thinking

On-the-Ground Learning: Materiality in Preservice Training

Art and design educators give expression to ideas through art processes and art making. They support their students' abilities to interact with and transform materials in ways that are both bodily and emotional. Contemporary art and its integration into the art and design education classroom is vital (Marshall, 2014), as it provides physical and connected investigations into the nature of things and object's materiality. Teachers sense and experience the material qualities of art, design, and visual culture—interpreting them and inviting young students to be transformed, through imagination and aesthetic inquiry (Mills, 2009).

In on-the-ground programs in art and design education developed by the researcher, students engaged in active learning investigations surrounding critical issues and enduring ideas of humanity, visual art, and

society. In particular, students learned about and created visual responses to works by contemporary artists in the context of deepening dialogue surrounding social justice issues (Ploof & Hochtritt, 2018).

Envisioned was the importance of preservice artist-teachers engaging with, and making art as a way to inquire deeply into topics affecting their future careers as educators and their identities as artist-teachers—an art-as-experience approach (Dewey, 1934). As described in the work by Ingalls Vanada (2017), "interacting with art provides opportunities to disrupt preconceived notions and is a way to challenge students in how they are not just consumers, but also creators—change agents for a better society" (p. 112). The following sections provide examples of student work in a teacher training program that support the intersection of digital and physical materiality.

Art-based Research and Teacher Identity

Arts-based research practices and methods such as action research, visual inquiry and reflection, and a/r/tography are arts-based research movements involving the topic of materiality (Cahnmann-Taylor & Siegsmund, 2007; Irwin & Springgay, 2008; Klein, 2012; Leavy, 2015; McNiff, 2013; Pinnegar & Hamilton, 2009; Rolling, 2013).

A/r/tographic inquiry, as a type of practice-based research, "offers a materiality, a physicality, and embodied approach to learning, that isn't addressed by many teacher education researchers" (Gouzouasis et al., 2013, p. 9). It also offers processes—ways of thinking and knowing—that are grounded in art and design, such as questioning, observation, interpretation, and analysis in what is known to a/r/tographers as "living inquiry" (Springgay, Irwin & Kind, 2008, p. 902).

In this section, strategies for self-study are explored which can support layers of materiality and layers of identity. Preservice teachers followed trails of inquiry that led to becoming more visually reflective practitioners, with a critical approach to dialogue as a culminating part of this work— often related to intersectionalities of their identities such as "race, ethnicity, religion, economic status, social class, gender, nationality, chosen interests, sexual identity, politics, and personal history" (Pfeiler-Wunder, 2017, p. 31).

Anna's Identity Triptych

In a "Contemporary Issues" course, students were challenged to create a triptych—an exercise in materiality and identity—that combined a (1) self-portrait (choosing to focus on relationships with others, their emotional lives, or issues they care about); (2) sense-of-place context; and (3) physical things and material "stuff' that defines them. These three aspects or layers of self worked together to dramatically and visually portray their stories and demonstrated how art-based research adds to the diversity and complexity of a learning community and culturally relevant practice.

Throughout this course we discussed how a/r/tography intertwines the artist, researcher, and teacher as a holistic entity; it embraces an undivided life of artistic expression, reflective and reflexive inquiry, and pedagogy (Gouzouasis, Irwin & Miles, 2013). Students engaged in provocative issues such as depression, suicide, homelessness, gay and gender adversity, pornography, sexual harassment and rape, racial profiling, immigration, and more. Through personal inquiry and artmaking, they investigated their personal identities as also related to teaching, as a way of connecting with their multiple roles.

One student, who we will call Anna, used the assigned triptych project to conceptualize multiple aspects of her identity through performance art from a feminist perspective. From a gender focus on living inquiry, this candidate activated embodied engagement regarding her identity as a woman, through personal performance photography as a form of interpretation and representation. Anna researched the work of Marín and Roldán (2010), who examine the use of photography as a research tool by questioning or problematizing. She used image content relevant to her investigation about personal experiences as a woman and being "body typed," or identified by body parts. Painting her body blue and arranging herself among the plastic limbs and parts of used retail store manikins—also painted blue—she instructed a family member to specifically photograph herself as a series of body parts. In this way, her work was both an engagement with the materiality of her art, as well as a digital provocation of her intended identity statement. The following image is one of three in a series that depict her identity in tryptic form (Figure 3).

Figure 3: Student's Identity Tryptich (1 of 3)

In the case of Anna's artwork as a performance piece, she benefited from the physical embodiment of her inquiry and being photographed as a part of that work. While not physically present to engage with her performance art, her peers engaged with the materiality of her photographed experience, made more engaging because of the large size of the printed artworks and Anna's presence in the room. In a real sense, the materiality of her work was evidenced in both her lived experience and the large printed photographs. As contemporary art, her choice of materials significantly informed and enriched her concept. Her work exemplifies embodiment of the ethos of digital making and learning.

An essential outcome of this assignment happened in the classroom as students shared their work with each other. Preservice art and design teachers become critical makers, but they also serve as critical viewers when they engage with the materiality of what one of their peers has created—not just its physical properties, but their bodily perceptions and senses, understood through their own personal lenses, yet also through the lens of the makers. As future teachers who will soon navigate the questions and ensuing dialogue of their own students, this is essential preservice practice; yet often only happens in the studio classroom and not the art and design education classroom. Artist-teachers gain practice in navigating the various viewpoints of materiality: their own point of view and the view of their peers. In most cases, the content of students' visual reflections were highly personal, adding to the depth of learning and conversations that ensued. They created quality works of art because they cared deeply about what they wanted to communicate through their artwork as attached to identity, which in turn altered the materiality to the viewer.

Self-Study and Visual Reflections with Materials

Self-study is a qualitative research strategy that fosters teacher identity and awareness toward becoming more visually reflective (Klein & Miraglia, 2017; Pinnegar & Hamilton, 2009). Self-study is known as "the study of teaching practice that explores identity, expectations, and the emotional side of teaching through any number of points: critical incidents, practice over time, and/or exploring assumptions, beliefs, and attitudes" (Klein & Miraglia, 2017, p. 25). In engaging in self-studies, preservice artist-teachers blend creativity with critical thinking and practical skill—supporting the reality that the artist-teacher's identity is dependent upon their personal life story as an artist/designer and a teacher—along with many other roles.

Sometimes students' deep inquiries were based on issues or incidents that they observed while in schools for their clinical observations, creating artworks and written reflections that connected their artworks to and sometimes they reflected on artists' works. This issues-based approach to art and design education offered insight into ways they might foster dialogue in their own classrooms and engender the courage to take risks in that regard, rather than skirt around differences of opinion or belief systems (Gaudelius & Speirs, 2002). One student's self-study engaged material processes that led to this response during a practice teaching experience (see Figure 4):

> *I began the day terrified and self-conscious wondering how in the world I was qualified to be in front of a classroom of malleable minds. I wanted to hide my face under a paper bag so to speak, so no one would know just how intimidated I was. I felt like insecurity was stamped across my*

forehead and it kept me from interacting with the students in any meaningful way… Upon realizing that my insecurities did little to gain the ears and respect of my students I tried to muster my confidence. "I AM QUALIFIED TO BE HERE!" I told myself and I tried to carry that attitude into the next class period. This act of "mustering" nearly turned into a mantra of pretending (Student participant, personal communication, May 6, 2015).

Figure 4: Student Self-Study, "I AM HERE"

Visual Inquiries with Contemporary Art

Students in the "Contemporary Issues in Art Education" classes developed by the researcher read chapters in Quinn, Hochtritt and Ploof's *Art and Social Justice Education: Culture as Commons* (2011) and conducted art-based research projects in response to contemporary artists' works. They created artistic or design-based visual reflections that were accompanied by creative writing, poetry, new design media, or narratives about their work. In this process, they connected theory to practice by envisioning practical, postmodern strategies for use in their future classrooms connected to materiality.

An essential outcome of this assignment happened in the classroom as students shared their work with each other after being coached regarding Lerman and Borstel's Critical Response Process (2003). One student reflected upon Blandy's article (2012) that reports on the creation of a commemorative community garden in response to a gang shooting. In response, this candidate created artwork that helped him to process a childhood friend's suicide. He collaged physical memories (pictures, objects of shared hobbies, etc.) to honor his relationship with his friend, becoming its own piece of material culture. In reflecting further, this preservice teacher also imagined using their "method of collecting and sharing stories to help bring healing to students whose lives have been effected by drug use" as a way to bring change in their future classroom (Student participant, personal communication, October 30, 2016). Certainly, professional identities are tied to our inner worlds, as well as outer. (Pfeiler-Wunder, 2017)

Opening up the classroom to dialogue surrounding issues requires reflexivity and vulnerability, but one benefit to preservice teachers was evidenced in a note I received from a former student after she started teaching:

> *Thank you for modeling how to facilitate and engage in critical and difficult conversations. Because of our Contemporary Issues class, I have had the courage to navigate difficult conversations about issues that have arisen in my high school art classes. I was scared, but you showed me how taking this risk as a teacher is worth it (First-year teacher, personal communication, June 3, 2018).*

Provocations and Where to Go from Here

In these critical times, preservice art programs must be concerned with co-constructionist ideals of preparing teacher-leaders who understand the shift needed from disconnected theory toward authentic, real-world practice connected to materiality. In looking at the field of art and design education, there is concern that if we

are to support socially engaged, culturally relevant and informed practices that prepare candidates as needed agents of change, the meeting between the digital and materiality are necessary.

In some cases, art and design education programs may have moved in the opposite direction from punching holes in traditionalism and embracing new materialism. It makes sense that we must find ways to support the identity and effectiveness of artist-teachers by fostering their abilities as researchers, awakened by their connections through direct experiences with materials—whether in online or on-the-ground learning. Using design thinking models to support collaborative action research that fosters a constructivist, maker mentality along with art-based, visually reflective work in preservice teacher training can advance preservice teachers' dispositions as "innovators and future artist-leaders toward success and socially responsible action" (Ingalls Vanada, 2014, p. 4). Their ability to cooperate with material ways of knowing should not be separated from aesthetic experiences with art objects and art making, as ways that humans sense the world and make sense of the world aesthetically. In art and design education, we can shift and change as digital beings, while keeping a vital connection to materiality.

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Research Perspectives IN THE ERA OF Transformations

Experiencing (from) the inside – Mediated perspectives in kindergartens

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This paper presents a case study of preservice kindergarten teachers' use of new form of digital imagery. The paper introduces spherical cameras and digital microscopes and discusses their affordances when introduced in practical use in in teacher education and in kindergartens. The use in kindergartens was introduced through a class of 34 teacher students in kindergarten education. The students were specializing in Arts and design at Western Norway University of Applied Sciences. The use of images from spherical cameras and digital microscopes is discussed and analysed, based on data from student responses through two questionnaires, group presentations and discussions in class, and an analysis of various media material produced by students.

Keywords: digital images, spherical media, microscope, 360-images, kindergarten

Introduction

In this project we investigate visual representations made with two digital camera technologies: digital microscopes and digital spheric cameras. The first is used to look closely into visual details – *at* a specific point. The latter represents a complete visual sphere, as seen *from* a specific point. We report from a case study, where students have used these technologies, and discuss how pre-service teacher students are able to utilise these technologies with children in Norwegian kindergartens.

The case study's focus is inspired by Hans-Georg Gadamer's view on aesthetic experiences as processes of meaning making, where meaning making is understood as an integrated part of the interaction with an observable reality (Davey, 2015). Gadamer's notion of aesthetic 'experience' is nuanced through the German language, which distinguishes between *Erlebnis* and *Erfahrung*. Erlebnis is something one experiences, like an event, whereas Erfahrung point towards a result from reflecting upon the initial experience. Erfahrung is when the experiencer becomes aware of the experience – he has "acquired a new horizon" (Gadamer, 1993, p. 354).

When exploring a physical environment our experiences can be said to vary in accordance with perceived affordances (Gibson, 1979). Quite a few sensuous experiences are closely related to size, not only the size of objects and the environment itself, but also the size of the perceiver. When the basis for experiences are mediated – represented in a medium – the medium also come with their own technological affordances (Conole & Dyke, 2004). Experiences will always be influenced by huge number of factors and the interaction between these factors in specific places and situations. Two persons will never have exactly the same experience, even when being in the same place at the same time and/or being subjected to the same mediated representation.

In *Perspective as Symbolic Form* (Panofsky, 1991), the art historian Erwin Panofsky states that perspective literally means "seeing through". Knowledge becomes a matter of perspective, both sensuous and metaphorically. During the Italian Renaissance one defined art as dependent upon the artist's ability to manipulate the spectator's perspective for dramatic purposes (Bolter & Grusin, 2000, p. 26). Following the idea of manipulating and playing with perspective, we like to investigate how the two representative, visual methods can be used by students in their internship in kindergartens, to develop the children's understanding and mediated experience of particular spaces and places.

We investigate this process of experience and meaning making through the following questions. The first question addresses the immediate experience by or through the media:

1. How can images from microscopes and spherical images be used to create individual and/or shared *experiences* (Erlebnis) involving children in kindergartens?

By this initial research question we try to address how the students are able to utilize the different visual representations and whether these affords specific aesthetic qualities.

This leads to the second research question, which addresses more reflected experiences, most often represented by recorded media:

2. How do teacher students develop individual and/or shared *experience* (Erfahrung) through communication with children, mediated with images from microscopes and spherical images?

Both questions are investigated through media products, made by the students together with children, accompanied by a intervention in class and student feedback through pre- and post-questionnaires.

The concept

As individuals, we experience the world differently. As children we saw something else than what we do as adults. Our past experiences and interests affects our perception, but also specific conditions such as size and point of view will vary and affect individual experiences. When coming back to a place last seen as a child, many will express things like "I remember it as much larger". Thus our experiences of the world is connected to our own bodies, and even if a room stays the same the relation between the room and a body will change as an individual grow older (Merleau-Ponty, 1994 [1945]). When the basis for an experience is mediated we also have to consider how various media offer different technological affordances. Media may provide us with perspectives that would often not be available if we were to experience solely with our own body, regardless of the body's age or size. Still, mediated perceptions do not become replacements for bodily experiences, but they can work as extensions (McLuhan, 1964).

Understanding experience though mediation can be seen in light of John Dewey's discussion in *Art as Experience* (1934). Dewey understands aesthetic experiences as something that can be found in every aspect of daily life, as something that should be available to the masses, and thereby contribute to the development of society. Dewey believed that humans are shaped by their environments and the experiences they have, a perspective that can be linked to James Gibson's definition of *affordances*. Gibson understands affordances as what a specific environment "offers the animal, what it provides or furnishes" (Gibson, 1979, p. 127). Affordances can be understood as all the possibilities in an environment, independent of any individual. The environment can, however, be shaped by the actors being present at a given time and by the media and tools introduced in specific situations.

Dewey's understanding of aesthetic experience can be understood as meetings between actors, artefacts, performances, natural objects, etc, and the culture that surrounds them. These meetings will always include material qualities, including technological affordances, which also evolve through feedback from the aesthetic process itself. Thus, what we can characterise as design for experiences has to be understood as integrated with material, culture and previous, personal and collective, experiences.

The virtual gaze

The aesthetic representations given by the digital microscope and the spherical camera have in common what we can call a virtual gaze: we see the world and ourselves through technology (Rettberg, 2014). When spherical images is viewed through "VR glasses" the user look into another world, being visually isolated from from the physical surroundings. A kind of virtual gaze that have many similarities with the field of view

directed by the microscope. One can argue that these media, in different ways, create a feeling of being immersed by the media, even when the perceiver is in another time and place than the perceived object. This idea of visual immersion was proposed back in 1965 (Sutherland, 1965), and first realised with head-mounted displays (HMD) a few years later.

In this project our aim has been to investigate the potential of two mediated forms of gaze, and their corresponding visual perspectives: looking from the outside into small details and, on the other hand looking out from a point, inside a sphere. To achieve the look into details we have introduced digital microscopes. The idea is that the microscope narrows the view down to an extremely individual perspective – a very specific view, focusing on one small detail. The spheric camera does something almost opposite: from a single point the camera captures light from all directions, creating a picture that can be wrapped on the inside of a virtual sphere. The user of a spherical representation can later control the view and see in all directions – the visual representation has a defined visual standpoint, but no pre-selected perspective.

Figure 1 : The four different cameras used by the students. The spherical cameras to the left: Ricoh Theta SC (1a), Samsung Gear 360 (1b) and Nikon Keymission 360 (1c). To the right the digital microscope (1d). All these cameras are off-the-shelf consumer technology.

The two pictures below show two dimensional versions of images meant to be mapped on the inside of digital spheres. The pictures indicates some of the possibilities related to change of perspective when placing the user visually, literally inside an environment.

Figure 2: Two spherical images. The top and the bottom of the image are lines that become represented as points, when viewed with the proper software. The right side of the images also meet the corresponding left side. Thus these images can be seen as analogue to a Mercator-projection, as used to project a globe on to a flat surface. To the left (2a) is an image directly from the 360-camera, where the camera is placed at the bottom of a flower bed. To the right (2b) a manipulated image made from two spheric images: one taken from the inside of a three dimensional, physical map model, and the other showing the terrain at the site that the map i representing. The two images are manipulated into one with the map model in front and the image of the terrain in the background. These images, from a previous project, were among those

presented to the students to give them ideas about changes of visual perspective. These images does of course look very different when viewed on screen with the proper software[1], which maps the flat image on the inside of a virtual sphere.

The digital microscopes we use are specifically intended for children's use (Figure 1d). With a simple tap on the top of the microscope, you take a picture of the object you are examining. However, the microscopes had to be connected by wire to a computer. The pictures below show microscope pictures taken of details from a printed book page and a finger, details we can barely see with the naked eye.

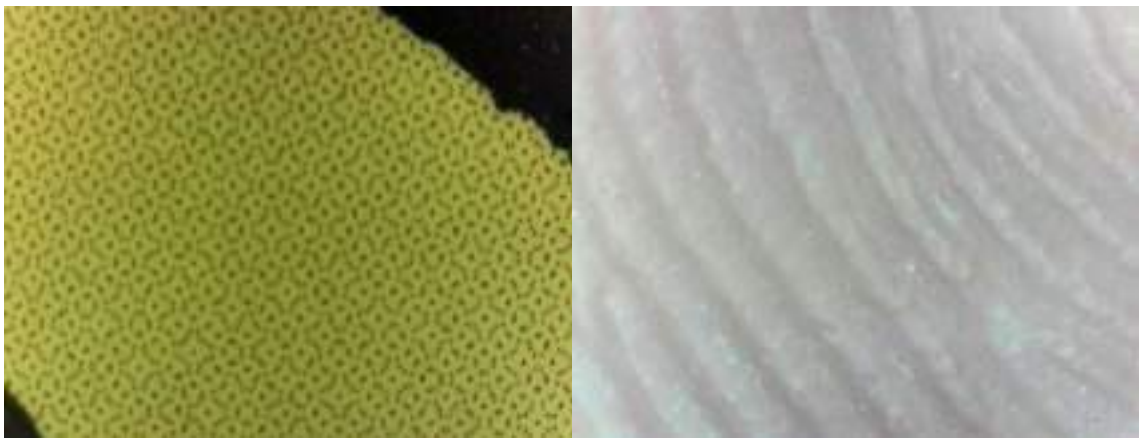

Figure 3: Magnifications taken by a digital microscope, showing a raster image on a book page (3a) and the pattern on the tip of a finger (3b).

The assignment the students were given in their internship was meant to encourage a playful approach to the use of digital media. When introducing digital technology there is always a danger that the digital artefact (physical devices and/or software) will limit the activity, play and imagination if the technology is given too much attention. The Danish drama teacher and researcher Klaus Thestrup has worked with the concept "media play", which he defines as children's play with the media they have access to (Thestrup, 2013, p. 66). Thestrup states that the use of a specific technology should not be given in advance, but be negotiated and changed along the way by the children. The goal, according to Thestrup, must be that children and educators investigate something they are concerned about (2013, p. 307). Researcher on children and media Stine Liv Johansen says that "One of the hallmarks of play is that it focuses on the process rather than the product, which unfortunately is rarely highlighted in play with digital media (our translation)" (Johansen, 2015, p. 86).

Our initial presumption was that students, when working with children in kindergartens, would explore the opportunities given by the different digital cameras. We also tried to encourage the students to offer these mediated experiences as an extension to playful, tactile and bodily experiences, not as an starting point or a final goal.

Findings

As soon as the students were beginning to get familiar with the technological aspects they were challenged to come up with some thoughts and ideas about how they were going to implement this during their internship. During their two-week internship in kindergartens, we asked the students to explore what it means to adopt different perspectives with the children. These perspectives could be created by physical means, and/or by mediated representations. The students visited eight different kindergartens, where the children range from one to six years. In their exploration of perspectives, we emphasized the use of physical materials, bodily

[1] Spherical versions: 2 – https://photos.app.goo.gl/6v6wycXYom3N1MH79 and 2a – https://photos.app.goo.gl/W7Vv2Xb7MR5H7USRA

exploration and the digital tools (spheric camera and microscope). After their internship, the students delivered pictures, "stories of practice"[2] and shared their experiences through group presentations.

Findings from pre-questionnaire and group discussions

The 8 student groups visited 10 different kindergartens. Prior to their internship, we let the students answer a questionnaire to get some insight about their previous experiences, reflections and attitudes regarding digital technology. The students were also able to write longer comments. We received a total of 29 anonymous responses.

10 students stated they had previously used digital technology with children, mostly by taking pictures together with the children. Most of the students were positive (17/29) to the use of digital technology in the kindergarten, some were more neutral (9/29) and only a few were more skeptical (3/29). Quite a few commented that digital technology is a large part of the children's life and therefore the kindergarten must take an active approach. None of the students thought the use of digital technology in kindergarten in general is too extensive. The students either said the use is at an adequate level (16/29), or that digital technology is being used too little (13/29). The students believed many employees in kindergartens have little knowledge about digital technology. Students commented on digital technology being used for the children to sit still (watching movies, playing a game etc.). This corresponds to national surveys conducted in Norwegian kindergartens showing the most widespread activities related to the use of digital media are about taking pictures, retrieving information, listening to music and playing games. It is less about creating something with the children. This is linked to the lack of competence among the employees (Jacobsen, Kofoed & Li, 2015, p. 78).

Only one student had previously used a digital microscope and one had used a spherical camera. We also asked the students if they were using Google Street View, given that this is the most widespread spherical media. We were somewhat surprised that none of the students seemed to use this service often (every week), in fact they either rarely used it (18/29), very rare (5/29) or never (6/29). Those who had used Street View mainly used it to get an impression of a place before they go there.

After answering the pre-questionnaire we lead the students to group discussions. Before their internship, we wanted them to discuss their starting point. The students already knew the children from their last internship. Roughly speaking, we can say the students planned for three different approaches:

1. Collect materials outdoors, and then examine them with the microscopes indoors. (This is much the same as we let the students do when introduced the microscopes. In other words, it is a way of working the students already know.)
2. Introduce the devices for the children, and then plan how to use them based on the children's input.
3. Working with concrete themes or materials related to activities they know the children like. This could be building with Lego or cardboard boxes, examining the body or reading a children's book.

Findings from student presentations and post-questionnaire

The following is based on students visual presentations and the teachers notes from the oral explanations given by the students in class. This part was finalised with a questionnaire where the students gave additional information on an individual basis. Here we received a total of 27 anonymous responses.

The students presentations were dialogic, and not following a specific structure. In the following we have organised some of the reflections and responses focusing on our interest in the affordances of the two media technologies: spherical cameras and digital microscopes. Each paragraph summarises the report form one

[2] «Praksisfortelling» or «Stories of practice» (our translation) is something similar to a personal field note, often used to make students reflect about situations they experience in their training.

student group. Not all groups are represented as there were quite a few examples of almost similar reflections.

Featured student experiences with digital microscopes

Working with the microscope the students asked the children what they expected to see before looking at the image on the screen. This became an engaging activity that kept the children interested for quite some time. Especially two children made many suggestions. The children did, however, experience trouble when trying to keep the digital microscope still and looking at the screen while the software counted down. This worked better when the students showed the children how they could work two and two together. The children especially enjoyed looking at books, and investigate the details that revealed how the printed colors and shapes are composed of raster. These details are hardly visible to the naked eye, and seeing these images was a new experience for the children.

One student group worked three times with the same group of children. The first time they used the microscope to look at food. The second time they chose the theme of body and clothing. The children got to explore this themselves, looking at skin, hair and different fabrics. The last time the children had to choose materials by themselves, and they ended with taking pictures of a book.

The students introduced a group of children to the microscope in a separate room. The children chose to take pictures of toy animals and pearl jewelry. The children were engaged, but a little impatient. Still, they kept on with this activity for an hour without anyone getting bored. Two days later, the same group wanted to try this activity again. This lead to further experimentation, and the children stated that they would like to do these activities on later occasions.

Featured student experiences with spherical cameras

The students made up a story about a fly on the dining table, as a way to introduce the children to a visual perspective seen through the spherical camera. The children found the story engaging, but as soon as the spherical camera was introduced it took away the immediacy from the experience. The children found it much more engaging to hide from the camera. These findings are somewhat consistent with what these students experienced with another group of children. They brought the spherical camera outside, and the children were to place the camera. The kids thought it was interesting to look through the camera, using the viewer built into the mobile application that can control the camera.

The students worked with two four-year-olds, who engaged in building a "fortress" with paper boxes. The students experienced that the children were more into playing, and less interested in taking pictures with the spherical camera. These children also found it more fun when they were allowed to take part in the picture, the idea of hiding from the camera became a showstopper. However, this may be caused by the fact that these students did not manage to control the camera from the app, making live view impossible.

One student group built a cardboard house, big enough to make room for number of other objects. The children enjoyed this activity, but as soon as the spherical camera was introduced some of the engagement decreased. The children did not put much effort in placing objects at specific places inside the house. The children did however show some interest when they were able to recognise the objects they had made, when the picture from the camera was shown live on a big screen. This inspired the children to create multiple installations with Lego figures, which they called exhibitions. The children put the figures into new contexts at several different places: in a box, on a table in a shelf, etc. On their own initiative the children asked that spherical pictures were taken.

One student told about how he was playing hide and seek outside together with three children. The children were sorry because they had to go indoors and the play was is interrupted. The student told the children he knew a way they could continue playing, even when being indoors. The student put up the spherical camera in a room, one of the kids hid and the others saw if they could find him on the screen. One of the children suggested that they could hide a doll instead. They hid the doll in turn repeatedly.

In one of the kindergartens the children had been introduced to tales about anthropomorphic characters where mice had a key role. The students showed videos of real mice, and talked with the children about how the world might look from the mice’s perspective. The students wanted to use the spherical camera to mediated the mouse perspective. They did however spend a lot of time setting it all up, and the camera ran out of power.

A group of boys found it fun to hide from the camera. They also hid the object in the picture and looked it up on the screen, on the mobile, afterwards. This group also found it engaging that they were involved in the location of the spherical camera. This way of working gave the children room for exploration and the students experienced good conversations and reflections with the children about how something looks when the camera was placed in different locations.

At one point one of the students moved the spherical camera out of the window. This way they could look at the same environment from two simultaneous perspectives: one by looking out the window, which became a kind of bird's eye view. The other perspective could be seen on the screen, a kind of frog perspective.

Post-questionnaire

The students were very consistent in their feedback that they would like to use digital microscopes later, when they start their professional career. They found the microscopes easy to use and catching for the children. The students were more skeptical for using spherical cameras. They tell about technical problems and adult-controlled activities. One of the students sums up their use of the spherical camera like this: "We didn't get the hang on it, and we thought it was difficult to catch the children. Probably because we lack knowledge and experience. I think this could be a nice activity with a little more planning and experience."

Figure 4:

"Do you want to use a microscope on a later occasion (when you start in the profession)?"

"Do you want to use a spherical camera on a later occasion (when you start in the profession)?"

Many of the students say they have gained new inspiration after listening to fellow students' presentations and that they now see new opportunities. When we asked the students "Have you changed your view on the use of digital technology in kindergarten?", their responses were reflecting that the students were either neutral or on their way towards more positive:

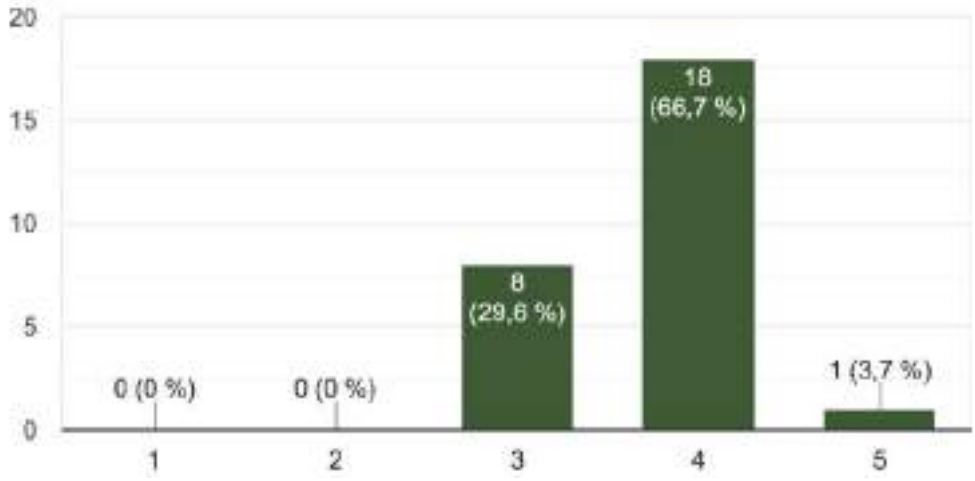

Figure 5: "Have you changed your view on the use of digital technology in kindergarten?"

The answers range from 1 – "More negative" to 5 – "More positive"

Despite technical problems, the students shows a positive view of on using digital technology in the kindergarten. "I am positive about using digital tools because society has changed so much today with regard to the technology and the development that is". The students, however, report that digital technology is not very visible in the kindergartens they visited. This is explained by lack of interest, finances or expertise. A student puts it like this: "The kindergarten had no experience with the use of digital tools, at least not the use of digital microscopes or spherical cameras. An employee had purchased a digital microscope one year ago, but she never used it. "

In the post-questionnaire the students were asked: "Based on your experience, what do you think about the use of digital technology in kindergarten you visited?"

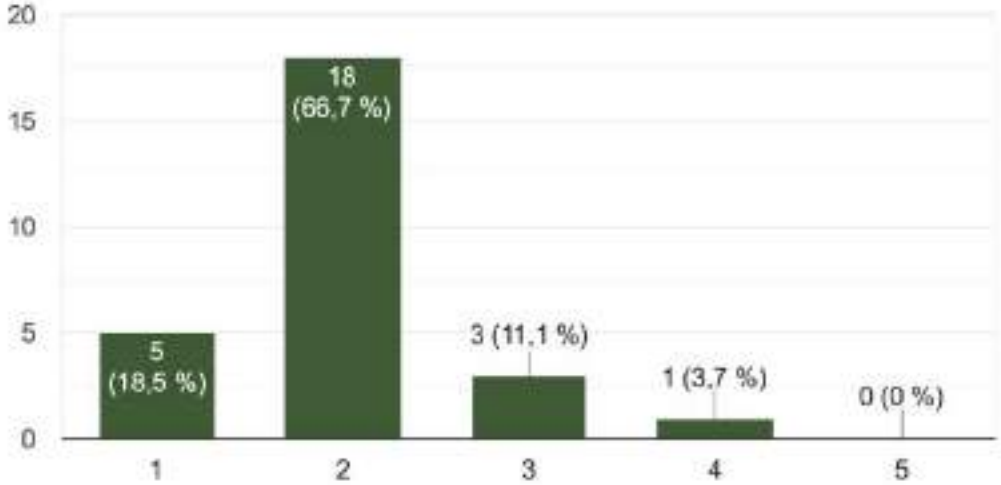

Figure 6: "Based on your experience, what do you think about the use of digital technology in kindergarten you visited?"

The answers range from 1 – "Used way too little" to 5 – "Used way too much"

Discussion

When comparing the students' reflections after the internship with their intended approaches, identified after the group discussions before the internship, we do see clear intentions that were brought into practice. However, not coming as a surprise: few things followed the exact plan, reflecting that learning design always has to give room for flexibility.

The first approach, defined through the first group discussions, focused on collecting materials to examine with the digital microscope: From their reports it seems like the students gave the children relatively large degree of freedom when being outdoors, collecting items to magnify. When bringing this material back to the kindergarten, working indoors, the spatial freedom became more restricted. This is clearly caused by the affordances (Gibson, 1979) introduced by the digital microscope, which has to be physically connected to a computer. The microscope itself can only be operated by one person at a time, but the operation is straight forwards and can be done by small children. The students were able to let one or a few children work together at the computer screen, or they chose to show the images through a digital projector on a big screen. During their test of the microscopes some students discovered that they were able to use the digital microscope as an ordinary webcam. We did not lead the students in this direction, but following the webcam-approach tools like webcamtoy.com can easily be used give the digital image completely new aesthetic properties (Conole & Dyke, 2004). This can open an exciting world of digital play (Johansen, 2015; Thestrup, 2013) where children can interact with the images in a number of new ways.

The second approach, where the students planned to introduce the devices and they play along with the children, came with a clear intention to allow the children to take more control. Especially when using the spherical camera one may assume that the activities could be controlled by the child(ren), given that these cameras can be operated through a smartphone or a tablet computer. The children might be allowed to place the camera, and then take the picture from a remote position, experiencing a specific situation and/or environment for two, simultaneous perspectives (Panofsky, 1991; Bolter & Grusin, 2000).

We did ask the students to try to avoid taking pictures where the children become visible in the picture. This is due to questions about minors, personal information and safety. This became a challenge as long as the spherical camera records information form a complete sphere. Our assumption that this could be developed into a kind of play, where the objective can be to hide from the camera, did only partly turn out successful. Some children found the hiding exciting, but quite a few took the complete opposite approach and found it more interesting to stage themselves in front of the camera. Some of the students characterised this playing with the camera as the children being in a "flow", where the children became immersed in the activity. The students also referred to aesthetic learning processes, reflecting that the introduction of the camera has an influence on processes, and that this brought something back to the learning environment.

The third initial approach was related to working with activities they students knew the children did like. One group in particular followed this approach, a plan that implicated a relatively high level of teacher control. However, even though the theme and the materials might be decided beforehand the following process did open up. One can argue that the key to a successful leaning design is likely to be found in the change between taking control (by the teacher) and opening up for various degrees of participation and control. The students reflected upon whether the smallest children were able to conceptualise the view from the camera and relate his to this perspective. Small children may find it difficult to understand the somewhat technical connection between camera and picture, especially if there is a delay between the action that is photographed by the camera and the time of viewing the final image.

When we introduced the students to the digital microscope and the spherical camera we did this with an assumption that this would introduce new ways of looking at familiar situations and objects. We were also hoping for some sort of division between the immediate experience, the images seen on a screen in real time, and a more reflected experience, when the images were played back after the represented activity was over. As it turned out we can clearly see a number of examples where this duality came into play, but most of the the students were not able to articulate these qualities in their feedback and through group discussion. Only one student did explicitly reflect upon this visual duality. However, he did not see this at the time when using the camera, but was able to see this in retrospect. The situation that triggered this reflection was the incident where a spherical camera was placed outside, below a window, providing an alternative view of the scene that the children were seeing from the window.

When it comes to the digital microscope the students had less to report. This may be because this camera technology did work without any significant problems – there were few pitfalls to talk about. We may also assume that the microscope was not considered a novelty, given that the digital version more or less replicate the functionality from analog microscopes. However, the possibility of bringing a live view of the image, up on a screen, for several children to see, do open for collaborative approaches.

According to the student reports the digital microscope did cause high engagement among almost all the children who were engaged. It is evident that all the children involved had an aesthetic experience, in the sense of Erlebnis. When it comes to the somewhat more distanced experience, Erfahrung, the students came up with few examples. One example did, however, stand out in particular: two student groups did emphasise that the children used the digital microscope to examine rasterized graphics in books. This look into detail reveals some specific features related to print technology, and thereby give the children insight in how images are represented in print, an experience that goes way beyond the immediate experience of what the image actually shows.

According to the Norwegian learning framework plan, the kindergarten is required to introduce technologies, learning materials and methods that can help children to experience in new ways (Norwegian Ministry of Education and Research, 2017). The students did feel that they were able to give the children new technological experiences, following the duality of experience (Gadamer, 1993). Some critics believe that kindergartens should be able to choose to use digital media on their own initiative, not that technology should be imposed through centralised plans. However, we will argue that the most important is what activities one facilitate and whether the children are really becoming active participants and contribute to the use of technology. Even small children have quite substantial knowledge about digital cameras and tablet computers. New camera technology catches another, but the children are often not allowed to use these devices by themselves. Digital competence varies in society and in this context kindergartens may contribute to reducing digital divides.

The students saw the use of digital cameras as an innovative activity for both children and adults in the kindergarten. It is, however, difficult to make a clear distinction between innovation when its comes to use and what can be perceived as innovation, but comes more from the novelty of the media and/or the technical artefacts.

One student group quite explicitly emphasised how the kids see a room, from another perspective than adults. They explained how they had used the spherical camera to represent three different points of view: a toddler, playing at the floor, a small child standing, and the room seen from the height of an adult, standing. The result became quite striking, and an eye opener. The students considered this something one can talk about in the collegium when planning activities and furnish the learning areas.

Several of the students reflected upon the possibility that a somewhat abrupt introduction of the cameras reduced the children's engagement. During their internship they did not have the time to see if the camera could be integrated in a way that the children saw as just another thing to play with, something that they could engage with as an integrated part of an overreaching activity. We saw quite a few examples of how children's creativity does often not lead to products, but tend to have greater focus on the processes. This process oriented approach may be further increased by digital cameras with preview possibilities, which invite to activities that can be conducted away from the camera itself and also favor real-time images without a specific focus on the image as a final result.

The students discussed whether it could have made a difference if they had used a tablet, rather than on a small mobile screen when working with the spherical camera. This seems like a very valid consideration. A larger screen would make it easier to work as a group, and a teacher might supervise the process from a little distance. In addition larger screens will give an interface that can be used by more children with challenges, e.g motorical, sight etc. On the other hand one often tend to look for more technology to compensate for observed deficiencies. From a learning design perspective it can be just as rewarding to work with the perceived limitations. In this case the small mobile screen, providing a limited, but also exclusive view.

Much of the feedback given by the students were concerning the spherical camera. However, this is not because this technology was the most functional. On the contrary, the digital microscope did blend much better into the activities in the kindergartens, and was more appreciated by both the children and the students. The digital microscope was a technology that all mastered, and it offered an immediacy that did not become as clear when it came to the spherical camera. The latter, even though on may argue that it holds a

stronger potential when it comes to change of perspective, did create some distance between the placement of the camera and the viewing of the images afterwards.

Conclusion

Through this project we wanted to find out how digital microscopes and spherical images can be used to create *experiences* (Erlebnis) involving children in kindergartens. We have looked at different visual representations and discussed some of their immediate aesthetic qualities. Further we asked how teacher students develop *experiences* (Erfahrung) through communication with children, mediated with images from microscopes and spherical images. We have looked at the relationship between recorded images, seen in situations that were distant to the events and places that are represented, and how the students were able to reflect upon this.

As expected, it is easier to point out experiences as Erlebnis from the students work in the kindergartens rather than what clearly can be called experiences as Erfahrung. The students found varied ways to use and utilize the digital tools, yet it is limited how many of them who move beyond what we introduced through the training, before their internship. Quite a few students have had children collecting materials, and examined these in the microscope. In their use of the spherical camera, they created various environments before taking pictures. To a large extent the students let their own knowledge and experience with the digital tools decide these activities.

From our findings it seems like the digital cameras could be used to facilitate situation where the Erlebnis-dimension of aesthetic experience became stronger. When it comes to the Erfahrung-dimension there are some indications that the spherical camera brought some other qualities. The more distanced view, in most cases seen in retrospect, do encourage reflection over immediacy. We are, however, not able to be conclusive given that similar qualities were found when looking at stored images from the digital microscope. Further and more thorough studies are needed to clarify the interplay between the media and the situation where the mediated representations are viewed.

The present study has not given exhaustive answers on how to use digital microscopes and spherical cameras in kindergartens. The use and integration of new technologies require both training and expertise. However, we believe that the present study points towards the practical use of digital tools and sharing experiences as ways to explore new learning opportunities, which also may lead to new educational methods.

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Research Perspectives IN THE ERA OF Transformations

Aarup 1960 and the poetics of materials

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All design has its own conditional modes of expression; however, these are realised through the maker's sense of the possibilities of materiality. This essay was inspired by a reclaimed piece of 1960s furniture designed in the modernist idiom, and is based upon autobiographical experiences, original works from own and contemporary aesthetic practices, and associated thoughts in the present. A completely new artistic expression was developed, which questioned the strict, use-defined style ideals and let shape reveal other values and statements than function. The intention of this essay is to put into words some of the cognitive processes in which creativity, critical reflection and the senses' experience-based insights may bring up something new. In creative work, the goal is not to reach a single result; every little discovery made by examining something specific could open up new worlds.

Keywords materials, modernism, post-modernism, meaning, arts based

Underneath the table top of what seems to be a nicely used piece of 1960s furniture that I recently bought is a stamp reading "O.P. Rykken & co, Øystese". The table stands shining in my living room; golden brown and perfected, with a pronounced elegant yet humble visual expression. As in the strophe from the hit song from 1963 written by Vidar Sandbeck and sung by Wenche Myhre says: it´s "a swanky girl on the path of life". There was no room for chit-chat or curlicues in 1960s design. Instead, it's a tight, consistent and unambiguous staging of the table's functional value; the properties of the material have become the fundamental essence.

In the hands of the maker, the material was given the chance to reveal its qualities of both strength and character in its own right. Dimension and proportion were balanced in a *to-the-point* and rational way. "The carrying and the carried" was a regular way of building constructions within functionalistic architecture. In furniture design, the essence was the *materials themselves*. Things were serially produced in a matter-of-fact and industrial way, without adornment or distractions, free from decorations that were found in the popular home-made traditional work. Materials were used with a simple and direct honesty, and even though surfaces could be given a veneer, it was a veneer made from real wood. Wood was wood and plastic was plastic. The praxis of the time can be called a *poetics of materials*, and held an infinite number of trials and solutions. It has accelerated through all epochs with the help of mankind's tireless curiosity and persistent activity, constantly working towards something new. With courage, a new age arose after the Second World War. The use of materials was naturally frugal and scarce, since so much to be rebuilt after the ravages of the war. The population was curious, ready to get rid of the old and invite in a new era, as if they were terrified of being *un-modern*.

The concept of modernity refers to an era that can be said to begin in the Renaissance, writes the philosopher Lars Fr. H. Svendsen in his book *Kunst, en begrepsavvikling* (Svendsen, 2000). He further explains how the style period of modernism began towards the end of the nineteenth century and continued into the twentieth.

Modernism represents the age of reproduction and a continuation of the age of technology. As a style expression, it grew from a reaction to the romantic and quirky forms of expressions that had emerged towards the turn of the previous century. Industrialisation, machine technology and rational form developed as a contrast to the swirly, handcrafted and romantic expressions of pre-modernism, which also accommodated the popular, pre-industrial visual expressions. "Post" means after. According to Svendsen, the age-after-modernism began as the Second World War ended. Even throughout the 1960s, an incipient postmodernism was developing within art, architecture and design simultaneously as honest and factual objects of modernism were finding their way into many homes

During this time, purist and cutting-edge opinions were formed by artists and designers. In this manner, one can detect how the style periods infiltrated each other. In retrospect, looking into the interpretations and retellings the style periods appears purist. Materials, colours, size and structures are used as elements in idioms that reveal *our* time. Postmodernism problematized modernist values and forms of expression by moving from one extreme to another. It recalled memories and allegations of the content of expressions that modernism, in its time, had dismissed as impure, ugly and seedy; ornaments merely regarded as decoration without purpose, or expressions of a criminal mind, which the Swiss architect Adolf Loos (1870-1933) stated in his lecture *Ornament und Verbrechen* in 1910 (https://de.wikisource.org/wiki/Ornament_und_Verbrechen. 20.09.2018).

Svendsen further explains how the distinctive features of modern times developed through "quotations" or imitations. Ornaments and decorations were re-adopted by borrowing from earlier times, manufacturers and artists. "Images that primarily refer to other images," as Svendsen refers to them (2000: 102). He writes about appropriations where the artist makes everything contemporary by adding their own work to part of the expression or by recreating an old motif through photography or paint. Dag T. Andersson justifies imitation or "mimesis" as "the force in all forms of play", and argues that "the mimetic urge" is expressed through our artistic activities (2001: 34). In this manner, the idioms of previous times were brought back, played with and re-examined in postmodernism.

"The basic features of the mimetic relationship to things is perhaps most apparent in craftsmanship," writes Andersson. "The methods of craftsmen are closely related to those of the artists. This clearly shows how a mimetic relationship involves reciprocity between man and things. The craftsman recognises the material's right to find its place through the object's shaping. The material may retain its remoteness even if it is transformed by the way the hand's work brings it closer" (2001: 34).

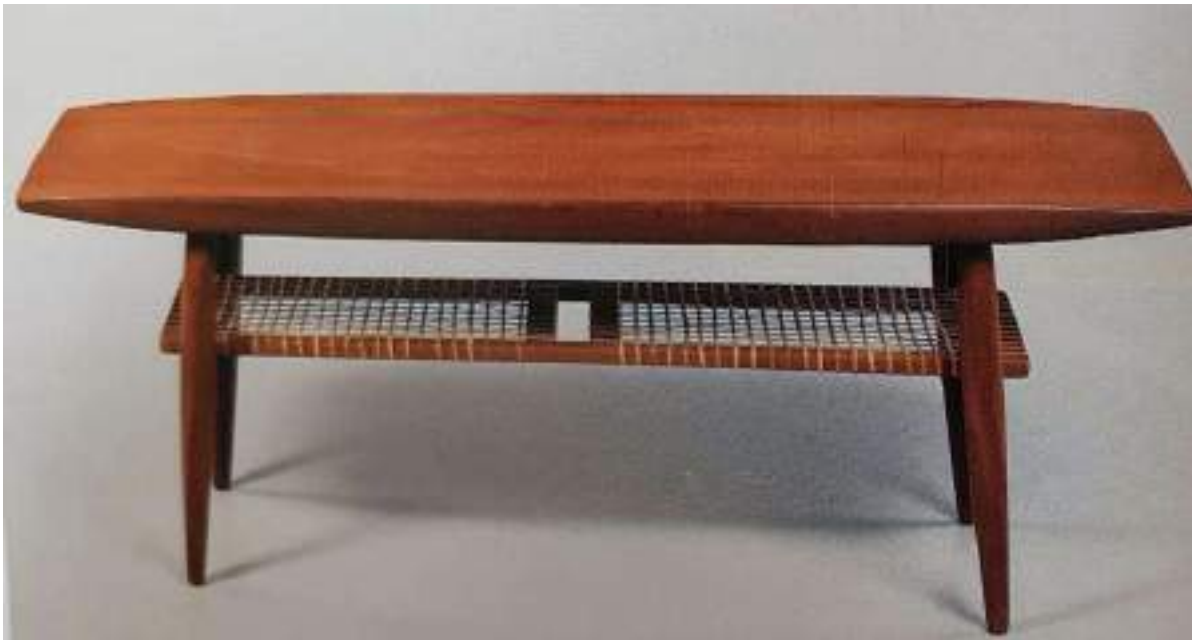

Figure 1. Aarup. Produced for IKEA in 1960. Source: Siesing, A.(2015, p.410)

I remember the 1960s. I experienced how saving materials and anything that could be saved was both normal and necessary. The 1960s still reflected the scarcity of materials after the war, with refashioned clothes and

worn-out rubber boots. We put newspaper in our rubber boots in the winter to try and protect our feet from the cold. But since the boots were full of holes from being used by older siblings, the wet and icy cold seeped into our toes anyway. IKEA was already in business and developing sensible and down-to-earth furniture for the average socially democratic family. The quality of their products must have been something completely different to what it is today, as their range included the Aarup coffee table: a wonderful 1960's idol (Figure 1:)

"Aarup is one of the finest pieces of Danish-made furniture produced in Sweden exclusively for IKEA. It has a quality of the construction, with lavish and rounded mouldings, solid undercarriage, and a newspaper shelf of braided rattan" read its advertisement (Siesing, 2015: 410).

Materials such as rattan and teak were used previously in modernism but in a completely different, simple and poetic manner, with small leaps, elongated arches and softly rounded corners. When combined, these features resulted in something tight and elegant. With this design, the production costs went down, and the object was made available to most socially democratic people. According to Svendsen, modernity is about the abolition of traditions. Wretched old things that the war hadn't finished off were finally thrown away or burned, everything reminiscent of hand-me-downs, worn-out shoes and walking home along long, winding roads. Norway was one of the poorest countries in Europe before the war. There were no busses or cars, only the high heavens and bitter cold. In my childhood home, we took nothing for granted. Internalised traditions of farming culture from the past was combined with pastel colours and modern checker tiles in the kitchen. New elements were added to "lydarmusikken"[1], which flowed from the Hardanger fiddles' mysterious, eternal tones.

Figure 2. Excample:18th century front cabinet. Source: private collection and photo. Source: private collection,photo: Håvard Gjernes

The eighteenth-century front cabinets became the inspiration for newer interpretations of more front cabinets (Figure 2). The last three variations were made by my father for my sisters-in-law and my sister in the 1990s. My aunts painted them in vibrant colours and this furniture lives on between us in a profound and old

[1] In folk traditions, music was communicated without sheet music. Instead, musicians listened to performances and played later.

happiness with its families. I was given a reproduction of one from the 1960s and it stands here, looming in heavy, Norwegian birch. The angular, stout and stabile structure, with its roots in times long past, casts a reserved sidelong glance at the swanky table, which bravely attempts to assert itself with its tropical woods.

This old table was restored before it ended up in the second-hand market. The table top is veneered with the finest teak, but if you take a closer look, you can see that it looks as though the construction is made of pine and stained with a teak-imitating colour. The look-alike-materials are chosen from exquisite subjects and the coniferous, edge-cut winter wood creates a pattern that can be mistaken for teak's sturdy, exotic wood grain designs. Take that, modernism! This piece of furniture pretending to derive from pure, exotic, imported wood is only a home-made interpretation of the real thing. The everyday pine wood board had to do the job once again. Yet, I forgive you little old table, because it's the form and shape that carries an object through time, and whether the materials are authentic is of minor importance. I must admit that I could be willing to drive far for an original 1960s Aarup from IKEA, one made from solid teak and real rattan, weighing 13 kg. Aarup was a rock solid, honest, industrial product, and its massive table top could have been sanded and oiled again and again. Perhaps one of them is waiting in a Swedish basement somewhere, longing to become real again. However, I can appreciate the aesthetics of necessity, and the notion of saving where possible, especially when creating something new. The swanky table is a design that has been imitated. It's a reproduction, a style-copy, whereas a 1960s Aarup was a role model. The only new aspect is the pine masquerading as teak. Skimping is skimping and that is okay. Why use valuable tropical wood when the whole thing can be recreated using home-grown pine from the shops? The understanding of art and the term "aesthetics" has changed since the second world war. Art is no longer unambiguous and true, and Svendsen explains how this has been phased out. He dismisses the notions of "true and divine", which had been understood and decided throughout all of modernism, and instead gives the power of the definition to the interpreter (2000: 25).

In 1936, the German philosopher and art theorist Walter Benjamin (1892-1940) published an essay called, *Art in the age of reproduction* (*Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit*). In this text, he highlights the circumstances of the human experience, when technology sets the premises. Benjamin used the term "aura" in his explanation of the relationship man has to things, which the philosopher Dag T. Andersson writes about in his book, *Tingenes taushet, tingenes tale* (2001). "Aura expresses an aesthetic relationship between man and things, between man and the world, in the way that there are relationships that do not concern the arts alone but any sensory relationship to things," he writes (2001:32).

Since the second half of the last decade, the circumstances for the material-specific, man-made objects have changed completely. However, our sensory relationship to things and their nature still lives in our encounters with them. All knowledge of the practical and living life rests in the human experience. In this manner, our worlds are built from our childhood and manifest themselves in a conglomerate of sensations, memories and experienced knowledge. We try and fail, perhaps by imitating what seems to be there; we copy and imitate, and examine and play with the possibilities in the attempt to get as close as possible to the nature of things, or "aura". Gradually we find the courage and insight to interpret the language of things, as we ourselves understand it. Ideals of different times frame our possibilities. Time opens up or limits our possibilities. It ties itself together with the act of existing, experiencing and conveying the world as we see it.

We express ourselves in everything we make and design, not just in what we articulate verbally or in text. This is why it is so important to design or make things in a close, analogue and one-to-one way. All things, all buildings and surroundings, say something about the spirit of time as it has been experienced, interpreted and told by the individuals that were present. Everything is there, still accessible for new experiences and interpretations. Through our personal and perceptual relationships, we bring everything into our world. "How do we experience what has no name, that is to say, that which is primarily experienced as definite?" Knut Ove Eliassen asks in his essay "Tingenes tale" (2008). He writes about how Foucault thematises "what we can call the meeting of 'things', meaning the experience and naming of them, but also our own experience and naming that through such meetings are made possible" (2008: 174). Bård Breivik (1948-2016) was an inspiring, contemporary artist from Bergen. He referred to his own specific experiences behind his meeting with the work he presented in public space in a lively way. As a sculptor, or maker, he concerned himself with matters of materiality and man-made. "The use of organic materials exposes a human and cultural intelligence," he said in an interview in 2015 (J. H. Landro in Veiteberg & Leppiniemi, 2016: 947). The poetry of materials lives in his understanding of intelligence.

For the designer, the artist or maker, material-based work and the sensory relationship to things drives the process. The senses interpret the materials through the sound of a sharp wood planer, the tactility of

processing a surface, the scent of an oiled shape. You experience a storyline of expression possibilities, which make themselves known and become concrete and understood, supported by the process that shapes them. Conditioned by our sensory relationships to things and the materials they consist of. We search for our things, we thoughtfully draw and sketch, always looking for something precise, for the result of our investigations into what is real and sensory to us; the definite. A careful process revolving around the realisation of inner imagination, made tactile and visible in physical materials.

In the craft of making furniture, the veneer was intended as a way to cut costs. My table is an example of this: the top was intentionally disguised to look as if it was made of teak, while in reality, it is only covered by a thin layer. This layer is glued on a core of some cheap, yet stable material. Veneer is a thin layer of wood, often 'sliced' off the tree-trunk, as one would peel a potato, in long strips down the length of the tree. The strips are then cut into suitable sizes for transport purposes and manageability. Under the finished veneered surfaces is a layer to ensure an even and stable surface. The second outer layer might be plywood, a very sturdy material made from gluing thin wood together, like 'layers' in Photoshop, but in alternating directions. Between these two layers, there might be pieces of wood lamellae lying next to each other, which defines the thickness of the board and is solidly glued to both the top and bottom layer. The reason the wood veneer is glued on is that it must be stable as the wood itself is unstable and hygroscopic. The material lives in the humidity of its surroundings and the cells of the wood absorb or release moisture, resulting in shrinkage or swelling. A newly cut pine board can shrink up to ten per cent. One of the challenges of working with solid wood is that the material continues to live on after it is cut and prepared. Wood craftsmanship has developed all sorts of methods and ways to use and exploit these characteristics. For example, a stile door is built with consideration of this, with tracks in the frames for the panels to sit in, so the wood has space to move according to its nature without bursting the frame apart. It is a respectful way of communicating with the material; no force and nothing falsified. The material is allowed to be what it is.

Insight into the possibilities of a craft and its ways of communication gives us the freedom to move closer towards materials and the aura of things. Treading hard on modernism's clean, purist toes was a strong need for those who came after it. With technical competence, we could make diverse and uncensored re-interpretations. We just *had to* get even after all those strict, cold and normative attitudes we had been exposed to during our art education. Elisabeth Engen, Lillian Dahle and I studied furniture design together in Bergen. For us postmodernists, the assertion that form must absolutely follow function was not just untrue but also wrong. A number of utterances and forms out there in history had been discarded as impure and as decorative crimes, stories that no one had properly listened to. We interpreted colour, ornaments, decorations and qualities of materials as a part of the communications things brought with them from present times. For us, this purity and unambiguousness sounded like a speech from a bygone time. During the 1970s and 80s, the speech represented boring, run-down and unacceptable content. It was like a relationship that you have grown out of or possibly never even felt like you belonged to.

Some things that belong to a particular time and that make up our lives are unchangeable. Other things are volatile, unpredictable and constantly changing, always on the lookout for something else. "Constancy and change means that something remains throughout change," writes Christian Norberg-Schulz in the introduction of his book *Stedskunst* (1996).

In his book, Noberg-Schulz writes about the "everlasting relationship between man and his surroundings", but acknowledges that they are "relations that must be interpreted again and again" (1996: 7). According to him, constancy and change contain all our possible conditions, both the given and the changeable. To be able to add adjustments and investigations as well as bear with the weight of such a re-interpretation, we must "listen" to the time we live in with open and undaunted senses. We must have the will, courage and capacity of implementation to develop our own expressions of our time and improve what we find wrong, humanised and imprecise. The book *Courage to Create* by the American psychologist Rollo May became a cult classic amongst artists and creatives during the 1980s (1975). May managed to put into words the risk of "being totally involved, yet attentive to the possibility that we might be wrong" (1995: 19). The paradox of courage is that it is accompanied with the anxiety of being mistaken; sleepless nights are never far away. May wrote about how this applies to all of mankind, not just artists. He encouraged us to commit to our imagination and

implement what art historian Anniken Thue described in a catalogue from 1986 as “furniture fantasies and fantastic objects.” [2]

My colleagues in the 1980s were Elisabeth Engen (her work: figure 4) and Lillian Dahle (her work: figure 3) They worked with wood in different ways to me, and with a closer connection to traditions of the craft, finding their expressions more closely connected to the actual materials themselves.

Figure 3."Heaven-earth" Small casket 1989© Lillian Dahle / BONO .Source: http://www.lilliandahle.no/ (03.04.2018)

Figure 4."Punk Furniture" PE. © Elisabeth Engen / BONO Source: http://seminarplassen.com/elisabeth-engen.htm (03.04.2018)

In my own work, wood was more of a raw material to be built and joined in rational ways. An infinity of imitations and lush floridities have been made: fluorescent ‘stone walls’, turning spiers, worked surfaces and areas where different qualities were forced into colourful fellowship, built and interpreted by memories and sensations. Thoughts and emotions about colour and form were reborn into new narratives of acrylic, steel-plastic and thick layers of paint. Experiments were ongoing in our working partnership. This was much to the shock and horror of all kinds of purists, and the modernists’ strict and normative view was given its deathblow. Out in the world, many have oriented themselves in the same landscape, such as the well-known Italian designer Ettore Sottsass and his Memphis-group. They designed the patterns of Formica and other design objects that were industrially produced. But we made our things by hand and had full control of our own workshops at our own expense and risk.

In my material-based reflections about the ‘speech of things’ was also a type of ironic humour. What I found especially funny was imitations of imitation. The anchor of authenticity and originality was completely rejected and made fun of. The idea of a pure material that safeguarded the unambiguous and rational function was done with. Imitations and loans were about bringing something back, investigating it once more with a particular view into form, colour and surface. The contemporary judges of taste, who were floating in the wake of modernism, tended to look down on and diagnose our utterances as ‘decorative’; this criminal, ugly and inferior luxuriant that could be traced back throughout my irreverent messing up of all clean and pure. The spectators’ interpretations were often steered by a lack of acceptance of knick-knacks and chit-chat. Any intimation of the function of things was judged in line with Kant’s tastes and overruled as ugly. My works were full of exaggerations and rabid claims. To soak a mahogany surface with thick-flowing, cobalt-pigmented paint was a deliverance dripping of materiality. You use what you have and do as you please, with no ‘master’ looking over your shoulder. Imperfect from a craftsman’s point of view: home-welded iron fittings in a rubbing disharmony with pastel colours for decorative purposes, hazel twigs and cow leather cushions. However, *Seating furniture for the culturally advanced* (1982) was purchased and still lives a quiet life in one of the

[2] The exhibition “Ting” Bergen + Festspillene in Nord Norge, 1986 was supported by Norsk kulturråd and Hordaland Fylke.

country's best-furnished homes. As the 2000s continued, our free-spoken expressions still produced a reaction. Especially from certain art historians, particularly the Swedish and Danish ones, as Jorunn Veiteberg writes in her article *Barbaric tendencies* (2004). Veiteberg refers to French sociologist Pierre Bourdieu's definition of barbaric taste when she writes about the difference between "the two tastes", which she refers to as different cultures. "What is valued in art has value in everyday life. The barbaric taste likes vibrant colours and things with a sensory appeal and is not afraid of sentiment or pathos," she says (2004: 81). She claims that the reason Norwegian artists shook the other Scandinavians lies in our culture. The "barbaric tendency" lives and thrives in the close relationship many of us have to peripheral and scarce folk traditions and wild nature, far away from the avenues of the Swedish and Danish bourgeoisie. Yet, when at public get-togethers, I often meet my works interpreted and exhibited fore mostly as functional objects. My "barbaric" fantasies about things in their own right and speaking subjects are reduced into harmless and almost futile curio cabinets, such as in *Store norske leksikon*: https://snl.no/Liv Mildrid Gjernes (06.11.2019). If *Silver birch for the asphalt jungle* (figure 5) was shown in a similar manner, it must be to reduce the sensory, poetic and sentimental that this thing speaks of.

Figure 5 . "Silver birch for the asphalt jungle" 1986.P.E. Denmark. Source: The artist´s collections
© Liv Mildrid Gjernes / BONO Photo: Rolf M. Aagaard for Aftenposten, 1987.

The birch pictured above is imitated. Its core is wood and its surface is built from steel-plastic and paint. The crown is adorned with aluminium leaves and acrylic paint. It has an inner space that one can carefully open up and close.

In 1985, a selection of my works was displayed at the international exhibition *Homo Decorans- the decorating human* at Louisiana outside Copenhagen, alongside works from the Memphis-group and a number of other contemporary artists, designers and architects from around the world. At this point a comprehensive

movement has developed. Its form reflected many modes of expression and was at least something with a more comprehensive content than modernism's ascetic mirroring of function. It was described as "critical design" or "radical design" in Europe (Hauffe, 1996). My distinctive career as a designer progressed for a number of years with many exhibitions and commissions. Elisabeth Engen and Lillian Dahle are still working on their own. Towards the end of the twentieth century, globalisation and internationalisation eventually led to a launch of competition against poorer countries. This again, led to a wretched situation when it came to working with crafts and material-based things. What Bård Breivik named "a human and cultural intelligence" was on request for tender and pulverized into the currents of globalisation at the same time as, according to Svendsen, the field of art was discontinued. Art became theorised and removed from the concrete by letting the idea or concept carry the meaning. The continuation is difficult to distinguish, as today digitalisation and computer technology challenge our occupation with "materials, time and space", writes Dag T. Andersson (2001).

Technology's pervasive impact on man's relationship with the world progresses unscrupulously. "Not only the arts changed due to technical innovations, but our opinion of matter, time and space became something else," Anderson writes. "New technologies make it possible to exceed the limitations set by the materiality of things. By violating the remoteness of things, technology invades the very nature of them (p.33)(…) things lose their aura when the invasion of technology destroys their remoteness, when the ability to reproduce robs them of their autonomy and their unique character," he continues in his interpretation of Walter Benjamin (2001: 35). Benjamin considers the aura to be a historical phenomenon that must be understood in the context of how humans' relations with the world have historically changed" (or in time, as I understand it). The aura protects the intrinsic value and individuality of things: "It is a question of whether man's individuality is as threatened in a society where things are reduced to goods," says Andersson (p.35).

During the process of restoring my swanky table, the thin teak veneer that covers the table top has been sanded so much that it is now worn down. When the consistently precious tropical wood appears as a shield and stuck on a wood board, the quality of material is dramatically reduced. In these days, table tops given a name such as "Ash", Oak" or "Teak" are made from plastic laminate. They are photo reproductions of the relevant materials, embossed and transferred onto plastic veneers, and bonded to a stable sheet of material in the appropriate thickness. Completely maintenance-free and stable, it is a dead copy of the living. Plastic is plastic, and in laminate it appears to be the king of all imitations. Only those who know the sound, fragrance and taste of wood will in most cases detect the difference. The imitation of material is so well done that even a cabinetmaker might have to whittle or bite it to discern if it's counterfeit.

Veneers can be cut into thin layers from all sorts of wood. "Images" formed by weaving different colours and wood varieties into intricate patterns are called intarsia. Hardening oil salvaged the remaining 1-2 mm of thin, peeled veneer on my battered and sanded table. Originally, the surface was most likely confirmed with a highly polished cellulose lacquer, which in its time created a smooth and shiny layer over the precious wooden surface. Well, until someone who has a strong drink and spills a little of it. The cellulose lacquer was soluble in spirits, and this would soon create rings and blemishes on the shiny surface. Eventually, plastic lacquer was invented. It withstands alcohol and most chemicals as it cures into plastic, just like wood glue does. The plastic coating does not understand that the wood is living matter. A small notch or crack in the varnish is enough for any moisture to reach the wood. Wood will, in keeping with its nature, swell, and the varnish will crackle. This problem particularly arises on soft woods, such as pine. The next solution was therefore to give the entire surface a coating of plastic. Wood was photographed and recreated in thin plastic flakes, ready and self-sufficient in its counterfeit form.

Within the traditions of furniture cutters, horn glue, or hot glue was used. Horn glue is organic and after it has hardened, it can be turned into liquid again, allowing parts to be disassembled with the help of heat. It's the drop in temperature that causes it to harden. The possibility of being able to replace, repair and correct parts allows for a longer lasting object. Today, the plastic product, glue, is also used. It cures as the moisture in it evaporates and becomes an unchangeable plastic. Once this has happened, there's no going back, and the piece of furniture cannot be dismantled without ruining the work. Anything that can be used can be discarded. Wood glue or PVA glue consists of plastic particles and cures as the wood and air in the room draws in the moisture of the glue. This plastic glue is the grief of conservators. Woodwork glued or veneered with old-fashioned glue consisting of horn/hooves/organic material can be salvaged. Since horn glue can be reheated and re-melted, the parts may be carefully taken apart to remove a woodworm-infested part and replace with a fresh piece. Just as gently as removing the old piece, a new piece can be added before glued together.

The slender wood table legs with brass extensions on my little reclaimed table are painted black. The underside of the furniture board that makes up the table top looks to be covered with flame-birch veneer. Tropical woods were readily available in the 1960s. During my crafts education in the mid-1970s, we worked exclusively w Norwegian woods. The warehouse probably had the occasional teak plank, yet the main supply was first-grade carpenter pine of a quality that you have to go to specialist sawmills to get your hands on these days. Formica, the definitive plastic material that was glued to an underlying sheet with a contact adhesive or synthetic resin adhesive, was also invented in the 1950s[3]. The underlying sheet was chipboard and consisted of wood shavings and glue mixed together into a mass that was pressured and hardened into sheets of low-tensile dead material. Formica solved the problem of surface durability, since it consisted of plastic that tolerated both stiff drinks and other strong beverages. During my childhood in the 1960s, the old long tables were eventually replaced with modern Formica-laminated chipboard boards on steel legs, in addition to the living room's coffee table in the wood type teak; shipped in from the tropical latitudes of the Norwegian merchant fleet.

Figure 6. "The Oak Place". Leirdal 2008.Source: http://www.erlendleirdal.com/ (03.10.2018)

The Oak Place is the name Erlend Leirdal has given to the wood trunk he exhibited at the Trøndelagsutstillingen in 2008 (figure 6). An oak tree trunk: big, heavy and resting in its own strength. It just lies there. Throughout the 2000s, the expressions of materiality have moved further away from any interpretation of function and utility, and back to oneself and its possibilities. One needs no other experience than touching it, leaning on it, smelling its scent and perceiving the timeless willpower the wood holds for our senses. I see a strong optimism in this expression.

[3] Respatex (or Formica) is a previously registered Norwegian trademark of a high-pressure laminate of composite produced by Norsk Hydro from 1958. (https://no.wikipedia.org/wiki/Respatex 14.01.2017)

Figures 7 and 8: "Furniture for wonder and conversation", 1997-2007. Liv Mildrid Gjernes. Source: The artist´s collections Photo: Liv Mildrid Gjernes.

For me, it was still about the problematisation of meaning and function towards the turn of the century, as shown in my series *Tuntre* (1997-2002). Tree trunks, equally remaining and surviving parts of something. They still have an "added value", as Austring and Sørensen call it (2006), even though it is simplified. What do visual expressions convey, regardless of time and technology? What meaning and values can we gather from their structures and autonomy? For the speech of things is addressed to us in a direct and completely physical way, in a communicating all their being, completeness and absolute presence. The way things meet our senses, the feeling of space, and the skin's sense for materials is something in itself. In our ears, materials have their own sound, as materials meet our aesthetic experiences with their offers to experience form. They blend in with our experiences and memories, and let their solid materiality frame our lives and tightly contain our history. Expressions in which form manifests meaning has followed mankind throughout time. As a historical phenomenon, and in present and concrete expressions, form and materiality have safeguarded and represented what Andersson describes as a "completely sensory relationship to things" (2001: 32).
All that has given shape to the importance of things in itself is also the medium of our own experience of being in the world. Thus, one can see that the poetry of materiality holds an infinity of trials, possibilities and potential solutions that are driven by emergency, urgency, a need to communicate and restless curiosity. What man-made things can bring to us can be reviewed by new eyes in the future. Such as this little table dressed in the subtle language of the 1960s. It was produced in a series by a small furniture factory established in Øystese in 1913. They were originally called O.P. Rykken & co Furniture Factory and later renamed RYBO (http://www.matslinder.no/2018/09/18/rybo-reklame-for-sybord/ 25.09.2018). As chubby pine furniture of the 1970s filled Norwegian living rooms, this small table was degraded into a room of less importance. However, it was not discarded, and through unknown paths it has retold its stories here in my room, 50-60 years later. Let us look at it once more, with new eyes, as it sits beloved and harmless in the afternoon light, enthroned in its 60's matter-of-fact aura. It rests here now, in our common story about the speech of things.

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Introduction Track 6.b: Design Literacy enabling Critical Innovation Practices

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Norwegian research group Design Literacy at Oslo Metropolitan University (OsloMet) which is led by professor Liv Merete Nielsen has initiative to this paper track. The paper track was accompanied by a workshop.

Design Literacy can be regarded as a catalyst for a move towards a better citizens participation in innovative design processes. By educating the general public to become design literate, there is a chance to support critical innovation and a possible move towards sustainable societies (Stegall, 2006). The challenge is to articulate content, performance and continuity for a critical decision-making process and how this influence critical innovation and design education at large.

The concept 'Design Literacy' addresses the complex matter of objectives, content and practices in design processes and education. Research on multiple literacies has evoked considerable debate and redefinition within several areas of educational research (Coiro et al. 2008); the understanding of literacy is no longer bound to the ability to read and write verbal text or numeracy. Design Literacy (Nielsen and Brænne, 2013) are among newly coined literacies. Design Literacy is connected both to the creation and understanding of design innovation in a broad sense. In today's mostly artificial world, the Design Literacy is regarded as a competence not only for the professional designer, but also for the general public in their position as citizens, consumers, users and decision makers in innovative processes.

Designed artefacts and services influence our lives and values, both from personal and societal perspectives. Designers, decision makers and investors hold different positions in the design process, but they all make choices that will influence new innovations and our future. In order to solve crucial global challenges, designers and investors must cooperate; for this purpose, we argue that design literacy is necessary for all. We argue that the Design Literacies can support practices associated with innovation, democratic participation in design processes, developing and enacting ethical responsibilities, and understanding and supporting sustainable aspects of production and consumption.

The track called for researchers to explore the following points:

- How development of Design Literacy can support critical innovation and sustainable issues
- Progressions in scaffolding Design Literacies from a pre-school to a university level
- The potential of Design Literacy to support collaborative and experimental approaches of projects between: investors/designers, general public/designers, children/designers

- How design education for the general public can represent both a foundation for professional design education and a prequalification for lay persons' competence for decision-making and critical innovation
- How might Design Literacy influence sustainability issues in society?
- What are the challenges of professional design, when everyone wants to design?

Research presented at this track addressing the points above have been useful as a point of departure for the Design Literacy workshop and the creation of the Design Literacy International network. The papers have also been useful for the promotion of critical innovation and to inform policy and for educational implementation. The importance lies in the needs to better inform design education itself, to improve the approach of design educators, and to educate reflective citizens, policy makers, entrepreneurs and consumers in perspective of critical innovation.

Eleven papers were accepted and gathered researchers from US, New Zealand, Australia, Chile, Finland, Portugal, UK and Norway to explore the concept Design Literacy through three sessions.

Eva Lutnæs (OsloMet - Oslo Metropolitan University, Norway) authored the first article *Framing the concept design literacy for a general public*. She explored the concept design literacy from a general public perspective. Asking the question 'What does it mean to be design literate in a context of critical innovation' she reviews three key texts storylines on how to cultivate design literacy and arrives at a definition of the concept design literacy for a general public. Lutnæs was awarded Top III Paper submissions for her contribution to the conference. Her paper was used as a point of departure for discussions in the Design Literacy workshop.

Miika J. Lethonen and Jia Jing Chew (Aalto University School of Arts, Design and Business and Aalto University School of Business, Finland) wrote the paper *Developing design literacy for social agency*. They look into how multidisciplinary teams of students in higher education develop their design literacy in an action-oriented course setting. Based on their initial analysis, blending the boundaries between universities and the surrounding society positively contributes towards developing design literacy. The contribution of design literacy to non-designers in higher education is preparing a workforce that is well-equipped with the skills and knowledge to navigate the complexities of our global human society.

Chris Pacione (LUMA Institute, United States of America) presented *A Framework to Accelerate Universal Design Literacy*. He argues the design is poised to become the next universal literacy. Just as arithmetic was once a peripheral skill until the industrial age brought about the need for math literacy, the socioeconomic conditions of our current age are heralding the need for millions of people to level up in design. The expanding role innovation and collaboration play in our daily work, combined with the ever-increasing complexity and rate of change of today's products, services, and systems are making the case for design literacy. The paper propose a framework with a set of skills to accelerate design literacy.

Úrsula Bravo (Universidad del Desarrollo, Pontificia Universidad Católica de Chile) and **Erik Bohemia** (Oslo Metropolitan University, Norway) wrote the paper *Representations of Design Process* where they argue that visual representations of design processes contribute toward social and material practices of design(ing). Metaphors was used to illustrate that they are active material devices of which circulation, production and consumption are informed and informing perceived complexities, ambiguities and paradoxes associated with design. These models can contribute to the development of Design Literacies. Bravo was awarded Top III Paper submissions for students.

Randi Veiteberg Kvellestad, **Ingeborg Stana** and **Gunhild Vatn** (all from Oslo Metropolitan University, Norway) had written the paper *Working Together - Cooperation or Collaboration?* where they elaborate on the difference between cooperation and collaboration through an action-research project in design education for specialised teacher training in design, arts, and crafts. At the Oslo Metropolitan University including the material areas of drawing, ceramics, and textiles. The project developed the participants' patience, manual skills, creativity, and abilities, which are important personal qualities for design education and innovation and represent cornerstones in almost every design literacy and business environment.

Anita Neuberg (Oslo Metropolitan University, Norway) presented her paper Social innovation for modified consumption by means of the school subject Art and craft. In her paper she asked: How can we, based on the subject of Art and craft in primary schools, facilitate the change in consumption through social innovation? Opportunities for actions were discussed under the subject of Art and craft, in Norwegian general education, ages 6–16.

Fiona Peterson (Auckland University of Technology, New Zealand), **Cathy Lockhart** and Catherine Raffaele (both from University of Technology Sydney, Australia) had written the paper *Adaptive digital capability* development*: Professional learning for educators across disciplines*. In a cross-university project, a mixed methods approach was adopted to design a learning model for digital work practices in line with evolving industry needs. Their responses indicated a predominantly functional digital capability focus in their current learning and teaching practice; rather than integrating functional, perceptual and adaptive digital capabilities, which are in high demand but short supply in industry. They argue it is vital for students and educators to learn and use the vocabulary of technology affordances, to strengthen professional learning for digital work futures.

Rebecca Kelly (Syracuse University: VPA, School of Design, United States of America) presented her paper *Democratizing Design: Can Higher Education Survive?* She claims that the tools and techniques of graphic design have become accessible to the public at large to such a degree that the profession itself may be threatened with extinction. At the same time, design literacy — the knowledge and reasoning beyond the use of those techniques — does not seem to be experiencing the same widespread dissemination. Educators must be innovative in order to prepare a new generation to evolve quickly and continuously. Programs must be fluid and adaptable, which requires educators to treat their curricula as design problems, to be solved with radical thinking and creativity.

Lars Groeger (MGSM, Macquarie University, Australia; 2: RWTH Aachen University, Germany) and **Jochen Schweitzer**, **Leanne Sobel** and **Bridget Malcolm** (all from University of Technology Sydney, Australia) had written the paper *Design Thinking Mindset: Developing Creative Confidence*. Their study examines the effect of an experiential Design Thinking (DT) learning environment on the development of a DT mindset. They analysed the extent to which key attributes of a DT mindset are understood, evaluated and assessed. They provide a framework for learning objectives and exemplary activities to teach and encourage designerly ways of thinking and doing in business education is provided, and argue that a mindset that embodies DT can address deficits in business school education, better preparing students for future work.

John Richard McCardle, **Samuel Dempsey** and **Max Humberstone** (all from Loughborough Design School, United Kingdom) had written the paper *Stressors and creativity in Industrial Design practice*. Current literature suggests that stress influences creativity, and current views are clearly divided on whether any negative effects on creativity are more dictated by environmental stressors or the reactions of individuals whilst under stress. In their study, participants completed a questionnaire comprising of a perceived stress scale and thematic questions. The results suggested that participants who identified as being more affected by their own negative reactions to stress displayed a lower calibre of creativity when time-pressure increased, whereas the participants who were suggested to be more influenced by their environment remained at a relatively constant perceived level of creativity.

Tore Andre Ringvold and **Liv Merete Nielsen** (both Oslo Metropolitan University, Norway) had written the paper *Complexity, interdisciplinarity and design literacy*. For decades, global organisations and researchers have pointed to interdisciplinarity as a way forward for educational systems. Educational research offers great possibilities and gains for students involved in interdisciplinary teaching and learning processes, and the interdisciplinary nature of design thinking and practice can play a vital role in interdisciplinary general education. This paper explores how future scenario-building, as part of general design education, can serve as a framework for inter-disciplinarity in general education and contribute to a better understanding of complex problems, challenges and design literacy.

Irene Brodshaug and **Janne Beate Reitan** (both Oslo Metropolitan University, Norway) had written the paper *Networking for strengthening design literacy*. This paper focuses on design education for the general public and the ways in which students and teachers can become more design literate through the development of networks, such as professional groups for teachers. The emphasis of this study is on how each municipality gives time and space for the development of design competence through professional groups. A well-organized professional group will hopefully contribute to a deeper level of expertise in schools and an increased ability for the general public to recognize design education.

Catarina Lelis (University of West London, UK) and **Oscar Mealha** (University of Aveiro, Portugal) had written the paper *Developing design literacy through brand-based artefacts.* They state that the brand is a powerful representational and identification-led asset that can be used to engage staff in creative, sustainable and developmental activities. Being a brand the result of, foremost, a design exercise, it is fair to suppose that it can be a relevant resource for the advancement of design literacy within organisational contexts. The main

objective of this paper was to test and validate an interaction structure for an informed co-design process on visual brand artefacts.

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Framing the concept design literacy for a general public

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Educating the general public to be design literate can be a catalyst for both environmental protection and degradation, human aid and human-made disasters depending on how the scope of design is framed – and how 'design literacy' is defined. This paper explores how to cultivate design literacy that supports critical innovation and a transition towards more sustainable societies. The research approach is a literature review of key texts that promote and conceptualize design literacy as part of general education. Four narratives are identified as vital: **a) 'Awareness through making'**, **b) 'Empower for change and citizen participation'**, **c) 'Address complexity of real-world problems'**, and **d) 'Participate in design processes'**. Moving towards more sustainable modes of consumption and production, a design literate general public provides a critical mass of users empowered to question how a new innovation supports the well-being of people and the planet and to voice their own ideas.

Keywords: design literacy, literature review, critical innovation, general education

Innovative design or critical innovation?

Progress depends upon the products of educated minds, stated UNESCO (1997) and launched education as humanity's best hope and most effective means towards sustainable development. Stephen Sterling (2001), however, claimed that: "most education daily reinforces unsustainable values and practices in society. We are educated by large to 'compete and consume' rather than to 'care and conserve'" (p. 21). Educating the general public to be design literate can be a catalyst for both environmental protection and degradation, human aid and human-made disasters depending on how the 'design literacy' is defined and how the scope of design is framed. It makes a vast difference whether students are asked to design beautiful products to increase sales or to design useful and lasting products or services that improve quality of life and mitigate pollution. Vande Zande (2013) defined innovative design as a unique solution that creatively satisfies a problem. A valuable outcome of introducing design techniques of ideation to companies is how unique solutions might advance economic competitiveness and success in a globalized market (Canina, Coccioni, Anselmi, & Palmieri, 2013; Martin, 2009). Judged meaningful in terms of business, innovative design, satisfy just one out of three mutually reinforcing pillars of sustainable development (United Nations, 2002) at the expense of social development and environmental protection.

Citizens of Western societies are facing what Stegall (2006) described as an: "extremely complex sociological dilemma, where the lifestyle that we have adopted is rapidly eroding our ability to survive" (p. 57). At the level of social equity, it would be favourable that all citizens of the world have the same economic vitality, but the capacity of the ecological system is already at its limits. Infinite economic growth, irrespective of its wider consequences, threatens not only social well-being and ecological sustainability, but also economic prosperity (Jackson, 2009; Meadows, Meadows, & Randers, 1991). Mateus-Berr et al. (2013) argued that designers have

played a considerable role in shaping today's consumerist culture by providing their skills and talents to create desire for new products. Design literacy will remain a driver of economic competiveness unless concerns for the environment and human well-being are made an explicit part of judging new ideas as meaningful or valuable. Mainstreamed as three equally important pillars, the global sustainable development agenda has focused too much on economic development, marginalizing both the social and environmental aspects (SANZ, 2009). We have not yet been ready for the task of large-scale changes in our unsustainable ways of living (Giddens, 2011; Intergovernmental panel on climate change, 2018). Critics called for a paradigm shift in which economic development is nested within social sustainability and environmental sustainability (Elmquist et al., 2014). Applying the paradigm shift as a baseline to design literacy requires critical scrutiny of how a newly proposed innovation supports a transition towards a more sustainable future. In the model below, critical innovation satisfies criteria of economic vitality, welfare of current and future generations, and safeguarding of the ecosystem:

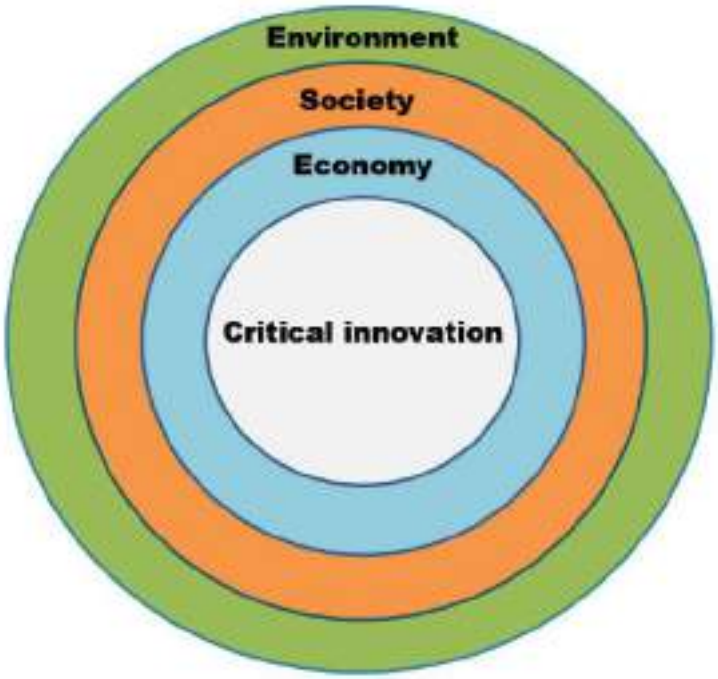

Figure 1: Critical innovation as nested within economic, social, and environmental sustainability

Relating the concept 'critical' to 'innovation' requires the facilitation of critical reflection as a baseline to any design process. Critical reflection addresses the fundamentals of practice, the why of action, and the reasons and consequences of what we do (Mezirow, 1990, p. 13). Critical innovation derives from asking basic ethical questions of how a new idea makes the world better and rejecting practices of overconsumption and destructive results of human creativity. Critical reflection called the foundations and imperatives of the system itself into question, assessed their morality, and considered alternatives (Brookfield, 2010, p. 219). The purpose of critical reflection is profound change in our attitudes and actions. Design and critical reflection share the same transformative agenda. In his seminal book, *The Science of the Artificial*, Herbert Simon (1969) described design as concerned with how things ought to be. The capacity to transcend the known is the expertise of design. According to Simon (1996): "Everyone designs who devises courses of action aimed at changing existing situations to preferred ones" (p, 111). Including design in any curricula fuels change by exploring and questioning existing knowledge and situations. In support of critical innovation, however, further effort is required. Critical innovation calls for everyone first to consider what situations to change, then the socio-ecological consequences of intended change, and who would benefit from a specific situation changing. Critical reflection is a key component to support a transition towards more sustainable modes of production, trade, and consumption. This paper explores how design literacy as a part of general education can support critical innovation and a possible move towards sustainable societies (Stegall, 2006). The research approach is a literature review of key texts that promote and conceptualize design literacy as part of general education. None of the texts synthesized the concept of design literacy into an explicit definition. By reviewing

the key texts' storylines on how to cultivate design literacy, this paper aims to articulate a definition of design literacy for a general public in a context of critical innovation.

Storylines as a method of inquiry

The literature review of key texts on design literacy for a general public is derived from Soini and Birkeland's (2014) approach when investigating the scientific discourse on the concept of 'cultural sustainability'. They used storylines as a semiotic tool to identify generative narratives used to give meaning to specific physical or social phenomena within a discourse (Hajer, 1995). The narratives in this study aim to give meaning to design literacy as a part of general education within the scientific discourse of design education. The discourse refers to ideas, concepts, and categorizations that are produced, reproduced, and transformed in the practice of writing academic papers. As a method of inquiry, storylines encompass complexity and provide a semiotic tool to voice different narratives in a specific discourse.

The first phase of the literature review identified papers that could inform the research question based upon the following criteria for selection: (1) incorporates 'design literacy' into the title, (2) focus on design literacy as part of general education, (3) enacts ethical responsibilities and critical reflection, and (4) written in English. The first criterion delimits the selection to papers in which authors have made design literacy one of the main concept. The second and third criteria ensure papers relevant to explore how to cultivate design literacy in general education and educate a general public empowered to support critical innovation (Figure 1). The fourth criterion enables transparency. As all the selected texts are written in an accessible language, the results of the study are open for inspection to other researchers, and the selected text can be reanalysed in future studies.

The search for relevant papers was completed in December 2018, using Skopus, Eric, Academic Search Premier, and Oria. This search identified eleven papers with 'design literacy' in the title. Three of the papers failed to satisfy criterion 2 as they discuss design literacy in a context of higher education (Formosa & Kroeter, 2002; De Eyto, 2014; Poggenpohl, 2008). Four of the papers did not satisfy criterion 3, enact ethical responsibilities and critical reflection (Pacione, 2010; Jones, 2013; Lerner, 2018; Rahimi & Kim, 2018). As criterion 3 is vital for design literacy to support critical innovation, I will explain how two of the papers failed to meet this criterion. In Lerner's (2018) paper 'Visual-Spatial Art and Design Literacy as a Prelude to Aesthetic Growth', design is framed as the process of giving form or expression to ideas. Lerner focus solely on the positive aspects of visual-spatial learning and involve no critical reflection. Design literacy is limited to the ability to understand and make use of a canon of aesthetic form. Pacione (2010) named "the act of arranging how something looks" (p, 11) as a stereotype of design to stamp out in order to convince a majority of leaders in business and government to support design thinking in companies and as a vital part of general education. Pacione took on a broader understanding of design literacy than Lerner did as he described an iterative process of uncovering and satisfying unmet needs as core design capacities. Still, Pacione's (2010) paper, 'Evolution of the Mind: A Case for Design Literacy', falls short on criterion 3 as no attention was given to the wider social and environmental impacts of design—critical reflection on what unmet needs to satisfy or not by design. Pacione (2010) asked the question, 'What does it mean to be design literate?' (p. 9). In this paper, I ask the question again, but in a context of critical innovation.

Four texts met the criteria, and prior to a description of the second phase of the literature review, their focus and research approach are briefly introduced:

1. Nielsen and Brænne's (2013) 'Design Literacy for Longer Lasting Products' has a conceptual approach as they discussed how design literacy is located amongst other literacies and connected to material knowledge, ecological literacy, and citizenship.
2. Green's (2014) 'Transformational Design Literacies: Children as Active Place-Makers' draws upon an ethnographic study in an Australian primary school in which students aged 8–12 and their teachers designed and made a new garden, 'learning landscape', on the school grounds. The focus is on the potential role of design in a garden-based curriculum and how the children were positioned as participants.
3. Christensen, Hjorth, Iversen, & Smith's (2018) 'Understanding Design Literacy in Middle-School Education: Assessing Students' Stances Towards Inquiry' presents a literature review on design thinking in children's education prior to a comparative study on how 449 students aged 11–15 took a designerly stance towards inquiry in a survey. The authors found no significant difference between how the control group and how the students who had received design education performed. The

focus is on what it takes to educate for complex adaptive capabilities. The study is a follow-up on Christensen, Hjorth, & Iversen (2016). Both papers satisfy all four criteria, and I chose the most recent one.

The second phase of the literature review started by reading the three texts, marking out descriptions on how to cultivate design literacy and for what reasons. Subsequently, a word search was used for a systematic approach by which key concepts in one paper were searched for in the other two.

Table 1, Preliminary analysis, key concepts across the three papers.

Key concept	*Nielsen & Brænne*	*Green*	*Christensen et al.*
Citizenship	x	x	x
Democratic/democracy	x	x	x
Materials/materiality	x	x	x
Transformative/transformational		x	x
Reflective inquiry/critical	x	x	x
Dialogue	x	x	x
Open-ended process		x	x
Agency/agent		x	x
Power/empower	x	x	
Awareness	x	x	x
Complex task/problem/dilemma	x	x	x

The preliminary analysis (Table 1) was a tool to approach the texts from multiple angles and familiarize with shared concepts on design literacy across the papers. The identification of generative narratives, however, relied on the combination of concepts, as meaning is not produced by singular words. Valid narratives had to stand a test of being coherent to the meaning produced in each of the papers as well as descriptors across the three on how to cultivate design literacy in a context of critical innovations. A repetitive process of combining concepts to narratives, revisiting all three texts, moderating narratives and revisiting the texts, identified four shared narratives:

a) Awareness through making
b) Empower for change and citizen participation
c) Address complexity of real-world problems
d) Participate in design processes

Across the shared narratives, the authors voiced different objectives and ways of acquiring design literacy. The third phase of the literature review presents each of the narratives, and discuss nuances and different agendas in the three key texts.

Generative narratives in key texts on design literacy

a) Awareness through making

A shared narrative among all three texts is the significance of placing materials in the hands of pupils. As makers, they transform materials to externalize ideas, and in the making, they connect both to the physical reality and to the conceptual in order to articulate meaning. Nielsen and Brænne (2013) stressed material knowledge as part of design literacy for consumers to opt for longer lasting products and sustainable choices in their everyday lives. Through the mode of making in physical materials, the demand of time and energy in production becomes a first-hand experience to pupils, as well as what it takes a product to become solid, functional, and interesting to use over time. The fusion of craftsmanship and design literacy is not self-

propelled. In their making, the attention of pupils needs to be drawn to the plural context of materiality, a context described by Nielsen and Brænne (2013) as purpose, use, production, transport, ecology, and ethics.

In the narrative of Green (2014), embodied experiences in outdoor sessions teach pupils to work with, not in opposition to, the peculiarities of a garden site. Through months of rigorous mapping of trees, soil, wind, sun, and distance, the pupils accumulated knowledge of the site. Their ideas for the new garden evolved from knowing the material realities and a personal connection to the site. In the first part of the project, the materials were placed in the hands of the pupils for them to examine, and Green (2014) argued that the field trips were critical in empowering pupils to develop, shape, and modify their critical spatial thinking (p. 194). In the second part of the project, materials were placed in the hands of the pupils for them to change the garden site. Green emphasised how making models in clay and three-dimensional maps with a wide range of materials enabled the pupils to advance their ideas and voice their visions.

Christensen et al. (2018) presented design as a basic literacy akin to reading and writing. Skills for materializing ideas as externalizations is among their described learning outcomes for design literacy, alongside abilities of designerly inquiry, ideation, and navigating a design process. In their study, the access to materials and maker settings varied significantly from one school to the other. This was pinpointed as one of the reasons why the FabLab group of students did not perform significantly better than the control group of students in how they took a designerly stance towards inquiry. The authors thus indicated the importance of access to materials and proper studios for design literacy initiatives to succeed. In the article, the authors also entailed an interesting section on the potential pitfalls of the emerging new technologies that make the creation of digital products feasible in schools. As the introductory workshops for teachers usually are constrained to short sessions with predetermined outcomes, the teachers are more likely to opt for activities focused on technological literacy than design literacy. Activities enable pupils to repeat the design of others by the use of technology, but not to take part in the design process. The authors' warning draws attention to the importance of a wider repertoire amongst teachers developed by experiencing a long, complex, and open-ended process themselves prior to the cultivation of design literacy.

The three texts emphasise the importance of first-hand experiences with materials as part of educating a design literate general public. In Green's (2014) narrative, the students examined the physical reality of the garden site to connect to its potential, and in their making of models, they experienced how visualization in materials might voice and advance their ideas. The agenda in the narrative of Nielsen and Brænne (2013) was twofold: designing and making their own products (e.g. garments or spoons) prepared the pupils to judge quality and longevity in products as consumers and provided an arena to enhance pupils' awareness on how conflicts, inequity, and exploitation of nature embed everyday consumption. Christensen et al.'s (2018) narrative on making was to provide students with tools to externalize and share ideas. They emphasised the importance of open-ended briefs, as the making of copies rather would cultivate students' technological literacy than design literacy.

b) Empower for change and citizen participation

The idea of empowerment is a key to design literacy across the three texts, challenging a script of schooling with teachers as experts who hold pre-set answers for pupils to unveil. The educational ideas of Freire (1970) were present in all three texts on design literacy. Freire brought attention to what he framed as the banking concept of education by which students are receiving, filing, and storing narrations from the teachers. The banking concept offers few opportunities for students to analyse how political, cultural, and social contexts shape their lives. Freire's alternative is a practice of problem-posing education. The teachers pose a problem that challenge humans' relations in the world and with the world, and they facilitate a dialogue of co-investigation with students to unveil oppression and situations as historical realities susceptible to transformation (Freire, 1970).

Christensen et al. (2018) promoted design literacy as part of education for citizenship and democracy, followed by an argument on how designerly ways of engaging with complex problems enable individuals to act as agents of change and creators of preferred futures. Seeking a single correct answer and relying on the same tried-and-tested method regardless of situation were described as opposites to the expertise of designers. The authors referred explicitly to Freire's criticism on the banking concept of education along with Biesta's (2008) concept of 'learnification' and Lin, Schwartz, & Bramsford's (2007) difference between routine experts and adaptive experts. The authors did not elaborate further on Freire or propose design literacy explicitly as an alternative to the banking concept; adaptive expertise was their chosen concept to explain a designerly stance

towards inquiry. Drawing upon a wide range of references, the authors framed a designerly stance towards inquiry as being open to new understandings, listening to the complexity by adapting a range of techniques, and gaining a holistic understanding of the existing situation (Christensen et al., 2018, p. 4). The authors found that the FabLab group of students who had received design education through middle-school maker settings failed to improve their designerly stance towards inquiry. Their study pinpointed the difficulties of implementing design literacy to general education and discussed how it challenged the more familiar scenario where the teacher 'has the correct solution to the problem at hand' (Christensen et al., 2018, p. 18).

Green did not quote Freire explicitly, but under the heading 'Agency', she described a shared feature of the countless facilitated discussions during the design of the new garden. They all positioned the pupils as the main stakeholders and required that they work with the emerging tensions and problems that arose during the design process. Green referred to an example of a discussion on how to incorporate a frog pond safely. The teacher's role was not to resolve the issue but to facilitate a space for dialogue among pupils 'that supported their "voice" and empowered them to successfully and safely incorporate a frog pond into the plan'. A key narrative in Green's text on design literacy is the importance of providing pupils with a sense of agency. The principal elaborates on how pupils' agency and decision-making is enhanced by inclusive and unhurried processes. Green connected agency to citizenship by quoting Mannion (2003) on how children are active local citizens of today who are capable of bringing a uniquely valuable perspective to civic discourse. Green positioned the pedagogy of design as a direct contrast to approaches that privilege teacher knowledge and position students as passive recipients, along with Freire's banking concept of education. According to Green, the pedagogy of design permits children to visualize the future and to see themselves as proactive participants with a significant role to play.

Nielsen and Brænne (2013) found the concept of design literacy as one bringing new life to the educational ideas of Freire (1970). The transformative agenda of design shares the ideas of Freire. The core of Freire's (1970) libertarian and humanist pedagogy was for people to discover themselves as permanent re-creators of the world: "To exist, humanly, is to *name* the world, to change it" (p. 88, original emphasis). In the text, knowledge of sustainable ways of producing and using material artefacts are key to design literacy for a general public, empowering them to refuse to buy unethical artefacts along with critical awareness of how groups are socialized as consumers and producers. Making design literacy a part of general educations enhances an alternative counterculture—a critical stance against shallow symbolic design-values and of being seduced through shopping to buy more than we need.

Empowerment of the individual pupil is a shared objective of design literacy, however, at different levels. The pupils in Green's narrative were empowered to voice their ideas and differing perspectives in the design of a garden. The pupils in Christensen et al.'s (2018) narrative were empowered to a designerly stance towards inquiry, to act as agents of change and create preferred futures. The pupils in Nielsen and Brænne's narrative were empowered to criticize and change the system in how they acted as consumers and producers. The last narrative is the one closest to Freire's more radical ideas on education as a means to challenge humans' relations in the world and with the world and to capacitate people to transform the sociocultural realities that shape their lives by their words and actions.

c) Address complexity of real-world problems

Design literacy is promoted as a tool to understand and deal with the complexity of real-world problems across the texts. In the narrative of Christensen et al. (2018), one argument of making design literacy a part of general education is how it facilitates awareness of the complex and wicked nature of problems. All real-world challenges are wicked, they claimed, and the pupils would be better equipped for their future if they developed a capacity to recognize problems as wicked (p. 4). With a reference to Lawson and Dorst (2009), taking on wicked problems is at the very core of design thinking and later elaborated as: "seeing the whole from multiple conflicting dialectical contradictions among stakeholders, including ethical, political, and even spiritual ones" (p. 16). In their study, the authors assessed how Danish middle-school pupils approached a wicked problem of demented elderly disappearing from nursing homes and how to create a secure environment for them without taking away their freedom. Only 5.69% of the FabLab group of students and 2.46% of the control group of students made a designerly stance towards inquiry by explicitly or implicitly recognized wicked aspects of the question posed. The vast majority approached the question with a stance of technical rationality, seeing the wicked problem as tame and focusing on answers that were readily at hand, e.g. implementing a GPS-device under the skin with no consideration of ethical dilemmas (Christensen et al. 2018).

Green's narrative has similarities to Christensen et al. (2018) in describing key features of design literacy as the ability to engage with an unknown outcome and connect to the complexity of the real world. In Green's study, the children were encouraged to undertake detailed mapping of the site for the new garden and 'to work with a degree of uncertainty and chaos alongside adults who support them to visualize the future and make it happen'. Quite contrary to Christensen et al. (2018), Green (2014) concluded with a successful implementation of design literacies in how children are recognized as practitioners who can undertake complex tasks, think critically, solve problems creatively, and apply design knowledge to new situations. Christensen et al.'s (2018) study drew upon a quantitative survey across 17 schools, while Green followed a long-term design project linked to a cornerstone in the school's charter, learning landscapes, and a pedagogical commitment to environmental studies for the past 20 years. Green's (2014) study supports Christensen et al.'s (2018) in their conclusion on how children might develop complex adaptive capabilities given more design education over a longer period.

Nielsen and Brænne's take on complexity was to emancipate the field of design from being associated with only form and colour, not on the complexity of the design task itself. They connected design literacy to Stegall's ecological literacy (2006) and the sociological dilemma of rapidly eroding our ability to survive through the lifestyles we have adopted. Vital to design literacy for a general public, they argued, is awareness of how choices as consumers impact the soundness of the ecological system, knowledge of materials, and the complex process of making and designing sustainable products. Drawing upon Stegall (2006), Nielsen and Brænne made the point that even the most sustainable product would not be sustainable unless every person used and recycled it in a responsible manner. The crucial game changer of overconsumption is the reflective user and responsible consumer who ask for sustainable design and buy only the goods they really need.

The capacity to embrace complexity and navigate solutions that contribute to a better future is a shared goal of the three papers in promoting design literacy for a general public. While Green (2014) and Christensen et al. (2018) focused on the complexity of the task given to the students and their inquiry into open-ended problem-solving, Nielsen and Brænne (2013) described the complexity of the knowledge involved to be a design literate person who opts for sustainable design and responsible consumption.

d) Participate in design processes

Narratives on the importance of personal experiences with design processes is present in all three papers. Green's (2014) object of study was a long-term design process in which students and teachers collaborated in the making of a garden, learning to landscape on the school grounds. She discussed how design literacies expand children's learning and deepen their connection to everyday places. Green's descriptions of the design process were rich and manifold, summed up as two main narratives: the physical and the collaborative. The physical process focuses on how the children connect to the site by rigorous mapping and first-hand observations, visualize their ideas through models and maps, and transfer ideas to a three-dimensional reality by building and gardening. The collaborative process is parallel to the physical, focusing on how the teachers position the students to voice their meaning, debate ideas, and agree on final designs as proactive and empowered learners.

Christensen et al. (2018) developed a design process model for the FabLab group students and their teachers. The researchers made the model sequential to simplify the complexity of the design process, consisting of six phases: design brief, field study, ideation, fabrication, argumentation, and reflection. In a later survey, they asked the FabLab group of students how familiar they were with each of the six phases, and more than half of the students rated themselves as knowledgeable. When the students were challenged to address a wicked problem, however, they were not able to adapt their knowledge derived from working with the design process model and take a designerly stance towards inquiry. The authors concluded that the students gained some routine expertise on the design process during their engagement with the project, but not the adaptive capabilities of designers.

Nielsen and Brænne (2013) had no description of phases in a design process or what procedural skills the students should acquire to be design literate, but they promoted students' understanding of the complex process of making or designing as vital. Core to design literacy, they argued, is awareness of how design processes have an impact on our surroundings and the physical aspects of material quality regarding what is lasting and functional. Their proposed route to these competencies for students included making with physical materials and a 'reflection in action' approach. Although not stated explicitly by the authors, this implies that

students should actively engage in a design process that combines skills of physical visualization with inquiry and critical reflection about the impacts on people and the ecological system.

In Green's (2014) narrative, student participation in the design process offered expanded learning opportunities to the garden-based curriculum and supported them as active place-makers. The design process offered a method to facilitate learning and empower students for ideation. Christensen et al. (2018) made the understanding of designerly inquiry and ability to navigate a design process as the main learning objectives, while Nielsen and Brænne (2013) focused on student awareness of the social and ecological impacts of design processes.

What does it mean to be design literate?

Pacione's (2010) answer to the question of what is meant by being design literate, as opposed to being a design professional, is basic skills in inquiry, evaluation, ideation, sketching, and prototyping. Pacione described phases of a design process, the fourth narrative identified in the three key texts: **d) 'Participate in design processes'**. Repeating Pacione's question in a context of critical innovation adds three additional narratives: **a) 'Awareness through making'**, **b) 'Empower for change and citizen participation',** and **c) 'Address complexity of real-world problems'**.

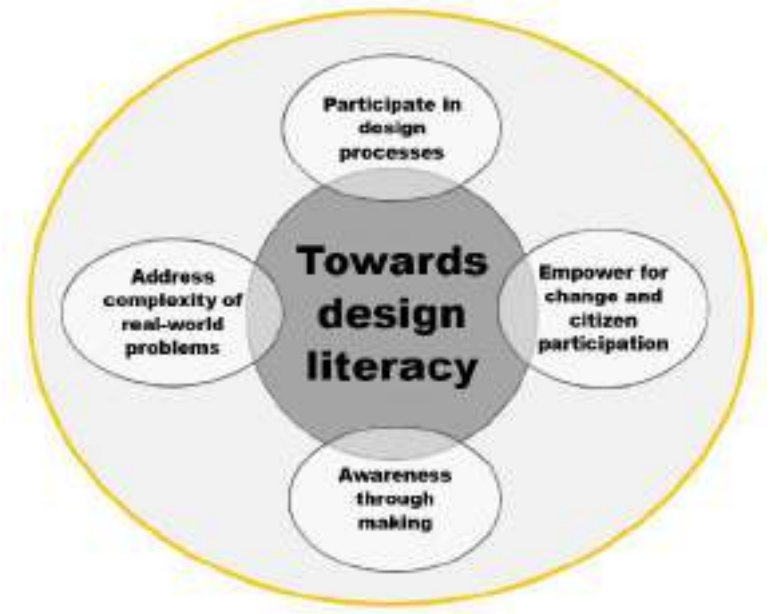

Figure 2: Sketch of a conceptual framework on how to cultivate design literacy in support of critical innovation

Reading and revisiting the three key texts identified four shared narratives on how to cultivate design literacy amongst a general public. **a) 'Awareness through making'** draws upon the significance voiced by the authors of placing materials in the hands of the pupils. As makers, they transform materials to externalize and advance ideas, and in the making, they connect both to the physical reality and to the conceptual in order to articulate meaning. Awareness indicates understanding of the socio-environmental impact of human-made artefacts, and what it takes for products to be solid, functional and interesting to use over time. **b) 'Empower for change and citizen participation'** is a shared narrative on the importance of providing students with a sense of agency and tools to question, rethink, and transform the world around them. Everyone has a significant role to play towards more sustainable ways of living or further destruction, and the authors promoted design literacy as a game changer towards more responsible citizen participation. **c) 'Address complexity of real-world problems'** is framed as a key feature of design literacy, and accordingly, students are challenged to map and navigate conflicting interests and dilemmas embedded in design practices and solutions. **d) 'Participate in design processes'** is the fourth narrative towards design literacy, endorsed by the authors as enabling students to adopt the designer's tools for innovation and understand how designers think. Figure 2 displays a sketch based on generative narratives on how to cultivate design literacy, derived from a literature review of three different texts. So far, the scientific discourse on design literacy in context of critical innovation is in an early stage of

development; the number of articles that could satisfy the four criteria for selection are few. This preliminary sketch would evolve as design literacy is addressed and challenged by further academic writing.

Defining design literacy in a context of critical innovation

The three key texts reviewed to identify generative narratives on design literacy as part of general education were published between 2013–2018. The idea of introducing design thinking to general education, however, is not a recent one, see e.g. Baynes (1974) or Cross (1982). Looking back at the initial arguments on why design awareness represents an important area of educational development, we can see some striking similarities to more recent scientific discourse. Design is a basic way of knowing along with humanities and sciences to serve us in our daily lives and in preparation for social roles (Cross, 1982). Design education was not introduced by Baynes (1974) as a means to shape consumerable items, but to meet "urgent need for the survival as well as the happiness of mankind" (p. 46). The role of design education is empowering the individual for participation in daily life and society. To participate, one needs to know the codes in order to act in line with expected practices. Understanding design as a form of literacy expands the purpose of design education to empower for criticism and transformation. The concept of literacy adds resilience by empowering individuals to challenge established regimes of knowledge and structures of society (Boehnert, 2015; Illeris, 2012). Kolko (2018) combined participation and transformation: "To be literate is to have a voice in society, and to see the things that are happening, build on them, change them, and reject them" (section 11). For a professional designer, transformation as the ability to change an object or service for the better is key, but for the general public, transformation might prove more powerful as rejection of unsustainable design. One aim of identifying generative narratives on how to cultivate design literacy in key texts was to attempt a definition of design literacy in a context of critical innovation. Drawing on the four generative narratives (Figure 2) and ideas of participation and transformation embedded in the concept of literacy, I suggest the following definition:

> *Being design literate in a context of critical innovation means to be aware of both positive and negative impacts of design on people and the planet, approaching real-world problems as complex, voicing change through design processes, and judging the viability of any design ideas in terms of how they support a transition towards more sustainable ways of living.*

Coda

Addressing the complex problem of overcoming a world made unsustainable (Fry, 2009), basic ethical questions of how a new innovation supports the well-being of people and the planet prove just as important to integrate into general education as into the education of professional designers. As Craft (2005) stated: "Promoting children's creativity in the context of wider ethical dimensions of our existence is not an optional extra" (p. 149). In a context of critical innovation, a core part of the teacher's role would be to draw the students' attention to how any design idea would satisfy real-world problems responsibly and towards a better tomorrow. Students need to recognize their capacity to transform unsustainable design practices as informed consumers and to challenge established regimes of policy, fundamentally rethinking definitions of human needs and desires (United Nations Environment Program, 2011). Only a few of a student cohort will become professional designers, but all of them are users of professional designers' innovations in their everyday living and as future employees. In support of critical innovation, the value of cultivating design literacy amongst a general public is empowering a critical mass of users who recognize their capacity to transform unsustainable patterns of living by the products and services they voice and opt for as consumers, democratic participants, and employees.

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Developing design literacy for social agency

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Preparing a workforce that is well-equipped with the skills and knowledge to navigate the complexities of our global human society is a key responsibility of design and higher education. Extant research has advocated design as one of the essential skills to master in the future, and this design literacy has been claimed to be a critical factor in creating innovations and new solutions towards transforming our societies. To explore how non-designers become more design literate, in this paper we present findings from a study looking at how multidisciplinary student teams develop their design literacy in an action-oriented course setting. Based on our initial analysis, blending the boundaries between universities and the surrounding society positively contributes towards developing design literacy. This, in turn, has pedagogical implications as well as increases our understanding on how design travels to other disciplinary domains.

Keywords: design education, empathy, societal impact, curriculum design, transdisciplinarity

Introduction

The real world is not like the university. In the university, professors make up artificial problems. In the real world, the problems do not come in nice, neat packages. They have to be discovered. It is all too easy to see only the surface problems and never dig deeper to address the real issues. (Norman, 2013, p. 218)

In the quote above, Norman (2013) gently touches upon the concept of wicked problem (Buchanan, 1992; Coyne, 2005; Rittel & Webber, 1973) that has been established as one of the seminal concepts in design practice. Especially now, with discourses around sustainability and intergenerational justice gaining traction, higher education institutions teaching design or its extensions (such as design thinking) ought to broaden their repertoire from teaching design as a craft to design as means of creating agency to solving wicked problems (Burdick & Willis, 2011; Christensen et al., 2016). While we acknowledge that such initiatives have been gaining traction globally in several higher education institutions during the turn of the century, at the same time it is also justified to constructively question what are the underlying political, societal, and economic paradigms that govern and frame how and why we teach design to our students. In a similar vein, extant research has questioned the value and validity of skills students acquire in higher education institutions (Arum & Roksa, 2011; Fink, 2013), and findings from these studies are alarming in the sense that if higher education institutions are not capable of educating their students with transferrable skills, where will they acquire these skills?

The study at hand, however, does not take a cynical stance to higher education nor do we expect to create a causal relationship between transforming higher education and solving wicked problems. In line with extant literature on design and design literacy more specifically (Burdick & Willis, 2011; Christensen et al., 2016;

Nielsen & Braenne, 2007), our aim in this paper is to contribute to research on design literacy by investigating how students in a multidisciplinary graduate program (consisting mostly of design, engineering, and business students) develop and reflect on their design literacy for social agency. More specifically, research question formulated for this study is as follows:

How does multidisciplinary and action-oriented course design contribute to students' design literacy towards social agency?

Instead of seeing design thinking (e.g. Cross, 1980; Dorst, 2011; Kimbell 2011, 2012; Rowe, 1987) as a set of tools and methods but rather as a manifestation of design literacy enables us to reflect on what we could be teaching when we teach design thinking. What is more, we argue that course designs that weave together theoretical reflections and real world challenges have the potential to instil our students with a sense of agency: that is to say, developing design literacy is not only about mastering design tools and practices, but understanding how they can be utilized for creating positive impact in the surrounding world. As Coyne (2005, p. 6) highlights, testing solutions to wicked problems are seldom undone, which is why design education plays a crucial role in helping students negotiate the relationship between the problem and the solution space and their stance towards it. As a concrete output, in this paper we present the SCET (Space - Community - Emotions - Transformation) framework as means to developing design literacy towards social agency.

As mentioned above, course settings with assignments that blend the boundary between the university and the surrounding society are especially fruitful for exposing our students to wicked problems as well as to help them discover them on their own. Moreover, taking design education as the point of departure and bringing students from other fields in touch with design further illustrates how design and design education can serve as catalysts for societal change (Cross 1980, 1984; Glasser, 2018).

In this enquiry, we draw on a multitude of data: students' reflections via their visual learning diaries, interviews with our partners, and finally autoethnographic observations and reflections. While the visual learning diaries enable us to explore how design literacy is manifested and developed amongst the participants and partner interviews provide us with insights on how such course designs are perceived to create value amongst our stakeholders, autoethnography makes our role as instructors and researchers explicit in the data collection period. That is to say, we are not just observing the field but simultaneously shaping and making sense of it (Anderson, 2006).

The rest of the paper is structured as follows: first, we discuss extant literature on design literacy and higher education, then we introduce the proposed framework for curriculum redesign and application to a course context. After, we briefly describe our research methodology and initial findings in this ongoing research before concluding with our next course of action.

Literature review: design literacy and higher education

Design literacy as spatio-temporal transcendence

When talking about design literacy, spatio-temporal transcendence is perhaps one of the most critical conceptual approaches towards understanding design and its value. In essence, design can be understood as conscious acts of improving the status quo (Simon, 1969, p. 55) or similarly as a practice aimed towards the future, and as such it is to a large extent about "acting in and on the world" (Yelavich, 2014, p. 12). As Yelavich (2014, p. 12) continues, "how and where design can contribute to conversations larger than itself" highlights the desire among practitioners and researchers of design to move away from design as a competitive advantage towards design as socio-political mindset towards future and contemporary societies. That is to say, spatiality in design refers to the designer engaging with the problem space here-now by attempting to empathically transcend their own boundaries, whereas temporality refers to crafting the solution space for the future society (Müller, 2018), and here empathy is also one of the key elements. Similarly, movements between the problem space (here-now) and the solution space (future society) can be seen as manifesting validations of design literacy. Thus, for the designer to be able to transcend their spatio-temporal boundaries and in the process develop their design literacy requires empathy.

Given that empathy is such a crucial element in design and various other disciplines, extant research in design (Ho, Ma & Lee, 2011; Hess & Fila, 2016; Smeenk, Sturm & Eggen 2018) and higher education (Ashworth & Lucas, 2000; McAllister & Irvine, 2002; Killick, 2012) has explored empathy from diverse perspectives. Especially in design, considerable amount of scholarly attention has been devoted to understanding our users

and stakeholders to frame the problems we aim to solve (Brown, 2008; Dorst, 2011). It points to leaving pre-assumptions at the door; stepping into someone's shoes and trying to explore how they interact with and experience the world. One of the earliest lessons taught in design education, is the difference between Sympathy and Empathy (Brown, 2013).

However, instead of seeing them as disconnected ideological constructs, we believe that the element of "care" appears to fill the transition void between reactions of "sympathy" and learning the ways of "empathy". Especially because one may feel sympathy towards issues observed in their lives, but taught to employ empathy in assigned situations that lack resonance. Indeed, if higher education institutions teach empathy as a sort of driver for innovation and design-driven outputs, can we speak of empathy as a genuine desire to understand the needs of others?

Customarily, we teach methods and tools to generate user insights that would fuel creative and meaningful solutions. We engage external partners to provide students with first hand experiences, and allow them to work on real issues in the industry and society. Many of these concepts are then evaluated on their novelty, and potential value to generate revenue. The projects are largely driven by commercial value, as is a matter of fact that most project briefs are highly dependent on paying clients and their organisation's demands.

In an ecosystem that relies on these engagements, it would be unrealistic and naive to imagine that the universities would function any differently. Yet, there are numerous social challenges in the world that would benefit from the knowledge and skills we teach, and if we do not nudge our students to start thinking about them, who will?

Higher education institutions as catalysts for social change

Universities were conceived to develop a compliant workforce with skills of print literacy and discipline that would enable them to function in modern corporations and a corporate economy (Dewey, 1938; Kellner, 2003). As a result, higher education institutions are viewed as the most legitimised social agent of creating, discovering, disputing, accepting and disseminating epistemology and its agreement process (Clark, 1998; Marginson & Rhoades, 2002; Hyun, 2011).

In an age of rapid globalisation brought about by exponential development in technology, communication and transportation, it has become increasingly difficult to anticipate the changes impacting society and lifestyles, that much time is spent focusing on utilising technology and creativity for innovations and businesses. Yet, at the same time, as these changes "become concrete only in the consequences which result from their application" (Dewey, 1938, p. 19), we ought to be more mindful of pedagogical decisions. Consequently, neglecting the fundamental social and environmental issues that deserve our attention as well (Stegall, 2006; Thorpe & Gamman, 2011).

Social challenges prevalent before are even harder to ignore now, especially because of digitalisation and our interconnectedness. Viral reports in the mass media make us wish that we could do our part in supporting those who are less privileged or effect change in unfavourable circumstances, yet why are we not doing anything? Do we lack the capacity and/ or orientation?

Spearheading these endeavours, governments around the world have involved academics and private companies in an array of research and consortium projects (e.g. Ambos et al., 2008; Ankrah & AL-Tabbaa, 2015; Bruneel et al., 2010). However, does everything have to be top-down? Is it only possible to tackle these challenges when there is provision from those in power? There seems to be a structure-agency dichotomy that we are not addressing.

An answer to this need and a trailblazer of its time, International Design Business Management, Aalto University's transdisciplinary graduate program, was established in the mid-nineties with the concept to educate future design managers capable of generating revenue and competitive advantages through design predominantly in large corporations. However, with the ever-changing needs of societies, graduates of the program could potentially be in positions where they lead and manage policy change, grow enterprises or champion social movements.

Framework for curriculum (re)design

In recent years, calls for transforming higher education institutions have been raised globally, and as this can be approached as a collaborative effort, most of our teaching methods and contents can be accessed online. In

line with this, here we elaborate on our pedagogical framework that illustrates the main building blocks onto which we base our initiatives. The SCET framework is our first attempt at analytically articulating how to bridge the gap between sympathy and empathy, and as such it is to be taken as framework-in-the-making.

- Learning is not restricted to a physical space we call 'university campus' (Proserpio & Gioia, 2007; Redpath, 2012)
- Learning is about leaving the ego behind: it is not a competition, but a collaborative effort to improve ourselves as well as our society (Bain, 2004)
- Learning is an emotional experience: getting your hands dirty, goosebumps, breaking away from existing patterns (Herrington, Reeves & Oliver, 2010; Meyer & Turner, 2006)
- Learning is transformative, and as such it transforms not only you but also others around you (Mezirow, 1991; Taylor, 1997)

More specifically, the table below fleshes out some of the roles and responsibilities for both teachers and students in the SCET framework introduced above.

Table 1: Roles and responsibilities in the SCET framework

Dimension	*Teacher's roles and responsibilities*	*Student's roles and responsibilities*
Space	Designing and identifying the learning spaces in and outside the campus	Participating in nurturing a good atmosphere in the space, reflecting on the meaning of space when it comes to each individual's learning
Community	Appreciating the knowledge and experiences students have, and attempting to active this in the learning process	Actively communicating about their knowledge and experiences to others, ensuring others are being heard
Emotions	Willingness to revise and develop the course after each iteration, reflecting on their own interests and competencies as a basis for new pedagogical content	Openness towards new ways of learning, respecting their peers, understanding that courses can be open-ended with the teacher merely designing the structure
Transformation	Appreciating change and embracing ambiguity, clearly communicating this in connection with the learning objectives to the students	Exploring their intrinsic and extrinsic motivations for studying and learning, trusting the teacher in that ambiguity and open-endedness in courses is in control

The thoughts above have been formulated based on our teaching experiences in several countries (most notably Finland, Denmark, India, Japan, Singapore and Russia), extant research, and engaging in discussions with our colleagues from different higher educational institutions over the world. Furthermore, we cannot – and perhaps should not – control what the students learn (this would imply control over their previous experiences), but we can draw on various methods and processes to enable the students to take ownership of their learning and thus formulate their own stance to the sympathy - empathy continuum (Dewey, 1930; hooks, 1994).

The SCET framework in practice: Care through iteration

An opportunity surfaced for us to test this framework during the transition of program leadership in 2017. This put us in a favourable position to act as a wind tunnel for this transformation in higher education, and marked the inauguration of our course, IDBM Challenge: A mandatory 3-week introductory course that brings together students from diverse cultural and educational backgrounds, and provides a setting for combining theory with practice. Through practical experience, learning-by-doing, critical and meaningful reflection; students acquire the skills to research, conceptualize, develop and introduce socially sound and commercially successful

solutions. In this context, learning-by-doing does not refer to doing that is complemented by superficial learning afterwards, but instead it echoes with Dewey's (1930, p. 390) knowledge and knowing duality as well as with hooks's (1994) attention to question the mind-body separation in the classroom through the concept of eros. Thus, learning-by-doing is essentially about being present in the world, interacting with it, and creating knowledge through our body and mind.

The first author has taught IDBM Challenge since 2016, and although the first iteration of the course was named differently, the learning outcomes and 3-week structure have remained the same. Being the introductory course, the reasons behind the structure focus on interpersonal relations: namely, by starting the program with an intensive course creates a space where everyone can get acquainted with their peers and thus create a sense of transdisciplinary community already from the get-go.

Moreover, being a challenge-based course where the theme changes every time the course is taught ensures students' focus on the learning experience rather than consulting their peers who already took the course, on how to optimize their participation. Thus, the course should be understood as a living organism that enables its participants to take ownership of their learning experience.

First iteration in 2017: speculative design and outer space

The 2017 iteration was when we first started to consciously pay attention to the pedagogical philosophy and specifically, course design. Challenge for this course focused on combining speculative design (Dunne and Raby, 2013) and outer space by allocating the teams to four decades (2027-2057) with each having its unique brief and setting. For example, in one of the settings the students extrapolated how the current behaviors and challenges could potentially affect how we live, forcing us to eventually move on to live on Mars.

In addition to the team-specific challenge, as a cohort the participants were also expected to organize a multisensory event showcasing their challenges and solutions. This design, then, emphasized learning to take place in three interconnected dimensions: individual, team and cohort to highlight the networked nature of learning (Schenck and Cruickshank 2015). Building on this, while the structure design for the course seemed to create spaces for the students to reflect on and act upon design as a catalyst for social and societal change, the fact that the provided challenges were quite abstract provided us with a sounding board for the 2018 edition that shifted the focus from outer space and future to our immediate surroundings and near future.

Second iteration in 2018: social innovation in first world cities

Using the course as a primer for students to start thinking creatively (and reflectively) about society's "wicked problems" (Rittel & Webber, 1973), we identified a recurring global theme that serves as a point of convergence across the public, private and third sector: the United Nations' Sustainable Development Goals (UNSDGs). However, we noticed that the subject often features developing countries and the predicament of those who may be trapped in unfortunate situations. In contrast, we often refer to countries such as Finland, Singapore, and Denmark as prime examples for other nations (Teo, 2018), and thus in the process forgetting that these developed countries, too, have their flaws that demand attention.

Therefore, we created a twist on the familiar topic for the 2018 iteration of the course by providing the multidisciplinary teams with the following design brief:

Five UNSDGs applied to the context of first world cities that the students currently reside in.

"What does poverty look like in a first world country?"

Two to three teams were assigned to each SDG and tasked to develop concepts that would create positive impact within five years.

In this edition, other than the intentional set-up around the challenge brief, we also structured the course to facilitate the projects that each team was working on. Although we did not explicitly refer to any framework or design process in our teaching content, we enforced key milestones (mandatory sessions) to gently guide the students in adopting the design process by taking them through the various phases of a design project: Research, Insights, Ideation and Validation.

i. **Research (Desk and Field)**
   As these topics were relatively new to the students, we spent a considerable amount of effort in nudging them to think outside of their comfort zones, and to explore the boundaries by physically

going to the field to look for answers. Rather than simply looking at statistics of these pertinent issues, students did field research by conducting interviews with stakeholders. To increase relevance and realism of the challenge, we kick-started the projects with organisation visits in collaboration with partners around the city. This enabled the students to have first-hand experience in witnessing that these challenges are not just conjectures, but discounted (and disregarded) issues. All teams partook in these organised visits, and some even made cold calls to other Non-Governmental Organisations to get a better grasp of the context and challenges around their given briefs. This allowed them to quickly get a good sense of the situation's challenges and user needs.

ii. **Insights Analysis**
Through the intensive field research in the first week, participants then sat down in teams to crystallise and distil their findings into actionable insights. These were done over a series of mentoring sessions. Students did ideation concurrently due to the short time frame given.

iii. **Ideation**
In the ideation phase, students were encouraged to use the Sanpo-Yoshi framework as a guideline for developing the concepts. The framework emphasizes the importance of systemic value: us – client – society. This not only gave the students a sense of agency, but also allowed them to consider factors beyond the monetary or novelty factors of a typical innovation project.

iv. **Validation**
As this was an intensive 3-week course, students did not have the luxury of time to prepare prototypes. Nevertheless, they discussed their ideas with relevant stakeholders throughout the process and finally presented their solutions to a 60-pax audience at a multisensory event they organized at the end of the course. At the event, each team presented their concepts in a PechaKucha format (20 slides x 20 seconds), where teams used a variety of creative storytelling methods to best pitch their concepts. Some presented imagined future scenarios through digitally edited images, while others suggested potential services through a website mock-up or physical artefacts. Each were compelling in their own ways and told of stories that not only demonstrated the students' dedication and interests to the topic or project, but also evoked a sense of agency that shows that they were motivated to effect change in their own ways.

As the historical account of IDBM Challenge above illustrates, the way this course has been designed has evolved throughout the years to further develop the students' design literacy and competences. By adopting a designer's mindset to developing the course, we have explored both the brief and the methods to see what kind of constellations would enable us to create a learning space conducive to nurturing design literacy. By the same token, by blending the boundary between the university and the surrounding society we also enable the course iterations to be influenced by actors outside the university setting. Thus, what we are teaching to our students is also put into practice when designing the course.

Research methodology: Exploring the emergence of design literacy

As the final assessment of the course, students were tasked to submit a Visual Learning Diary in which they were expected to demonstrate what they have learnt by reflecting on the happenings and insights of the course; documenting their thoughts and takeaways from the (lectures and workshops) sessions, taught content (readings, online episodes) as well as team work and community involvement for event planning. Content and stylistic conventions were not evaluated: as long as the participants covered the required topics, they would get maximum points for the assignment. This design decision, then, helped the participants focus on their learning experience instead of hunting for the maximum points.

The visual learning diaries act as basis for analysis on two dimensions: not only do they provide substantial data to assess our pedagogical methods and how the students articulate their design literacy, but they also offer an exceptionally intimate view on how the individuals have experienced the course. Students' course feedback online and during the final reflection session also serve as good measure. During the first session of the course, we sought permission from the students to use their outputs as research data, and since no one declined our data set consists of sixty-seven visual learning diaries. While we will be showcasing excerpts from

the diaries throughout the remainder of this paper, parts of the diaries that might identify the student will be covered or blurred out to respect the students' anonymity.

In addition, interviews with our partner organisations (both public and private) have allowed us to better understand whether there was industry relevance in the solutions developed by our students, and if this format of a course is suitable for continuity. As of writing this paper, the second author has conducted two interviews with our partners: these interviews lasted approximately sixty minutes and they were recorded, and immediately afterwards transcribed also by the second author.

Finally, as being active designers and participants in the process, we used autoethnography to reflect on how our course design decisions have enabled or disabled care and conceptualizations for the emergence of care (Anderson, 2006). Since care as a phenomenon and a way of being in the world is fragile (hooks, 1994), triangulating research data enables us to carefully analyse how course design can support care and how the participants craft their stance to it. The table below summarizes the dataset utilized in this study:

Table 2: Data collected for this study

Type of data	*Key statistics*	*Purpose in this study*
Visual learning diaries in digital format	Sixty-seven learning diaries	Analyzing the learning journey as well as how design literacy emerges and is articulated by the participants
Partner interviews	Two transcribed interviews	Supportive material for understanding how the course enables blending the boundary between academia and the surrounding society
Autoethnographic observations	Notes from debriefings after course contact sessions, internal communication and artefacts focusing on course design and implementation, video recordings of the sessions	Analyze the design decisions and consequences of the facilitators

At this point it should be noted that the visual learning diaries are our main source of data with the interviews and our observations providing additional flesh around the analysis. We analyzed the diaries as multimodal texts (Kress and van Leeuwen, 2006; Rose, 2016) documenting students' learning experiences throughout the course; as such, main emphasis is not on validating whether the students actually learned what they reported in the diaries, but instead to look at the journey they went through during the course. What is more, as extant research on design literacy has focused on empirically exploring how students understand inquiry in connection to design (Christensen et al., 2016), our study extends this body of knowledge by looking at how inquiry – and hence design literacy – emerges over time. To illustrate this, Figure 1 is an excerpt from one of our participant's learning diary.

Figure 1. An excerpt from Participant #5's visual learning diary.

As the participant writes, "[t]he cold call to Shortcut made us see how ignorant we have been on the whole refugee situation - how delicate we have to approach the issue" and "[l]ooking back, the main issue is that as a team, we did not realize how different we operate as everyone has different ways of problem-solving" – both of these descriptions show how interacting with the surrounding society triggers relevant reflections on developing design literacy.

Acknowledging the multisensory nature of design – and nudging our non-design students towards multisensory expression – we framed the learning diary as visual, and as such they were analyzed as multimodal texts (Kress and van Leeuwen, 2006; Rose, 2016) by utilizing the Gioia methodology (e.g. Gioia & Chittipeddi, 1991; Gioia, Corley, & Hamilton, 2012). In short, the Gioia methodology aims at creating transparency and rigor in qualitative research by generating theoretical insights through the respondents' lived experiences. That is to say, first-order concepts in Gioia methodology are directly derived from the data, whereas the second-order themes are crafted by the researcher, and finally the third level constructs are more theory-driven. As of writing this paper, our data analysis is still in the process, and below we will shed light on our initial findings.

Initial findings on developing design literacy

Our initial findings suggest that design literacy for social agency in classroom settings is positively influenced by the following three concepts: interaction with the surrounding environment (Space), multidisciplinarity (Community), and porous learning content (Emotions). Below, we will go through these separately before bringing them together.

First, through deliberate design, we have forged a foundation that supports an individual's learning on several levels – personal, team, community – and dimensions. We have found that this set-up enables reflexion and reflection (Schön, 1983), which contributes considerably to the forecasted denouement of a sense of belonging and establishment of trust amongst peers early on. Furthermore, as one of our guiding principles in designing the course focused on 'taking the university where the students are', we are also interested in seeing how different activities and learning spaces contributed to developing (or hindering) design literacy. In this context, then, porous learning content refers to curating a selection of videos, podcasts, and articles that enable the participants to approach design from diverse perspectives such as technology, teamwork, and management. Based on the participant feedback from the course's 2017 iteration, video episodes were significantly condensed (from sixty to fifteen minutes on average) and more explicitly connected to the design brief, and this seemed to create positive impact towards developing design literacy as criticism towards the episodes this year was significantly reduced. That is to say, the less technology clutters the learning process, the more time and cognitive capacity the participants have to develop their design literacy.

We identified through the compositions, that this intensive course is often an emotional experience for our students as they discover the extents of their capabilities, while forming alliances to tackle tasks beyond their means. This is an important factor in constructing individual perspectives, a determinant between "feeling for" and "feeling with"; made possible as the students display a controlled level of vulnerability that permits them to be more receptive, and in turn, empathic. From design literacy's point of view, this implied a departure from seeing design as a set of tools, but rather as a mindset or a catalyst for socio-political change.

The foundation of design literacy often begins with an introduction to an array of tools and canvases applied to a made up problem within the safe contexts of the university. This allows students to customise their learning by getting acquainted with the design vocabulary, methods and processes, while enabling them to discern from other modes of approaching solutions and problem solving. This increases their metacognition and ability to effectively apply design tools to their work. However, at the same time, the nature of such projects briefs give a false impression of control over the design process as they are usually open to interpretation, without much restriction.

This in turn generates the unavoidable problem of "distortion" as mentioned in discussion with one of our partners, as he voiced difficulties in his past experience of engaging design students for collaborative projects. It often occurs that students who have only had experience in these types of projects end up assuming the same amount of perceived control when "reframing the brief" for these assigned projects, in a way that it goes off tangent from the original intent, rendering the concepts futile for the collaborators.

Thus, it would appear that developing design literacy seems to benefit from blurring the boundaries between the university and the surrounding societal setting as it enables the students to see the consequences of their design actions (Dewey, 1938). Or in other words, design literacy can be practiced in a closed classroom setting, but it is experienced when the classroom blends itself with the surrounding context. Returning to the SCET framework introduced earlier in this paper, it seems that space, community, and emotions serve as triggers for transformation. This seems to be in line with Dewey's (1930, 1938) and hooks's (1994) arguments on reconciling the mind-body separation plaguing our classrooms. Or in other words, in order for the students to move from sympathy to empathy, we, as educators, ought to understand the lived world of our students to provide them with courses that reconcile the mind-body separation.

Moreover, IDBM Challenge being the first course many students take in their graduate studies, presents us with the opportunity to instil values and design circumstances best suited to nurture these traits while they are new to the city and undergoing a transition phase in their lives. This course sets the tone for their mind-set and approach towards challenging issues and social awareness that they would carry with them throughout.

Concluding remarks

Extant literature has illustrated positive outcomes in learning contexts when design practices are utilized as a catalyst for providing the students with opportunities to take ownership of their learning (Christensen et al., 2016; Green, 2014), thus highlighting the intertwined relationship between design and politics. That is to say, departure from designing *for* someone to designing *with* someone is a question of agency that has at least two implications: first, by becoming active participants in co-creating the learning experience enables students to shift their mindset from static to transferrable skills (Dewey, 1930; Lin, Schwartz & Bransford, 2007) and second, experiencing this shift in a multidisciplinary team when working on a real life project provides the students with first-hand sensations on how and why one should design with, rather than for, someone (hooks, 1994).

This short paper serves as an introduction to our experimental methods, including a proposed framework for curriculum (re)design. In gist, we suggest that a critical prerequisite for students to truly grasp the notion of relational needs is for educators to set an example by employing empathy in the design of their learning environments; understanding what their concerns, ambitions and interests are, in order to design the right conditions to foster the emergence of care. To this end, the SCET framework introduced in this paper warrants more inquiry and theoretical development to push teaching and research on teaching and learning forward.

Rather than teaching empathy in the sterile manner that we currently adopt (through canvases and readings that serve as prompts) to solicit the "right" type of answers from users to generate actionable insights; we believe that emotions play an instrumental role in learning, especially in eliciting care practices.

Using our initial findings, we will be planning the 2019 edition of the course. Through which, we hope to uncover more insights that could point to a more conclusive set of results enabling us to refine the SCET framework further.

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A Framework to Accelerate Universal Design Literacy

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Design has historically been a specialty, something practiced exclusively by engineers, architects and all manner of design professionals. This is changing. Just as arithmetic was once a peripheral skill until the industrial age brought about the need for math literacy, the socioeconomic conditions of our current age are heralding the need for millions of people to level up in design. The expanding role innovation and collaboration play in our daily work, combined with the ever-increasing complexity and rate of change of today's products, services, and systems are making the case for design literacy. This paper: 1.) makes the case that design is poised to become the next universal literacy; 2.) argues that in order for such a literacy to arise, there must first exist a framework of agreed-upon skills that are taught and practiced by the masses; and 3.) proposes such a set of skills along with the research and reasoning that support this proposed framework.

Keywords: Design, methods, literacy, taxonomy, framework

Everyone Designs

During a client meeting in London, I said something I believe deeply and share often: "Everyone designs." Immediately, a young professional designer in the group challenged me. "That is not true," she said. "Everyone does not design, and it's an insult to me—a professional designer—to insinuate that 'everyone is a designer.' Not everyone has the expertise and experience to do what my team and I do."

I wasn't taken aback by her remarks. This wasn't the first time I had encountered this perspective, and it's understandable among those who have formal training in design and years of experience. That young designer was simply voicing her frustration with the idea that anyone could assume design competency or the role of a "designer" especially after taking a few "design thinking" workshops, something very much in vogue today. She had earned a professional standing that took years of education and application. And she is not alone. Many professional designers and design educators feel this way. They believe the growing popularity of design among non-designers cheapens the value of design and trivializes their profession.

However, I find this perspective shortsighted, counterproductive and futile, especially as more and more organizations—desperate to get their employees to be more innovative, more customer-centered, and more agile—embrace design and attempt to integrate it into their wider work culture. It's shortsighted because it shortchanges the true power and intent of design. It's counterproductive because it reflects a worldview rooted in an outdated, twentieth-century belief that design is a profession for only the special few, and that it should stay that way. And it's futile, because as I argue later, our times are demanding that everyone level up in design.

The reality is that everyone already designs. No one needs permission. Humans have always lived in a world teeming with millions of tangible and intangible things calling for change, and we are hardwired to pursue

ways to bring about that change. As Nobel Laureate Herb Simon (1969, p. 55) said, *"Everyone designs who devises courses of action aimed at changing existing situations into preferred ones."* As such, products are designed. Services are designed. Policies are designed. Laws and strategies are designed. Business models, negotiations, and curricula are designed. Everything manmade is designed. When something fails, it fails because it is not useful, usable, or desirable for the people and situation it was *designed* to serve. And in a world littered with poor design and in desperate need of change, design professionals, design educators, and leaders in all sectors, have an opportunity — a duty, even — to expand design from the profession that it is now into the liberal art it also needs to become and help as many people as possible hone their natural impulses to *change existing situations into preferred ones.*

Everyone designs who contributes to the creation of something new. To design is to play a role, however big or small, in the creation process of all sorts of intangible and tangible things people rely on every day. Whenever and wherever a person finds themselves collaborating with others in the work of bringing something new into this world — whether it is a new product, a new process, a new plan, a new policy, or a new perfume — they are engaged in the vital and communal act of design.

The Case for Design Literacy

Although math has played an important role throughout the history of mankind, it wasn't until the onset of the Industrial Age (1780 - 1840) that math transformed from a skill taught to and used by very few — scientists, engineers, and bankers — into a universal literacy taught to and used by society at large.

In their *Handbook on the History of Mathematics Education*, Karp & Schubring (2014) wrote:

> *In the eighteenth and nineteenth centuries, economic development, no longer exclusively based on agrarian modes, led to an enormous increase in urban populations. Basic numeracy skills such as the ability to tell the time, count money, and carry out simple arithmetic became essential … Within the new public education systems, mathematics eventually became a central part of the curriculum from an early age.*

While knowledge of the local terrain, agriculture, weather patterns, and various farming technologies was important and widespread, one didn't need math to work the land. That all changed with the arrival of the Industrial Revolution and the human exodus from field to factory that marked the age. This was the cultural tipping point for math because a very real need emerged to better educate millions of agrarians relocating to cities looking for work in factories. Lawmakers, industrialists, and educators — faced with a willing but unskilled labor force — responded accordingly. New education policies and education offerings were designed to teach the basics of mathematics to the general public. Research by Soysal & Strang (1989) suggests that these reformations made school compulsory to the age of 10 and made arithmetic a central part of school curriculum from an early age for the first time in history.

Today, we are entering a new age. The socioeconomic reality of our time is calling for design literacy much in the same way the socioeconomic reality of the industrial age called for widespread literacy in mathematics. Consider the following:

- 88 percent of CEOs are concerned about the loyalty of their customers and 82 percent about the relevance of their products or services. (2016, KPMG)
- Only 27 percent of leaders feel they've mastered the elements needed for innovation success over the next decade. (2014, BCG)
- According to a major IBM survey of more than 1,500 CEOs from 60 countries and 33 industries worldwide, chief executives believe that — more than rigor, management, discipline, integrity or vision — successfully navigating an increasingly complex world will require creativity. (2010, IBM)
- The Partnership for 21st Century Skills, a government-sponsored consortium of state-run and privately-run organizations dedicated to education reform, and authors of the book ***Leading 21st Century Schools,*** Schrum & Levin (2009) believe that *"Learning and innovation skills are what separate students who are prepared for increasingly complex life and work environments in the 21st century and those who are not."*

In the Harvard Business Review article *Design Thinking Comes of Age* (2015) Jon Kolko writes, *"There's a shift under way in large organizations, one that puts design much closer to the center of the enterprise. But the shift*

isn't about aesthetics. It's about applying the principles of design to the way people work." Add to this the growing numbers of Fortune 100 companies investing in designers and design training, and studies by the likes of McKinsey & Company, Forrester Research, and the Design Management Institute, that extol the business benefits of design and the ROI of "design-minded" companies[1], the shift is clear – design is poised to become humankind's next universal literacy.

Creating a Universal Framework of Design Skills

The existence of any literacy, by definition, assumes there is a fundamental and agreed on set of skills that is taught, understood, and practiced by society at large. The approach by which one teaches or learns such skills can vary, but without widespread agreement on what those skills are— and a single framework or taxonomy with which to organize and refer to these skills — technically, there can be no literacy.

According to the U.S. Department of Education, traditional *literacy "is an individual's ability to read, write, speak, compute, and solve problems at a level of proficiency required to be productive workers, family members, and citizens."* (OCTAE, 2018) This advisement suggests another way to frame the challenge: What skills should be taught and learned by the general public so that they can apply design at a level of proficiency required to, *likewise,* be productive workers, family members, and citizens?

Below are the heuristics a small team at LUMA Institute established to guide the research, reasoning, and creation of a proposed framework of skills that could serve as a suitable answer to this question. A proper taxonomy of design skills would need to be:

17. Based on extensive and thorough research of all known design methods
18. Organized in a way that is relevant and timeless
19. Essential; a collection of methods used by a multitude of people for a multitude of design situations
20. A comprehensible and accessible framework for the masses

The First Heuristic: Basing our work on extensive and thorough research

For the most part, I think we can agree on what it means to be math literate as opposed to being a math expert or a mathematician. We are talking about the basic skills of math like arithmetic, algebra, geometry, measurement, and statistics, which we learned in our formative years and find ourselves using on a daily basis and without which we would have a difficult time getting by. We are not talking about mastery of specialized forms of math that a physicist might use such as calculus, or actuaries might use like differential equations. We are talking about basic skills that are well within the full range of everyone's cognitive ability and can be employed in the midst of our everyday challenges.

If we apply this same logic to design literacy, it helps frame what it means to be design literate, as opposed to being a design expert or design professional. We are talking about basic skills such as problem framing, learning about the people we are designing for, and prototyping. We are not talking about mastery of specialized forms of knowledge that an industrial designer might employ, like color theory, or advanced techniques an ergonomist might use, such as a Psychological Workload Assessment. We are talking about basic skills that are well within the full range of everyone's cognitive ability and can be employed to navigate everyday challenges. But what are these basic skills? And how should we go about determining them?

This line of reasoning. and these questions yielded the first of our four heuristics. In order to identify these basic skills, and guard against our own bias as design professionals and educators, we believed strongly that we first must conduct extensive and thorough research of all known design methodologies.

To gain this understanding, we conducted an audit. Initially we spent about six months identifying and familiarizing ourselves with dozens of scholars and practitioners who, throughout history, had ever developed a model or published any sort of method compendium on design, problem solving, engineering, or creativity. We were careful to be inclusive and quite divergent in our pursuit of this knowledge. We considered anyone who had created a collection of tools with the primary intention of helping people design, solve problems, or bring about change and improvement. Our first wave of research yielded more than 200 methods. Our subsequent auditing included everything from classics such as John Chris Jones' book ***Design Methods***, published in 1970, to more recent and well-researched compilations like Vijay Kumar's book, ***101 Design Methods***. Included also are the methods of Six Sigma and Kaizen. In addition, we examined system engineering and design curriculums of top schools like the University of California Berkeley, Carnegie Mellon

University, Domus Academy, and the Illinois Institute of Technology. We also spent considerable time familiarizing ourselves with the favored techniques of dozens of creative consultancies like the UK Design Council and IDEO, as well as innovative product companies like Steelcase and Procter & Gamble.

Overall, we would uncover just over 900 distinct design methods. This collection was, to the best of our knowledge, the largest compilation of design methods ever assembled. While many of the methods were variations on a common theme or differed only in name or protocol, the sheer size of the list surprised and humbled us.

However, during our research, we noted that many of these methods were conceived during specific business eras and for specific industries. As such, while relevant for those times and trades, they are less so in today's business climate. For example, not all, but most methods associated with Six Sigma, while popular in the 90's, and within manufacturing, are no longer in vogue today due to sweeping changes to many facets of business and society.

This got us thinking. If design literacy is the goal, then not only do we need to identify the most fundamental methods, we need an organizing principal for these methods that everyone can relate to, but also stand the test of time. This led to the creation of our second heuristic.

The Second Heuristic: Organizing design methods in a way that is both relevant and timeless

While reviewing the different collections of methods during our first phase of work, we noticed that each group of methods came organized in one of two ways. The first way was by a process. The second way was by skill or ability. Our assumption was that our taxonomy should be based on one or the other of these two schemes. However, we were open to another if such a scheme presented itself.

Design Processes

Design practitioners and educators such as John Chris Jones and Vijay Kumar, as well as many schools and companies like Stanford University and IDEO, chose to organize their compilation of design methods by way of a design process. These processes tended to fall into three categories: linear, like many Stage-Gate and New Product Development Processes; cyclical, like Vijay Kumar's variation on Boehm's Spiral model *(figure 1*); or nonlinear, like Stanford's well known "Honeycomb" Design Thinking process *(figure 2).* Design methods were grouped under each phase or mode of work and recommended in order to become skilled at that phase or mode of work. For example, in the first mode of Stanford's Design Thinking process, which is labeled "Empathize," methods such as *Interviewing* and *What? How? & Why?* are advocated and taught in order to develop the student's capacity for empathy.

Figure 1: Source: Vijay Kumar. 2012

Figure 2: Source: Stanford D-School. 2010

Design Skills or Abilities

In our research, we also learned that some experts and organizations preferred to organize design methods by meta-skill or ability. Clayton Christensen, Jeff Dyer, and Hal Gregersen's book ***The Innovator's DNA***, Tom Kelley's book ***The Ten Faces of Innovation***, and IDEO's***, Method Cards,*** *(figure 3)* epitomize this way of

revealing the underlying discipline of design. All of these resources are well-researched and come to understand the practice of design from either observation and interviews with innovative leaders and organizations, or from the actual practices of a design consultancy. For example, in ***The Innovator's DNA,*** the authors identify "observing" as one of the five key skills an individual needs in seeking to be a disruptive innovator. After sharing the research and case stories that led to this insight, the authors identify a handful of principles and methods individuals and teams can use to develop this innovation "muscle." Principles like "Observing with all your senses" and practicing a method called "Dialog in the Dark" are recommended for each of the key skills.

Figure 3: Covers of three publications that organize design/innovative/creative skills by ability in contrast to process.

When we began to consider both design processes and design skills as ways of organizing design methods, we quickly determined that organizing them by way of a process was suboptimal for several reasons:

- Processes varied from industry to industry.
- People and organizations do not tend to follow one-size-fits-all processes.
- Branded processes are not timeless. They come in and out of vogue.
- Some methods could be used in multiple steps of any process. For example, interviewing as a method could be used at the beginning, middle, and end of any process, design or otherwise.

For these reasons we ruled out organizing methods by way of a process.

Aligning on design skills as an organizing principle

These insights, and our early observations suggested that organizing design methods by "skill", as opposed to "process" might be a better way to construct a framework of design methods that would remain relevant to the general public over the course of time.

While we were certain, skills and abilities already identified by experts such as "observation" and "iteration" would in some way play a significant role in our final assessment, we were careful not to jump to conclusions. After all, we felt it important that our framework be as relevant to millions of people 100 years now, as it would in today's society. To our knowledge, no one had ever undertaken a census of all design methods. And when we considered the rich data-set we had assembled, we saw an opportunity to build a taxonomy from the ground up by analyzing this amazing compendium of ways man had devised to solve problems. Our hypothesis was that if we carefully compared and contrasted these methods, a unifying principle might naturally emerge. So, we began to employ one of these 900 methods, an activity called Affinity Clustering, to see what we would find.

Figure 4 shows an early version of this affinity cluster. After analyzing only about 200 of the methods, the contours of a framework of skills began to emerge.

Figure 4: Early Affinity Cluster of the design methods. At this point we had mapped just over 200 methods, but already n organizing principle had begun to emerge. Source: LUMA Institute

We discovered that these methods could be grouped into three meta-skills everyone can relate to:

- **Looking** — methods for observing human experience by watching people and listening to them.
- **Understanding** — methods for analyzing and synthesizing information, uncovering insights, and framing problems.
- **Making** — methods for envisioning future possibilities through concept ideation, modelling, and prototyping.

As we began to examine subsequent methods, this basic organizing principal remained unchanged — meaning the other 700 or so methods fit easily into the categories we had identified at this early stage.

However, upon further examination of all these methods, we realized that the hundreds of methods under each of these three meta-categories could be organized into related subcategories. (*Figure 5)*

Figure 5: The subcategories. Source: LUMA Institute

While these subcategories represented skills that might not be as familiar to those new to design, they gave our model some necessary structure. Sub-grouping the ways in which people go about **looking**, **understanding,** and **making** helped us understand each practice in more depth, and quite frankly, made our taxonomy feel more like a discipline and less like a cluster of related techniques. After completing a full analysis of all the methods, here is how the taxonomy looked.

Skill 1: Looking — Observing human experience

Subcategories:

- **Ethnographic Research**— studying behavior in its natural setting; methods like Interviewing, Shadowing and Fly-on-the Wall Observation.
- **Participatory Research** — inviting people to participate in cooperative design activities; methods like Journaling and Build-Your-Own exercises
- **Evaluative Research** — examining the usefulness, usability, desirability, and reliability of solutions; methods like User Testing and Focus Groups.

Skill 2: Understanding — Analyzing and synthesizing information

Subcategories:

- **People and Systems** — making sense of relationships and the way things work; methods like Stakeholder Mapping and Experience Diagramming.
- **Patterns and Priorities** — revealing unseen structures, relevance and significance; methods like Affinity Clustering and Importance/Difficulty Matrix.
- **Problem Framing** — characterizing the situation to address; methods like the Five Whys and Root-Cause Analysis.

Skill 3: Making — Envisioning future possibilities

Subcategories:

- **Concept Ideation** — coming up with ideas; methods like Brainstorming and Alternative Worlds.
- **Modeling and Prototyping** — building representations of future solutions; methods like Storyboarding and Business Model Canvas.
- **Design Rationale** — justifying the future that we envision; methods like Concept Poster and Cover Story Mock-up.

As this organizing principle was not tied to a particular era or industry but in fact was informed by analyzing methods used thorough history and across disciplines, and employed labels like **looking**, **understanding** and **making** that everyone can relate to, we felt we had arrived at a taxonomy that held universal promise.

The Third Heuristic: The collection of methods must be essential; able to be used by a multitude of people for a multitude of design situations

We had arrived at a trustworthy taxonomy of design skills, one not influenced by our own biases or current business trends, but rather, from a careful examination of all the design methods we had gathered. The next step was to identify the most essential methods — those that would serve the goal of propagating design literacy.

But how does one go about choosing which methods are the most essential? How do you determine which are going to be the most indispensable to all manner of people and in all manner of design situations? And how many should that be? This proved to be a bit of a puzzle as we had no way of knowing how often each of these 900 methods had ever been used. Nor did it make sense to conduct a survey that asked people to name their go-to methods because we had arrived at a taxonomy that included categories and methods that were unfamiliar to all of the design professionals we had interviewed. The same was true for us. Each of us, having been professors and/or practitioners of design for a combined 60+ years, were familiar with only a few dozen *(a fraction!)* of the methods we had found.

We decided at this point, that the best way to determine what the most essential design methods are, was to create an algorithm — a string of questions or rules that would automate our reasoning. Again, this would guard us against bias and honor this incredible collection of methodologies. Below is the algorithm *(Figure 6*) that we created and used to scrutinize each of the 900-plus methods in order to determine their essentialness.

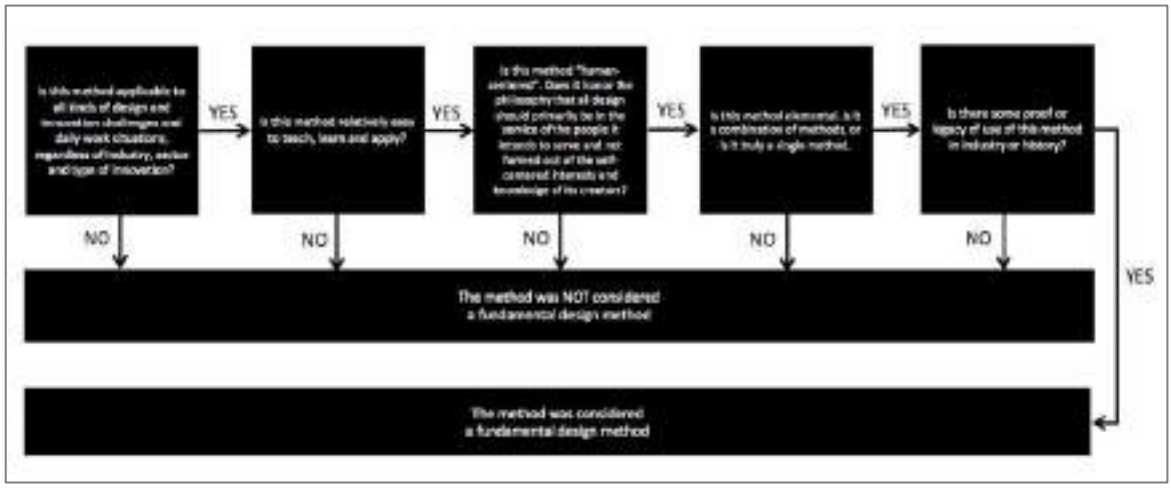

Figure 6: Our algorithm for determining the most essential design methods. Source: LUMA Institute

We used five key tests to evaluate each method. Only if the method passed all five tests was it deemed worthy to be considered an essential method. That is, a method that should be taught to and employed by everyone.

Test 1: Determining the universal applicability of the offering. A method was considered essential only if it could be applied to a wide spectrum of challenges, not just the design of new products but also new processes, programs, policies, etc. We believed that a method that could be used in a variety of contexts, industries, and sectors would appeal to the design specialist and general public alike. For example, Stakeholder Mapping *(Figure 7)* passed this test because this method helps teams gain an understanding of the domain or ecosystem of people who have a "stake" in the solution they are working toward, no matter the challenge or sector. All potential design solutions are intended to serve an ecosystem of specific people and understanding that ecosystem is critical to success.

Figure 7: An example of a Stakeholder Map. Source: LUMA Institute

Compare Stakeholder Mapping to a more specialized method like Wireframing, which creates a two-dimensional illustration of an interactive interface and specifically focuses on layout, navigation and the prioritization of content and functions. Wireframing is a great method, especially for UX designers. But it is not universal enough to be considered an essential method because it was devised to support a particular kind of design — interactive interfaces.

Test 2: Determining the ease by which the method could be taught, learned, and applied. A method was considered essential if it was "portable," meaning its benefit is easily grasped and it is not difficult to perform. This value is quite qualitative and as such we took liberties that might cause a scientist to scoff. However, for the purposes of our exercise, we had to draw a line somewhere. We considered a method easy to teach, learn, and apply if it could be shared through experience. In contrast, if a method required continuous reference to a detailed protocol, it was deemed difficult. If one could share a method by showing it, that method was considered easy. It also helped if the method could be performed effectively in different ways.

Our reasoning behind this test reflected our hypothesis: methods whose purpose and procedure can be quickly grasped will have a higher likelihood of being shared with others and used repeatedly, thus creating the conditions for mastery and therefor literacy. For example, a method like Interviewing passes this test because it is familiar to most people, can be approached in a variety of ways, and is easy to teach and perform. A few well-crafted questions and a notepad, combined with some good listening skills, will produce reasonable results. Over time, one can master Interviewing because the barrier to execute this method is low. Compare this to a more complex method like the Modified Cooper Harper Scale (MCHS) *(Figure 8),* which is a Human Factors technique for assessing mental workload. It is a great method, but it did not pass this test because it is a very specific protocol and requires in-depth explanation and training.

Test 3: Evaluating the method's "human-centered" quality. In order for a method to pass this test, it had to increase the likelihood of an outcome that successfully served people. Our reasoning behind creating this test was the common observation that when a design fails, it's because that design is not useful, usable, desirable,

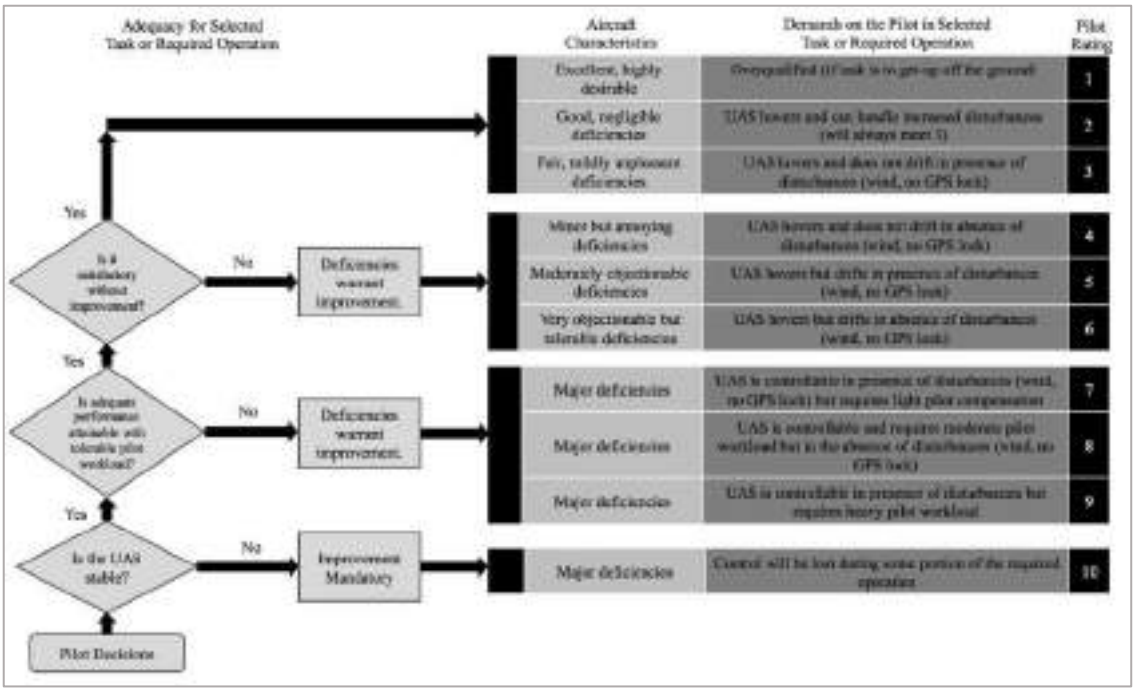

Figure 8: An example of a Modified Cooper Harper Scale. Source: Travis Fields. University of Missouri, Kansas City, Department of Civil and Mechanical Engineering.

or reliable to the people it is intended to serve. For example, a method called Importance/Difficulty Matrix *(Figure 9)* made the cut as a human-centered method. On the surface, it looks like any other "quad" method, of which there are many varieties. But in reality, its protocol helps teams debate and focus on two of the most centrally humane questions about any need, idea, feature, or initiative: How important is it to the key stakeholders? How difficult will it be to deliver it to them? Compare this to more internal or business-centric methods like Break-Even Analysis, which while good for understanding financial risk, puts the needs of the creating-entity first, instead of the people for whom one is be designing. This isn't to imply Break-Even Analysis is a bad method, but only that it didn't pass the human-centered test because it is concerned with understanding profit, instead of people.

Figure 9: Examples of an Important/Difficulty Matrix. source: LUMA Institute

Test 4: Determining if the method was a single method. Many of the methods we gathered were not really individual methods. Instead, they were combinations of methods. For example, the IDEO Method cards include Experience Prototype, which instructs users to "*quickly prototype a concept and use it to learn from a simulation of it."* Upon closer examination, this is actually two methods. The first method is building a prototype using variations such as paper prototyping or click-through prototyping. The second method is simulating use of the prototype in order to learn, using variations such a cognitive walkthrough or a user test.

Experience Prototype is really a compound method, or what we call a method set or a recipe. The distinction is important because we were looking for elemental methods. If a proposed method could be broken down into individual methods, it did not pass the “single method” test.

Test 5: Examining the method’s legacy. It was important that any method we could consider essential have a history of use in industry. We determined this through evidence of use. For example, many books and papers have been written about the method called *Experience Diagramming*, also known as Journey Mapping or Story Mapping. *(Figure 10)* There are numerous case studies and real-world examples of how Experience Diagramming has been used. Compare that with a method called “WWWWWH,” which was included in a number of design method collections we found and consistently defined, but for which we found little evidence of use in pictures of artifacts, books, papers, or case stories. Therefore, it did not pass this test.

Figure 10: Examples of experience mapping in use. The cover of Jeff Patton’s User Story Mapping and an example of an Experience Map courtesy of MAYA Design. sources: Jeff Patton & O’Reilly Publishing (2014), and MAYA Design (2010)

Using this algorithm, we were able to spotlight the most essential methods and thus reduce the number of potential candidates for universal framework from hundreds to dozens. However, we had something of a mess on our hands. For example, there were dozens of ethnographic research techniques still in consideration, but only a handful of design rationale methods. And while quite a few problems framing methods passed the test, some were so similar, like *The Five Whys* and *Abstract Laddering*, that we had to consider if both should be included. When we took a step back and considered what we had, it was uneven and lacked a clear sense of ‘a whole’. What we had, looked a bit random and complex — something the general public might have a hard time comprehending and accessing, which was the very opposite of what we desired.

After presenting our findings to key stakeholders for feedback, it was clear that our collection needed to be curated and designed if it was ever to become a framework the general public might embrace.

The Fourth Heuristic: The Framework should be designed to be comprehendible and accessible by the general public

In cognitive psychology, there is a technique known as “chunking” in which *“individual pieces of information are bound together into a meaningful whole”* (Neath & Surprenant, 2003). It is well studied and understood among psychologists that when this technique is used, the information presented is more easily remembered than when this same information is presented as individual items. It is also understood that in order for chunking to work, the optimal size of the *chunks* generally consists of no more than three-to-five items. For example, when recalling a number such as 4105551367, grouping the numbers as 410, 555, and 1367 creates a mnemonic in the form of a U.S.-based telephone number. Instead of remembering 10 separate digits, which is beyond the "seven plus-or-minus two" heuristic, we recall only three groups of numbers, each containing only a few digits.

With this in mind, we began to edit and iterate. We developed and presented a successive series of candidate frameworks to key stakeholders, who offered us insightful feedback regarding the coherence, relevance, and usability of each version. After several iterations, we arrived at what we called the LUMA System.

The LUMA System *(Figures 11 & 12)* is a collection of 36 methods presented as a simple aphorism that summarizes design into the three fundamental skills of **looking**, **understanding**, and **making**. The simple acrostic **"L-U-M-A"** is offered as a mnemonic for the fundamental skills of design. The final letter, "A," stands for "adapting," which is a synonym for change and is the main concern of design.

Figure 11: The LUMA System. Source: LUMA Institute

Figure 12: An alternate representation of LUMA System. Source: LUMA Institute

To grasp the combinatory power of this system, it's helpful to think of this system like karate or common foods in your kitchen and pantry.

Years ago, a client and colleague of mine, Seth Starner, who today heads up Advanced Development at Steelcase, and is a blackbelt in karate, mused about design and innovation in one of his very thoughtful blog posts. He wrote: "*In the end the martial arts are about a state of mind, yet if you have ever been involved in taking a Karate or Kung-Fu class, you spend a good portion of your time practicing forms called katas (figure 13), over and over and over again. The same moves in the same sequence until you dream about them. We think of design and innovation in the same way. It is a state of mind, but to get there you have to know the tools and approaches and then you need to practice them."*

Figure 13: Sochin is a kata practiced in several styles of karate. Source: https://www.karatedo.asia/shotokan-ryu-katas/sochin/

I've always found Starner's comparison of karate to design and innovation a powerful one. His analogy is a good reminder of how one becomes skilled and fluent in anything. The reason anyone is fluent, whether that be in karate, or reading, writing and arithmetic for that matter, is because at some point that person was taught a system comprised of atomic elements and *how* to combine those elements in a variety of ways for a variety of reasons and contexts. In Starner's karate example, it is the 36 katas which, once you understand them, can be combined in thousands of configurations and used in many offensive and defensive situations. In mathematics, it is just a handful of methods such as addition, multiplication, and simple algebraic formulas that, once you understand them, can be utilized when, where, and how you need them. In reading and writing, once you know the 26 letters of the English alphabet, you can read, comprehend, and utilize any word in the Oxford English Dictionary.

Since publishing the LUMA System in 2012, we've looked for ways to help people understand what it is, and how to use it. One analogy we've found particularly effective is to think of this system of design methods like the common foods you keep in your kitchen and pantry, such as everyday fruits, vegetables, and carbs, plus dairy products, your favorite protein, and go-to seasonings (Figure 14).

Figure 14: Source: LUMA Institute

Just as everyday recipes like Pasta with Cheese and Pepper or Peach Cobbler are made up of these essential food staples, so, too, can all sorts of everyday work experiences be made up of essential design methods used to address challenges such as improving the employee onboarding process or uncovering customer insights. (Figure 15) We have found the recipe metaphor particularly helpful in explaining what the LUMA System is and how to use it, to people without formal design training and who are new to the idea that *they* design.

Figure 15: Source: LUMA Institute

This is a system, not a process, for everyone. No matter what they do or what challenges they might face

Recalling our second heuristic, and the fact that the LUMA system's organizing principle is design skills, not design processes, the system is able to be utilized in all kinds of processes, whether Stage-Gate, Product Innovation Process (Figure 16) or Google Ventures Design Sprints. (Figure 17).

Recalling our third heuristic, and the fact that the LUMA system is comprised of only the most universal and essential design methods, it can also be employed by everyone – from business consultants to human resources managers, to solve common challenges, whether that's coming up with better ideas or working with remote teams. (Figure 18)

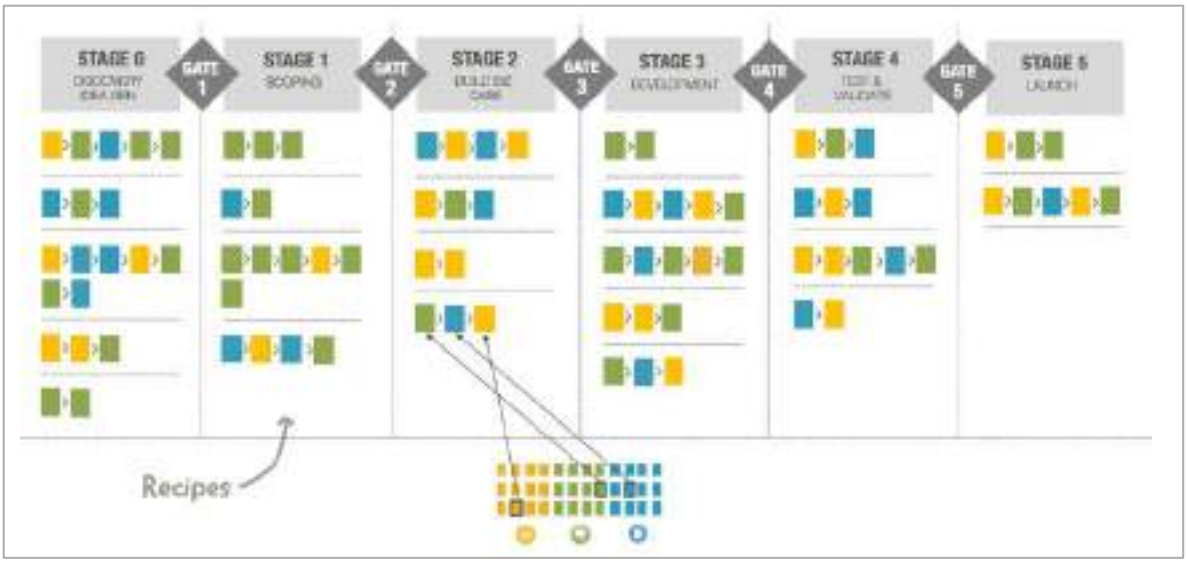

Figure 16: How the LUMA system underpins a typical Stage-Gate® innovation process. Source: LUMA Institute

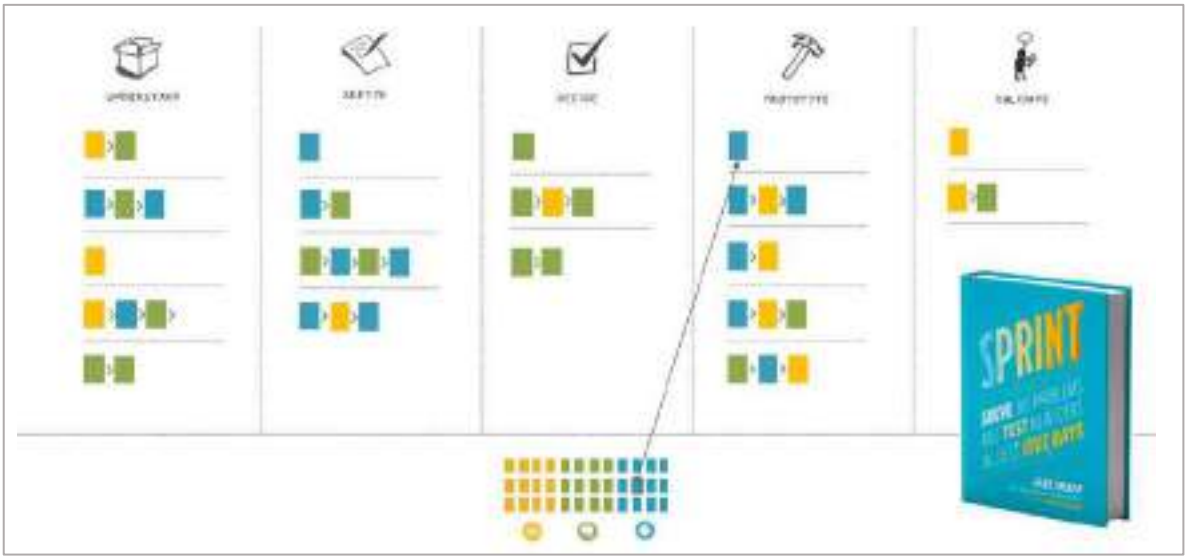

*Figure 17: How the LUMA system underpins Google Ventures Design Sprint process. Source: **SPRINT** by Jake Knapp & LUMA Institute*

Figure 18: Recipes from our SaaS LUMA Workplace, are everyday examples of the combinatory nature of the LUMA system. Source: LUMA Institute.

Even popular design activities such as iteration and empathy are supported by this framework. For example, iteration is a really just a combination of a making method, followed by a looking method, followed by a making method. For example, a popular recipe for iteration might include building a Rough & Ready Prototype, followed by Think-Aloud Testing of that prototype, followed by building a new and improved Rough & Ready Prototype based on the feedback. Empathy is a combination of a looking method, followed by an understanding method. A popular recipe for building empathy might include conducting a Contextual Inquiry, which is a looking method, and then codifying the data collected using the Understanding methods of Rose, Thorn, Bud and Affinity Clustering.

Our goal was to create a design framework that was relevant, timeless and that anyone could learn and apply to all manner of challenges, no matter where they work or what problems they and their teams may face

But how is this system being used? And how effective is it?

The LUMA System: Usage and Impact

We created the LUMA System in response to a clear, unmet need among organizations around the world to elevate design and innovation, and in response to our core belief that the socioeconomic reality of our time is heralding the need for universal design literacy. Since its inception in 2012, the value of our framework has always been measured by its reception, adoption, and efficacy in real-world settings. Here is what we have learned.

Reception

- In 2015, *Harvard Business Review* featured the LUMA System and called it "A Taxonomy of Innovation."
- Our book, Innovating for People, (Figure 19) has a 4.6-star rating on Amazon based on 109 reviews.
- Our workshops and digital platform LUMA Workplace, currently have a Net Promoter Score of 80.

Adoption

- The LUMA System has been used in over 78 countries including mainland China (Figure 20).
- It has been employed at over 600 organizations worldwide, including dozens of Fortune 500 companies. This list includes organizations such as Accenture, Autodesk, Standard Chartered Bank, U.S. Department of Defense, and Knight Foundation.
- About 100,000 people have been introduced to the LUMA System through the book, ***Innovating For People***, in-person and online workshops, and our digital platform, LUMA Workplace®.
- We have certified about 200 instructors worldwide to teach the LUMA System. In addition, hundreds of teachers worldwide are using our system, including K-12 and post-secondary settings. While we would love to include stories of how they are using this system in the classroom, this is outside the frame of this paper.
- Launched in 2016, LUMA Workplace® currently has more than 5,000 monthly active users, a number that has grown more than 60 percent year-over-year.

Efficacy

- The taxonomy is very durable and sound. To date we have received no strong indication or feedback that the organization of the methods is flawed. Also, since our original research, we have uncovered dozens of new methods and each has fit precisely into our framework.
- Not everyone needs 36 methods. In no cases has an individual, team, or organization adopted and used all 36 methods on a regular basis. We have received feedback numerous times that 36 was still too many methods and we have no evidence that all 36 are essential. The data gathered to date indicates that people use a subset of anywhere between nine and 18 of the methods on a semi-regular basis, although not the same ones.
- We are in the process of examining the use of the system and expect to be updating and republishing our framework sometime in 2020. It is likely that a few methods will be removed and/or replaced with more effective candidates.

- We have more than 100 documented case stories shared by users of how they have employed the LUMA System. We assume there are thousands more that our clients have not shared with us.

While we can in no way claim that this framework has produced "universal design literacy," these statistics indicate that the LUMA System is helping to make progress toward this future state. We have much to learn, but we are confident that a system configured such as ours, but not necessarily ours, is necessary to the propagation of design literacy.

Figure 19: A spread from the book about the LUMA System called **Innovating for People: Handbook of Human-Centered Design Methods**. *Source: LUMA Institute*

Figure 20. Photos from a workshop in Shanghai, China. This team is using Creative Matrix and Important/Difficulty Matrix, to diverge and converge on concepts for how to improve the car buying experience. Source: LUMA Institute

Conclusion

Imagine a world in which hundreds of millions of people have mastered basic design skills so they can frame problems, deeply understand people and situations, pull insights from a complex sea of data, generate unconventional ideas, sketch, build prototypes, test assumptions, and iterate quickly — the hallmarks of good designers.

Imagine a world in which everyone is as competent at looking**,** understanding, and making as they are at doing arithmetic, simple forms of algebra and geometry. Imagine that they possess the creative confidence and capability to take on all kinds of opportunities calling for change.

It's hard to see that future clearly. But I predict that it will be a world in which people enjoy their work more, collaborate more, and tackle more of the world's problems, big and small, easy and wicked. I can't help but wonder if that world would be an entirely different place than it is today.

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[1] These include but are not limited to: UK Design Council (2011) Leading by Business Design; Frog (2018) The Business Value of Design; The Danish National Agency for Enterprise & Housing (2003) The Economic Effects of Design; Forrester (2017) The Total Economic Impact of IBM's Design Thinking Practice;

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Research Perspectives IN THE ERA OF Transformations

Roles of Design Processes Models as Didactic Materials

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We argue that visual representations of design processes contribute toward social and material practices of design(ing). They are used as didactic devices. We will discuss them using metaphors to illustrate that they are active material devices of which circulation, production and consumption are informed and informing perceived complexities, ambiguities and paradoxes associated with design. We propose a follow-up study to investigate how teachers and designers use and interpret visual design process models. The reason is to identify how these models are informing what design is as we are interested to understand how these models are contributing to the development of Design Literacies.

Keywords: visual representations, design education, didactic image, design thinking models

Introduction

More than three decades ago Gather Morgan (1997 [1986]) published a book entitled “Images of Organization”. In his book Morgan explored organisations through lenses of eight metaphors: (i) organizations as machines, (ii) living organisms, (iii) brains, cultures, (iv) political systems, (v) psychic prisons, (vi) flux, (vii) transformation, and (viii) instruments of domination. Wilkes (1989, p. 67), suggested “that metaphor is an especially appropriate tool for assisting us to appreciate, interpret and understand” complexities, ambiguities and paradoxes associated with organisations. Metaphors contribute towards production of organisational cultures and how we can think of organisations, including their possibilities and limitations (Jermier & Forbes, 2011). We would like to extend this idea to design process models.

The motivation to study the design process models is that they ‘represent’ how design practices are conceived (Wynn & Clarkson, 2005). Chaplin (1994, cited by Banks, 2007, p. 17) suggested that “representation has the following three properties:

1) its form is not dictated solely or even at all by the thing represented but by set of convention codes […] but only [comprehensible] to viewers who understand the convention
2) reflects and constitutes social process
3) the representation has some kind of intentional force behind it (agency)

Representations, including representations of design process models, embody sets of shared values, cultural codes, concepts and “emotions we associate with them” (Hall, 1997, p. xix). According to Hall (1997, p. xvii) “representation is one of the central practices that produces culture”, including professional cultures such as that of design. Holliday (1999) refers to these professional cultures as ‘small cultures’.

Hall (1997) suggests that "in part, we give things meaning by how we represent them – the words we use about them, the stories we tell about them, *the images of them we produce,* the emotions we associate with them, the way we classify and conceptualize them, the values we place on them" (p. xix, our emphases). In this sense the designing is the 'thing' to which a meaning is given by representation through the design process models.

The representations do not have any meaning in themselves, "it is we who fix meaning" (Hall, 1997, p. 7). Therefore, in order to 'translate' and to "read visual images", such as the design process models, the members of the cultural group (e.g. designers) "must share, broadly speaking, the same cultural codes" (p. x), as it is "only viewers who understand the conventions can read these" visual representations (Banks, 2007, p. 1). For example, the visualisation of a time has developed its conventions. The past time might be related to what was 'left behind' and the future time to what 'comes forward'. One can visualise this as if a person is standing with their back turned on the past and facing the future (Meirelles, 2013). In graphic terms, this translates into horizontal lines that can be 'read' from left to right, where the left end represents the 'beginning' and the right represents the 'end'. Thus, in this way of representing a time direction, a situation that happened in the past must be placed to the left of another element that occurred afterwards. However, Kress and van Leeuwen (2006) suggested that direction of reading, including a time, cannot be assumed. For example, Tversky (2001) suggested that those writing/reading right to left also tended to map temporal concepts from right to left. Mijksenaar (1974, p. 19) illustrated how African miners read instructions of a cartoon, which was designed to be read from left to right, from right to left and thus reversing the proposed set of actions. The outcome was that rather than loading stones the miners were off loading them.

The design process models stand for or represent concepts and ideas about design. The representations are constructed by those producing (inscribing) as well by those using (consuming) and interpreting these models (Bowker & Star, 2000).[1] The circulation, production and consumption of these visual design process models are constituting and sustaining the 'cultures of designing'. They act as a focal point to initiate the 'uninitiated', the novices, such as students (Bobbe, Krzywinski, & Woelfel, 2016; Howard, Culley, & Dekoninck, 2008), about what design and designing is (the act of designers). According to Dubberly (2005) "models of design process were developed to help […] students to learn to design" (p. 29).

Thus, the design process models act as *didactic materials*, whether it be in classrooms or in offices. According to Díaz Barriga Arceo and Rojas (2002) the use of images, such as the illustrations, concept maps and diagrams, facilitate the processing of information by improving the codification and organisation of information. Therefore, if we understand the design process models as didactic materials then we can reason that they contribute to the development of 'Design Literacies' (e.g. Kolko, 2018; Pacione, 2010).

The Design Literacies can be understood as a set of craft skills such as ability to draw or making a mock-up or producing a prototype (Heller, 2004). However, as design has been increasingly promoted as a creative problem thinking / working / solving activity, we would like to adopt a broader perspective of Design Literacies which can be associated with, for example, creative problem-solving process (Cross, 1982) which in turn has been promoted under the banner of 'Design Thinking' (e.g. Brown, 2009; Buchanan, 1992; Norman & Verganti, 2013; Pacione, 2017). This way of understanding design(ing) enables it to be increasingly promoted and appropriated well beyond the design disciplines (Glen, Suciu, Baughn, & Anson, 2015; Razzouk & Shute, 2012; Riverdale Country School & IDEO, 2012; Stigliani, 2017) as a method of creative problem solving for professionals of other disciplines under the term of 'Design Thinking' (Liedtka & Ogilvie, 2011; Martin, 2009). Dorst (2011) identified 'Design Thinking' as a new paradigm for dealing with problems in many professions such as Information Technology and Business. It has been suggested that the 'Design Thinking' encourages creative thinking through supporting identification of problems and development of more diverse and user centred solutions (Dorst, 2011; Hassi & Laakso, 2011; Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). We would like further to extend the application of Design Literacies beyond 'production' to encompass practices of consumption of goods and services (Ingram, Shove, & Watson, 2007) and development of citizenship (Nielsen, 2013).

[1] This separation between production and consumptions is not as clear cut. The reason is that designers and design educators who 'inscribe' design practices into design processes for benefits of their colleagues, clients and students may be using these models themselves.

Visual Representations of Design Processes

Many authors have tried to visually represent the design process[2]. The visual design processes models are recurrent representation of proposed 'fundamental' elements such as steps and types of thinking and feedback loops that take place during the design process (see Table 1). However, each emphasises different aspect and incorporates elements of their own professional or academic context. Given the diversity of authors, their careers and disciplinary linkages, the representations of design process models are diverse, both in their structures such as number of different activities, steps and phases as well as the naming of these. For example, Wölfel , Debitz, Krzywinski, and Stelzer (2012) interviewed 50 designers (15 Industrial and 35 Engineering Designers) who together provided 701 named methods! (p. 1400) The large number which was collected represents 14 different named methods per each of the interviewed person.

These visual representations can range from very precise tasks, starting and ending with defined tasks, with phases which bring together various activities which may overlap with each other. The type of activities involved, also vary including practical procedures (e.g. prototype and test), cognitive skills (e.g. analyse, synthesize) and attitudes required (e.g. empathy). The elements involved, are so many and so varied, that it is impossible to reunite them all in a single diagram. For example, the consider complexity associated with transition between the 'problem' and the 'solution': the process moves from a 'current' to a 'future' situation, from 'analytical thinking' to 'creative synthesis', from 'divergence' to 'convergence', from 'knowing' to 'making', from a 'concrete situation' to the 'abstraction of the ideas and concepts', to finally return to the 'concrete' through the implementation of a proposal. The overwhelming diversity has been noted by scholars trying to examine design process models (Bobbe et al., 2016; Gericke & Blessing, 2012; Wynn & Clarkson, 2005).

Dubberly (2005), who collected over 100 design process models, suggests that just recording a design process does not necessarily represents what took place and why. He provides an analogy of recoding the design process to that of recording a photograph. It is "the author [who] chooses where to point the camera—where to begin mapping the process, where to end, and what to put in, what to leave out, how much detail to include." (p. 13) He argues, that "one risk in using this framework is that it neatens a messy world. It may promote an illusion of linearity and mechanism of case and effect." (p. 12) Howard et al. (2008, p. 168) research suggests that the design processes are more erratic than most design process model representations suggest.

Similarly, in the field of school education, there are also many variations of the design processes, such as: the diagrams by the Design Thinking for Educators (Riverdale Country School & IDEO, 2012), Design for Change (Allende, 2016; DFC Global Inc., 2019), and Index (INDEX: Design to Improve Life, 2019; Stenlev & Boegeskov, 2016). Specific questions we might ask are: What are the characteristics of these visual representations? What elements of the design process are maintained across the models and which are different? What elements inherent to the field of education are incorporated into these design models?

Díaz Barriga Arceo and Rojas (2002) identified five types of illustrations, according to their main function in the teaching-learning process: descriptive, expressive, constructional, functional and algorithmic. These categories are not exclusive of each other rather they are part of a continuum:

1) The *descriptive* images show what an object is like and what are its most relevant physical characteristics, for example atlases of the human body or the double helix of DNA.
2) The *expressive* images seek to generate an emotional impact that mobilizes an attitude toward some phenomenon. For example, a photograph of sea turtles trapped by plastic bags, to promote the non-use of plastic.
3) The *constructional* images are used to explain the components or elements of an object or system, emphasizing the structural aspects.

[2] For the purposes of this article, thought and process are used indistinctly to refer to the set of activities, stages, abilities, skills and attitudes deployed by designers in the development of their projects. It is not the objective to focus on analysing the meanings and emphasis associated with each term, although it may be an interesting challenge to address in the future.

4) *Functional* images show processes and interrelationships that occur between the elements that make up a system, for example the illustration of the water cycle, the food chain or the communication scheme
5) *Algorithmic* images allow to describe procedures, visualizing possible actions, routes or steps of an activity. They are used to teach procedures to solve problems, for example flow charts.

Most of the design process representations would fall into the algorithmic category, as generally they define steps to solve problems. Some however include functional elements, which try to characterize thought forms (divergent thinking / convergent thinking), axes or dimensions involved in the process design (understanding - doing, concrete, abstract).

Cross (2005 [1999]), Lawson (2004), Wynn and Clarkson (2005), Dubberly (2005) and others have made a useful contribution in keeping record and analysing different models. For example, Dubberly (2005) classified over 100 models according to their formal characteristics — linear (Figure 1) or cyclical (Figure 2) — or by the context from which they are elaborated: academia, professional consulting, software development.

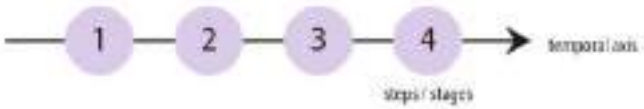


Figure 1 A linear Design Process with Specific Steps

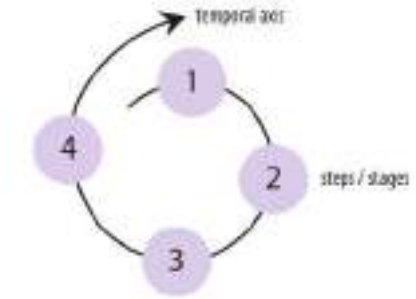


Figure 2 A Cyclical Design Process with Specific Steps

Our interest is to view these design process models using metaphors. During our research we have identified the following metaphors which might be useful for exploring design process models:

- Design Process as Problem Eradication
- Design Process as a Rational Order (e.g. Simon, 1988)
- Design Process as a 'Thinking Journey' (e.g. Alexander, 1973 [1964])
- Design Process as a Co-Evolution (Maher, Poon, & Boulanger, 1996)
- Design Process as an 'Mental State'
- Design processes as a Learning

Design Process as a Problem Eradication

Generally, a design process starts with a problem and ends in a solution (see Figure 3). But this is a fairly schematic way to define it because a design process can also be activated with the detection of a need or an opportunity (Ulrich & Eppinger, 2000). If the design process starts with a 'problem' then it is referring to a 'problematization' of an aspect of reality, and the interpretation of the reality is that there is a 'fault' or a deficiency.

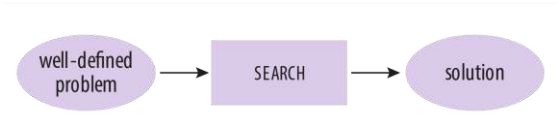


Figure 3 A Design Process Models with a 'well-defined' problem
source: Maher et al. (1996, p. 4)

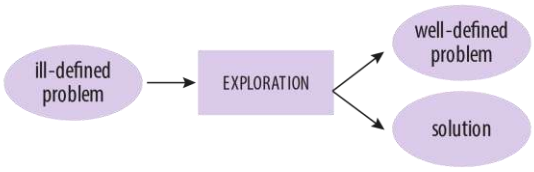


Figure 4 A Design Process model with 'ill-defined' problem
source: Maher et al. (1996, p. 4)

However, Dorst and Cross (2001) suggested that designers do not consider the problem as an objective element—on the contrary—they interpret and construct it from their own contexts, experiences, capabilities and resources, manipulating it during almost the whole process. Implication is, that in this context the problem is never fixed but rather it is continuously 're-moulded' throughout the whole design process. Prior to Dorst's and Cross' article, Rittel and Webber (1973) outlined that "every textbook of systems engineering starts with an enumeration of these phases: 'understand the problems or the mission,' 'gather information,' 'analyse information,' 'synthesize information and wait for the creative leap,' 'work out solution,' or the like. For wicked problems, however, this type of scheme does not work. One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve." (p. 162) However, we would like to consider that this issue is not much related the wicked problems, but rather to a desire to develop a demand. Mol (2008, p. 27) suggested that "advertising agencies are not at all inclined to 'treat demand' as something that is given. For them 'what people want' is not rational phenomenon, they try to create demand. Not with arguments, but through seduction." (p. 27) We can extend these very qualities onto designers who with professionals such as advertisers, reporters and journalists, are part of the cultural mediators (du Gay, Hall, Janes, Mackay, & Negus, 1997). It is these professions who are in the business of producing seductive 'meanings' for the consumers to consume (Berger, 2010; Fry, 2011).

Design Process as a Rational Order

The design process models developed under the influence of engineering, focus on identifying the main stages of the process. They tend to be linear representations, which are organized in a temporal axis (representing a transition of time, from left to right and from top to bottom) — vertical or horizontal—on which activities or stages are deployed. Some include tasks, objectives, results and feedback loops. 'Synthesised' models identify only the main phases. The green rice by Munari (1989 [1981]) also reflects a linear logic, although clearly the invitation to cook is friendlier and in general well received by design students.

Lawson (2005) stated that these sorts of design process models suggest that transitions will take place during the design process. He used RIBA's sequential design process (see Figure 5) to examine how it might be interpreted by a designer. On a practical level, he observed that it might be difficult for a designer to complete phase 1 before the problem is investigated in phase 2. However, more importantly, relying on his teaching experience, he suggested that students might step over the transition process between phase 1 and phase 2. Implication of this design process representation is that it might "encourage unproductive procrastination!" (p. 34) Further on, in his analyses he outlined that the model does not indicate how the transition (a jump from one of the phases to the next) will take place or how a designer should gather the "information about problem, study it, devise a solution and draw it" (p. 35). In addition, it is not clear how often and what will trigger these jumps.

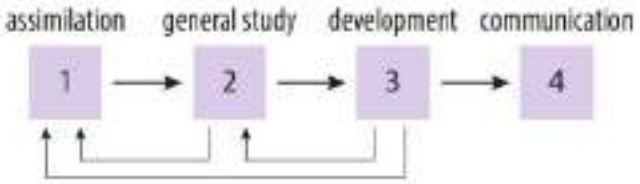


Figure 5 A map of design process according to the RIBA plan of work
source: Lawson (2005, p. 35)

Design Process as a Co-Evolution

Maher et al. (1996) characterised the design process as an exploratory activity, aimed at defining a problem and searching for possible solutions. They suggest that the design process represents into discreet phases "is not good (or correct) description of design" (Maher et al., 1996, p. 3). Unlike the search process, which starts with a well-defined problem (see Figure 3), exploration begins with an open and poorly defined problem. So, that in addition to generating a solution, a designer must shape and define the problem itself (see Figure 4). They suggest that problem and solution are interrelated rather than separate entities. For example, producing a prototype (solution space) might redefine a problem space (Dubberly, 2005), "which in turn will generate a new design space" (solution space) (Maher et al., 1996, p. 4). Thus, the problem space and solution space co-evolve (p. 7), see Figure 6 and Figure 7. To advance their thinking they used analogy of gene mutation.

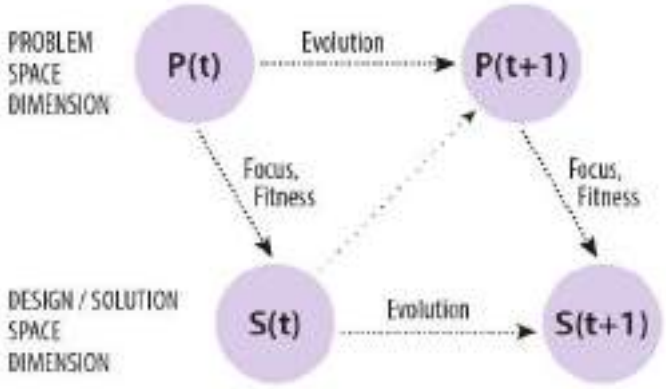


Figure 6 Co-evolution of a problem and a solution (based on the genetic mutation metaphor)
source: Maher et al. (1996, p. 7)

The understanding of the problem and the solution affect each other (Rittel & Webber, 1973). The information needed to understand the problem, depends on the idea that a person has to resolve it and the characteristics and constraints of a possible solution affect and contribute to redefine the problem. The issue is even more complicated, as according to Cross (2011) designers do not interpret the design brief as a specification for a solution, but as a starting point to explore and to define the problem. Thus, the problem definition is one of the results of the design process.

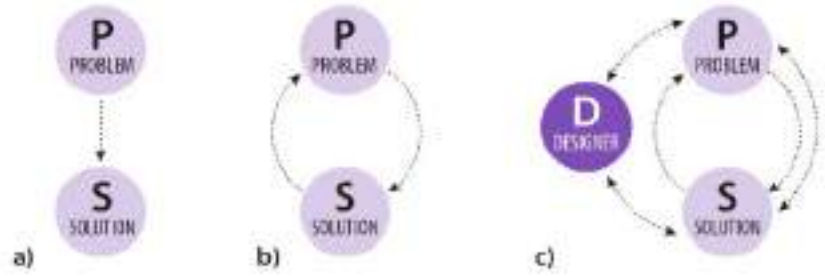


Figure 7 From linear positivism (a), to constructivism (b), to phenomenological (c) design process conception

Design Process as a 'Thinking Journey'

The diagrams of Alexander (1973 [1964]), Dubberly, Evenson, and Robinson (2008) and Kumar (2012), emphasize ways of thinking. Alexander (1973 [1964]) distinguishes the context of the form and explains that the complexity of the process is due to the successive mental and formal interpretations that the designer makes of the context and the form, see Figure 8. Kumar (2012) establishes two axis that intersect forming four quadrants. The vertical axis goes from the 'real' to the 'abstract' and the horizontal, from 'knowing' to 'doing'. Each quadrant is associated with a type of thinking (analysis and synthesis) or procedure (research and realization), see Figure 9.

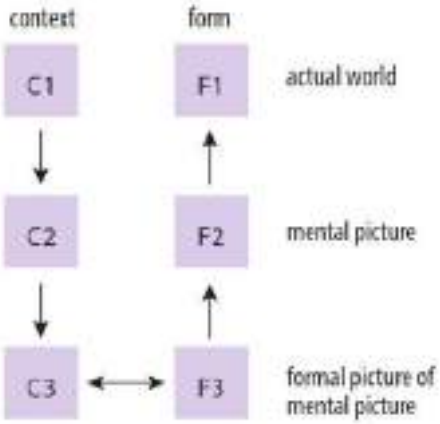


Figure 8 Mediated Design Process model
source: Alexander (1973 [1964], p. 76)

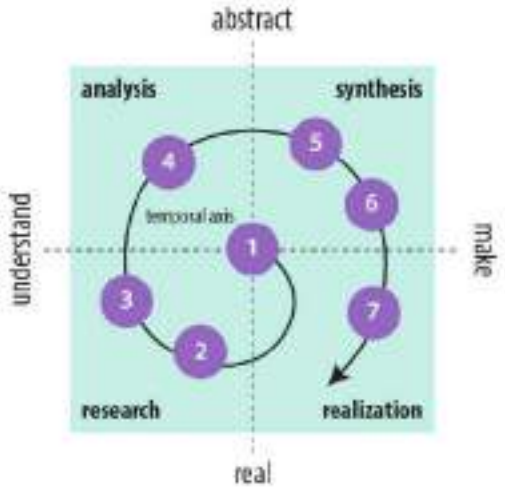


Figure 9 A Model of the Design Innovation Process
source: Kumar (2012, p. 8)

The Double Diamond Model (see Figure 10) proposed by the Design Council (Design Council et al., 2015); which resembles Banathy (1996) 'Dynamics of Divergence and Convergence' model, see Figure 11 (Dubberly, 2005, p. 24); combines a temporal linear structure, with the representation of two main cycles of divergent and convergent thinking, culminating respectively with the definition of the problem and the solution. This model is based on the mnemonic[3] resource of the 4D: **D**iscover, **D**efine, **D**evelop, **D**eliver (Figure 10) (Dubberly, 2005, p. 6). Both models incorporate two key phases which are made of two steps. The diagrams suggest that as the design progresses during the first step problem finding grows exponentially (discovery/divergence). Then, during the subsequent step (define/convergence) the designs are reduced into a 'single problem'. This is then followed with developing many divergent solutions to address the identified problem in the previous

[3] Mnemonic is a device such as a pattern of letters, ideas, or associations that assists in remembering something.

step. Once again, the next step (delivery/convergence) is to reduce these divergent solutions into a 'single solution'.

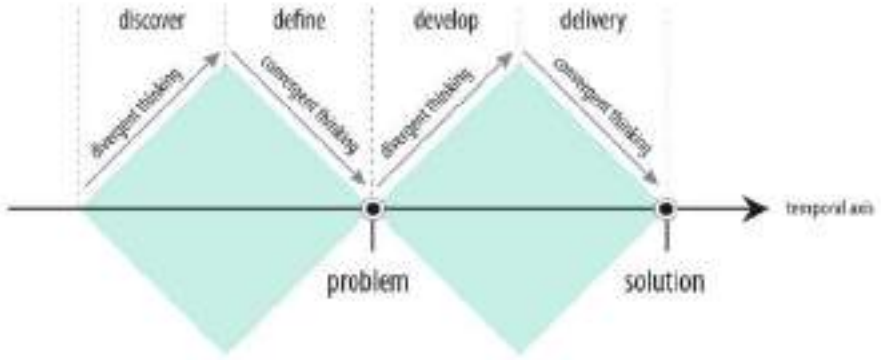


Figure 10 Double Diamond model
source: Design Council et al. (2015)

The key difference between the Design Council's and Banathy (1996) 'Dynamics of Divergence and Convergence' models is that Banathy (1996) attributes the divergent to involvement of members from different disciplinary backgrounds and it is these disciplinary differences which enable to generate the divergence in thinking. What is not clear, is how the use of same elements which facilitate generating the divergence in the prior step will also achieve the convergence.

McComb, Cagan, and Kotovsky (2014, 2015) suggested that as expert designers select a 'good' direction for solution quickly they will generate low levels of divergence, which means that they will consider fewer solutions in comparison to novice designers. The implication is that convergence takes place much earlier in the process then the model might indicate.

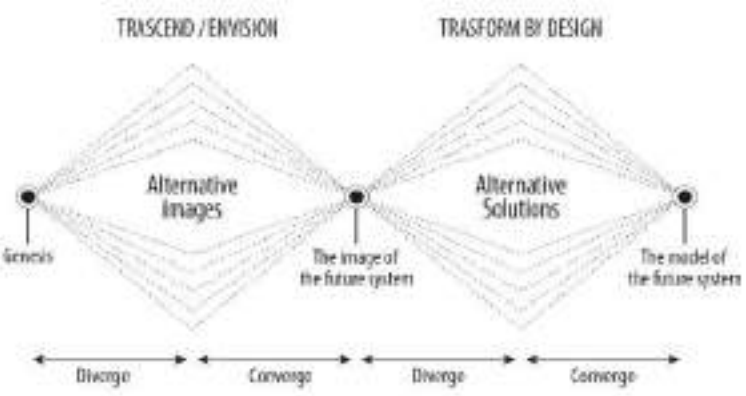


Figure 11 Dynamics of Divergence and Convergence
source: Banathy (1996)

The separation of analysis and synthesis can be observed in many design process models (e.g. Double Diamond, see Figure 10). The influence comes from understanding cognitive thinking skills having analysis (divergence) and synthesis (convergence) as separate thinking activities, see Figure 12, even though research suggests otherwise. For example, Koberg and Bagnall (1981 [1972]) suggested that both analysis and synthesis continue through a project. This is supported by Eastman (1970, cited by Lawson, 2004) and Akin (1986) that analysis (understanding the problem) is much more integrated with synthesis (generating a solution). For example, Akin (1986) concluded that designers were constantly generating new goals and redefining constraints. Thus, Akin (1986) suggested that analysis is part of all phases of design and synthesis is found very early in the process.

The implication of understanding these as separate activities results in, for example, forcing design team members delaying making solution for as long as possible (Bason & Austin, 2019).

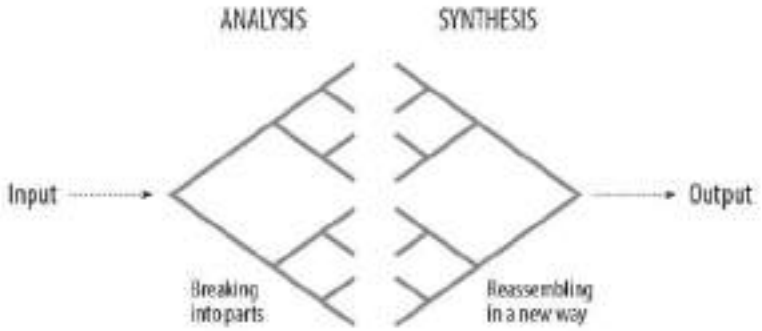


Figure 12 Separation of Analysis and Synthetic
based on: Dubberly (2005, p. 22)

Design Process as a Continuous Improvement

Popularised within the Total Quality Metagaming (TQM) movement the Continuous Improvement cycle also known as the Shewhart-Deming Plan-Do-Study-Act[4] Cycle (see Figure 13) was developed for problem solving and it was used in manufacturing to eliminate a waste (1997):

- PLAN (Approach) means to avoid MURI, or [waste caused by] unreasonableness
- DO (Deployment) means to avoid MURA, or to control [waste caused by] inconsistencies
- CHECK (Study/Results) means to avoid MUDA, or to find waste in outcomes[5]
- ACTION (Act/Improvement) indicates the will, motivation, and determination of the Management

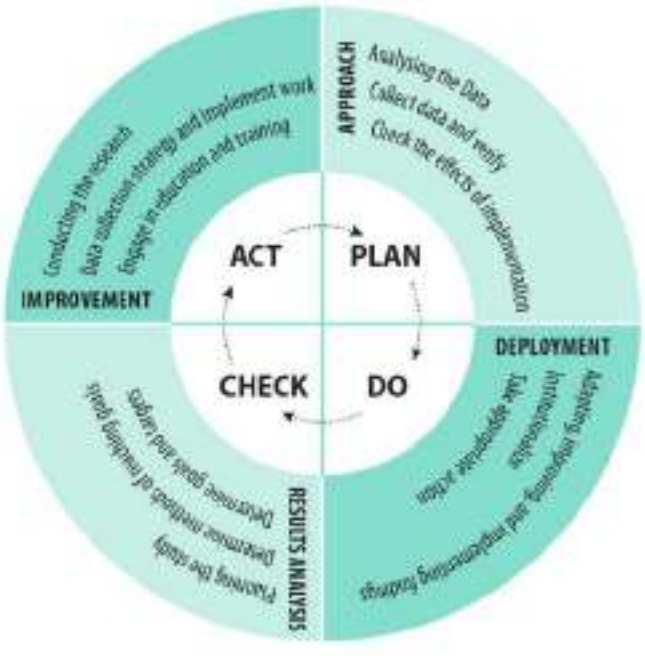


Figure 13 The Shewhart-Deming Plan-Do-Study-Act Cycle for problem solving
adapted from: G. H. Watson (1993, p. 4), Ishikawa (1985, p. 85), Dubberly (2008, p. 31), (Hamson, 2003, p. 239) and Chestnut (1997, p. 52)

[4] There are many variations on how these steps are named.
[5] Explanations of muri, mura and muda see Kitano and Toyota Motor Manufacturing (1997) and Ohno (1978)

The cycle was adopted as a cyclical design process model to illustrate the 'never ending' cycle of the design improvement. One of the implications of this model is that any development is done in relation to the existing solution which most likely might prohibit a radical innovation and most likely entrench exiting practices.

Design Process as a 'Mental State'

Some of the most popular models are those of the Institute of Design at Stanford University (d.school). They have been developed to teach design thinking to students from various academic undergraduate and graduate programs in Stanford, as well as executives and young professionals who take their courses and workshops.

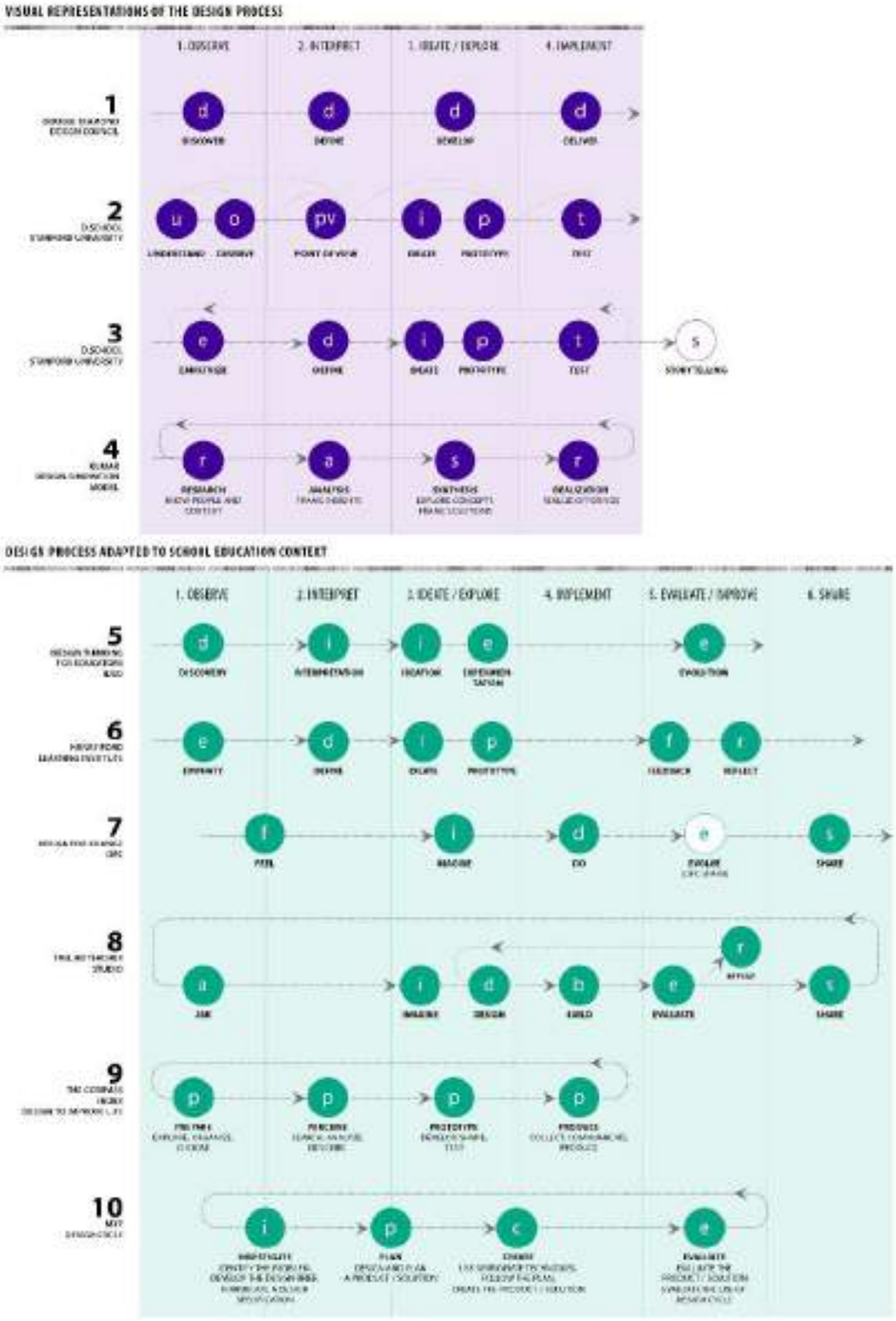
There are many d.school design process models in circulation (see Table 1 and Table 2). However, perhaps the most widespread is the (i) model composed of six stages—understanding, observing, point of view, ideate, prototype and test—represented by coloured circles, from which curved lines display alluding to the iterations. In addition, (ii) the model consisting of five hexagons where empathizing and defining stand out. (iii) A third model includes the same hexagons arranged in a circular shape and adds a final stage of storytelling.

Design Thinking refers to the process that designers 'follow' to address problems and develop proposals with a purpose of solving those problems. As the process includes both cognitive processes and concrete actions, we will refer to those as processes. The differentiators of the d.school models are empathy and prototyping. These are not only considered as stages, but as a 'mental state' or disposition towards innovation. Empathy seeks to identify motivations, needs and wishes of the people, with the purpose of anticipating behaviours that allow the introduction of innovations that are highly significant and relevant to the users. Prototyping is not a stage at the end of the creative process, which enables to make adjustments before starting the production, as was conceived in the traditional models (see for example Ulrich & Eppinger, 2004); on the contrary, it is a way of materialising ideas from a very early stage, with the purpose of communicating and validating them with various stakeholders, as the team members or the users themselves.

Storytelling is another of the additional elements included in one of the d.school's models. It is different from the stages of communication of the traditional models, because it is not geared to describe the proposal for subsequent production, but to build a persuasive story to support the launch of a product or service.

The leaders of IDEO, Kelley and Kelley (2013) and Brown (2009) do not adhere to rigid models, but identify fundamental phases. They proclaim that the processes are not linear and that several iterations are necessary before completing the process. Using the acronym HCD (Human-Centred Design), the manual for social innovation developed by IDEO proposes three phases: Hear, Create and Deliver. In synthesis, it is possible to identify the following stages with their characteristics listed in the Table 1.

Table 1 A List of Design Process models
adoped from the following sources: Brown (2009), Design Council et al. (2015), d.school, Both, and Baggereor (2013), Kelley and Kelley (2013), IDEO (2009) and Kumar (2012)



Design processes as a Learning

The adaptations of the design process to the educational context also vary in structure, naming and number of stages. In general, the first phases aim is to observe contexts and people, identify and define a problem to develop and explore solutions. However, the testing and implementation stages—that respond to the logic of the productive processes where professional designers operates—are replaced by stages of *reflection* and *evaluation*, seeking to promote meta-cognition processes. In some cases, *improve* and *share,* are added, enriching the proposals and facilitating their application in other contexts to promote collaborative work between the students. Some models use pictograms that facilitate the identification of each stage. As in the representations of the design process, it is possible to identify linear and cyclical models.

Henry Ford Learning Institute (HFLI)[6] and *Design Thinking for Educators*[7] adjusted the models developed by the d.school. HFLI seeks to develop creative thinking and collaborative work, promote empathy, critical thinking and the resolution of problems through learning by doing. The model was developed in conjunction with d.school with the purpose of transferring design thinking to their students. It maintains the stages of *empathy, definition, ideation* and *prototyping*, and incorporates *feedback* and *reflection*. Each phase is represented using abstract arrows as symbology.

The *Design Thinking for Educators* manual for teachers—undertaken by IDEO and Riverdale Country School—describes design thinking as a mental ability and is characterized by being collaborative, optimistic, human-centred and oriented towards experimentation. It includes a description of the process, working guides, testimonies and cases in which it has been applied to problems of diverse scale and level of complexity. Testing is replaced by a stage of *evolution*, oriented to develop the proposal in time; either looking for the necessary support to carry it out, documenting the process, defining criteria for success, sharing the experience or planning future stages (Riverdale Country School & IDEO, 2012).

The international *Design for Change* (DFC) movement[8] proposes a methodology of four steps, for children and young people to develop creative proposals to solve problems of their communities. It seeks to develop leadership, empathy, collaboration, and promote analytical thinking and creativity. The stages have pictograms and motivating names as *feel, imagine, do* and *share*. DFC Spain[9] adds "*evolúa*" (a term that mixes the words evaluate and evolve). The organization has developed an illustrated manual that invites the children to be super heroes: explains the activities of each stage, proposes questions, promotes reflection and makes suggestions.

FabLab Teacher Studio (DiGiorgio, 2013) proposes a spiral structure of seven steps: *question, imagine, design, build, evaluate, refine* and *share*. They have developed a canvas named *Project Planning Doc* that includes the visual representation of the process, questions that guide the conduction of the different stages, a definition of criteria for assessing results, a list of challenges to improve the proposal and a stage to share results, conclusions and suggestions. It does not include explicitly the observation of users in the initial stage and focuses on manufacture and promotion of collaboration and the transfer of learning. Developed under the influence of the MIT, the model has been used to strengthen critical and creative thinking and the resolution of problems and the integration of content (A. D. Watson, 2015).

The design cycle of the MYP[10] has a circular structure composed of different stages that are grouped into four main phases: *investigate, ideate or plan, create and evaluate*. There are numerous versions of this model published online. The shape and structure are maintained, but the names and the number of stages vary. This mode is based on the 'Continuous Improvement' model: Plan, Do, Check and Act (see Figure 13).

[6] https://hfli.org/

[7] https://designthinkingforeducators.com/

[8] https://www.dfcworld.com/SITE

[9] https://www.dfcspain.org/

[10] MYP It is the English acronym for Middle Years Program, corresponding to the intermediate cycle—from 11 to 16 years—of the IB or International Baccalaureate.

Table 2 A list of various design process models

Reference / Main stages	Observe	Interpret	Ideate / Explore	Implement
Brown (2009)	Inspiration	Ideation		Implementation
Design Council et al. (2005)	Discover	Define	Develop	Deliver
d.school et al. (2013)	Empathize	Define	Ideate / Prototype	Test
d.school by Carroll (2010)	Understand / Observe	Point of view	Ideate / Prototype	Test
Kelly and Kelly (2013)	Inspiration	Synthesis	Ideation	Implementation
IDEO, 2009	Hear	Create		Deliver
Kumar (2012)	Research	Analysis	Synthesis	Realization
Synthesis of the authors	Know and understand the context that is going to be intervened. It is necessary to collect data related to persons (customs, beliefs, motivations, etc.) and the context (economic, productive, technological, political, commercial, institutional aspects, etc.). The product of this stage is a set of quantitative and qualitative data, images, recordings, testimonies, etc. It is a divergent process, because collected data, generates the need to collect more data.	Analyze, relate and interpret data. Categorize, classify, and possibly collect new information. The product is a vision or particular problematization of the context and translates into a hypothesis or definition of the problem. It is an analytical, abstract and progressive convergence process.	Generation and exploration of ideas. Includes drawings, diagrams, fast prototyping, exploration with materials, mental maps, etc. Initially is a divergent and abstract process. Prototyping facilitates communicating ideas and validating them with users. Make decisions, and move towards a concrete result.	Final testing, specifications for production, implementation and subsequent evaluation. It can include the communication strategy, to support launching or deployment. Can include the final evaluation and feedback for the complete process.

The Compass model by Index, also with a circular structure, proposes four main phases— *prepare, perceive, prototype and produce*—, each one composed by actions or activities. The system incorporates the three dimensions of sustainability—social, environmental and economic —and sets parameters of evaluation—form, impact and context—. In addition, it defines learning objectives of each phase, describes the activities and proposes techniques to facilitate its implementation. It is a very interesting proposal, which manages to articulate elements from design, education and sustainability.

The enthusiasm generated by Design Thinking in the field of education can be perhaps attributed to their common need to understand people, fundamental for both disciplines: their particularities and motivations; making diagnoses and proposing strategies of intervention and applying creativity, in both diagnosis and troubleshooting. Understanding how designers address these issues are seemed to be valuable for educators, in the light of current methodological requirements and curricula.

Conclusion

Becoming professional entails developing and refining embodied understanding of professional practice that integrates knowing, acting and being in the world (Dall'Alba, 2009). We argue that design process models act as didactic tools by mediating between the aims of instruction (the models) and the outcomes (how to do) (Gellert, 2004). The representations of design process models contribute towards production of the design professional culture. It is through the production, circulations and consumptions of these design process models which contribute to 'shared values' amongst the designers and others who are wishing to adopt this way of working. Images of the design process models, in part, give a meaning to what it means to design (act) and to be a designer (identity).

The representations of the design process vary according to the economic and productive context in which they were developed and the disciplinary and professional influences that generate them. The representations originated in the context of the industrial boom, differ from those developed under the influence of emerging technologies and digital economy. The difficulty of graphically representing the design process lies in its

complexity and adaptation capacity. They are complex, because they seek to propose solutions to 'open' problems that 'shift' throughout the process. Feedback processes defy assumed certainties, which require high levels of flexibility. There are cognitive skills, practical procedures, attitudes and productive variables involved, and can be applied to different contexts and address problems of varying complexity.

The design process models do not have any meanings themselves, they signify, it is us who 'read' the meaning. The meaning is constructed by system of representation, which is fixed by the code (Bowker & Star, 2000). It is the code which makes it possible to establish the 'translation' between those producing representation and those consuming (reading) them. This means that the readers need to have access to both the code and mental maps in order to read the design process models. The design process models are not passive objects. Thus, as with maps representing geographies, the design process models do not fully capture all of the design process 'terrain', they are nevertheless "powerful technologies" (Becker, 1986 cited by Bowker & Star, 2000, p. 54). The importance of the design process model representations is their 'doing' (agency).

Even though the representations of the process are not formulas or recipes as they are visual analogies that indicate certain milestones that occur during the process and not a path to follow in a strictly linear way, they privilege certain ways of understanding design practices such a separation of doing and thinking.

As design process models are increasingly taken up within the field of education, the understating of their 'doing' as significant didactic resource is becoming imperative. Therefore, we propose a follow-up study to investigate how design process models are used by teachers and by designers, and their interpretation of these in the used context. The reason is to identify how these models are informing what design is as these design process models are one of the vital components which are contributing to the development of Design Literacies.

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Working Together: Cooperation or Collaboration?

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Teamwork involves different types of interactions—specifically cooperation and collaboration—that are necessary in education and many other professions. The differences between cooperation and collaboration underline the teacher's role in influencing group dynamics, which represent both a foundation for professional design education and a prequalification for students' competences as teachers and for critical evaluation. As a test case, we focused on the Working Together action-research project in design education for specialised teacher training in design, arts, and crafts at the Oslo Metropolitan University, which included three student groups in the material areas of drawing, ceramics, and textiles. The project developed the participants' patience, manual skills, creativity, and abilities, which are important personal qualities for design education and innovation and represent cornerstones in almost every design literacy and business environment. The hope is that students will transform these competences to teaching pupils of all ages in their future careers.

Keywords: art and design education, cooperative and collaborative learning, drawing, ceramics, textiles

Introduction

Is teamwork a necessary premise for success in design environments or in creative entrepreneurship? How can we facilitate innovative pedagogic models for individuals working in a group in order to achieve higher goals? To answer these questions, we consider teamwork and small communities of practice (Wenger, 1998) as important parts of training and preparing for the teaching profession, specifically design education, where dialogue, discussion, co-working, co-exploring, and the building process itself play central roles. Small communities occur when students discuss design, materials, methods, and function and when they experiment with materials and tools to develop manual skills. Building community in teacher education has several features common to teamwork, where students discuss, work, and look for new possibilities. Dialogues between lecturers and students and amongst students play an important role in creating a positive environment.

This article focusses primarily on learning processes in a wider context. In a typical situation, teamwork allows individuals to explore the best ideas for addressing a given issue in a company. Likewise, the lecturer's role in a learning institution is to guide students towards understanding new concepts. Teachers have the opportunity to support critical innovation and raise awareness about sustainable perspectives. Instructors can offer potent insights to their students, enabling students to accomplish their objectives in the classroom context. Hence, individuals should embrace teamwork and work closely with those in charge to pursue their assigned tasks and meet set standards.

Different working methods will influence student community, develop design literacy, and stimulate innovation. Through the assignment of professional tasks in the drawing, ceramics, and textiles fields, students can gain experience from the beginning of their studies, which will increase confidence in their own ideas and develop students' abilities to communicate their intentions to others. In particular, at Working Together—an action-research project in design education within the bachelor-level Specialised Teacher Training in Design, Arts and Crafts at the Department of Art, Design and Drama at Oslo Metropolitan University (OsloMet)—students participated in teamwork by cooperating and collaborating on the assignments.

Using reflections based on Etienne Wenger's work (1998), the groups developed a shared repertoire of resources within the project, including experiences, designs, tools, and ways of addressing recurring problems; other important factors included having mutual trust and respect for each other's differences. The dialogue amongst the participants played a central role. The importance of dialogue is based on the tradition of practical knowledge and knowledge in action (Molander, 2015), which in turn is based on Schön's *The Reflective Practitioner* (1983).

It might be helpful to note how research-based teaching relates to the idea that both education and research are required for design and education. Following Norway's introduction of a common law for universities and colleges in late 1990`s, research requirements became clearer.[1] The term 'research-based teaching' was generally emphasised to stimulate quality and diversity in Norwegian higher education. The term is multifaceted, and the form it should take depends on the subject area in which it is being applied (Hyllseth, 2001). OsloMet's strategy is to develop and stimulate interaction amongst education, research, professional practice, and innovation (Havnes, 2011), but it is important to determine how this strategy can be implemented practically and which materials and techniques are most suitable.

The Working Together project was a type of action research conducted in a practical course, which stimulated design literacy. The students were the main actors; their knowledge development helped to create concrete solutions for the tasks at hand. The lecturer's role as facilitator and tutor was important for academic debate and for research related to the project. Niedderer (2013) discusses which research questions are important to ask in the creative practice of art and design, noting a distinction between art knowledge and design knowledge, which require different questions. This article's questions are related to teamwork in three material cases. Retrospective reflection linked to teamwork about what and how the students designed and improved their performances was a cyclical process of concrete experimentation and learning (Levin, 2017). We will use the reflections of the students and the lecturers as the basis for professional development and discussion throughout this article.

The value of cooperation and collaboration in higher education

In the autumn of 2018, the research project started as an introductory programme for a large 'herd' of 62 students, so they would become known to each other, and to OsloMet in generel, work together, and gain professional knowledge.

A thorough analysis of an earlier teamwork project with first-year students showed a difference in participation in the design tasks (Kvellestad, 2017). In the healthcare field, Ness (2016) distinguishes between cooperation and collaboration to create better outcomes for patients and their families. This distinction has also opened new analyses of teamwork in education. Both cooperation and collaboration have goals that participants should achieve, but the process for reaching those goals is different.

Researchers agree that distinguishing between cooperation and collaboration is important. Roschelle and Teasley (1995), for example, describe *cooperation* on a task that is achieved as a situation 'where each person is responsible for a portion of the problem solving', whereas *collaboration* is 'the mutual engagement of participants in a coordinated effort to solve the problem together' (p. 70). Cooperation can seemingly be successful as long as one individual in the group is up to the task; collaboration, however, is largely based on each individual exchanging his or her perspective.

The definitions for cooperation and collaboration, as they relate to design, clearly describe communicative and relational processes (Kvellestad, 2017). A lecturer's communication with the students plays an important role by initiating activities and precisely articulating tasks. Students are users and designers in the completion of

[1] Retrieved from: https://www.regjeringen.no/no/dokumenter/stmeld-nr-39-1999-/id192405/sec3?q=forskningsbasert%20undervisning#match_0

the teamwork as a whole. In a didactic context and in education, relational processes are based on dialogue between the actors and on making progress in the design work. The lecturer provides the students with the thesis (i.e. the keystone) along with certain guidelines; the students must then communicate, plan, and distribute the work (figure 1). To attain helpful strategies for creating a positive psychosocial environment in education, tasks must be equally understood by all parties. In a creative process, it is common to stop and discuss the work completed at that point, change and perhaps add new strategies, and then continue. In design education or in a company, it is important for leaders to take responsibility, correct and clarify tasks, and ensure participants' involvement. In Sennett's (2009) *The Craftsman*, he emphasises and elevates crafts by discussing them with great respect and insight. He mentions targeted work as an important part of crafts. According to Sennett (2009), targeting is something that is achieved, not something that is set in advance.

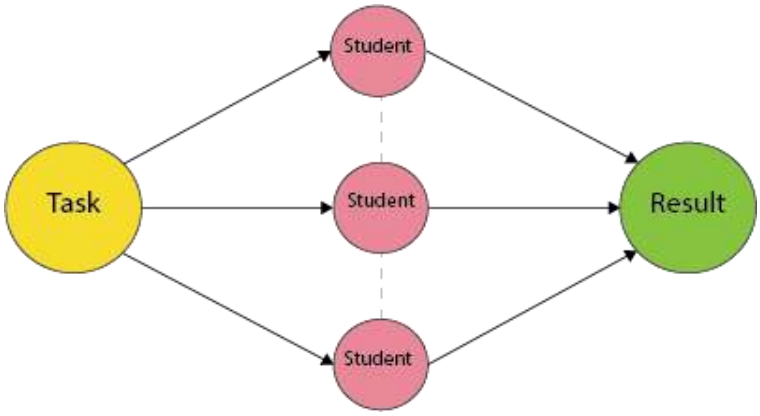

Figure 1: Cooperation in the relational process: the start of the project. The lecturer's introduction of the task (the whole) activates the students (the parts) who solve the task jointly. Illustration: authors and Peter Haakonsen, © 2019 OsloMet

According to figures 1 and 2, this process is similar to Riis's (2016) creative dialogue, which is characterised by openness, complexity, and a dynamic nature. A creative dialogue contains sketches, form studies, solutions, and changes. Knowledge in design emerges through application, challenges, and the development of experiences, as well as through knowledge and action rules (Riis 2016). Ensuring that everyone is involved in teamwork is often a challenge—even in higher education. Cooperative efforts where everyone has tasks usually proceed smoothly because all participants know what to do. In collaboration, however, participants should work and discuss more, listen to and understand each other's points of view, and interact with those with whom they disagree or with those who do not have an opinion (figure 2).

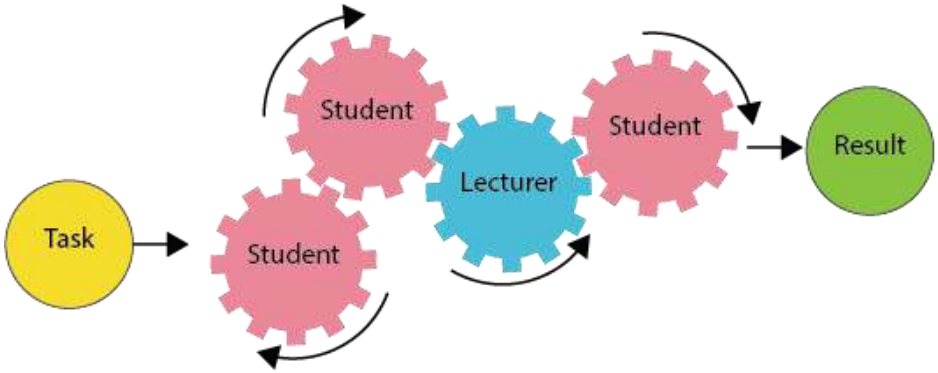

Figure 2: *Collaboration in the relational process that eventually unfolds; dialogues develop the process. Illustration: authors and Peter Haakonsen, © 2019 OsloMet*

Molander (2015) is a pragmatic philosopher who reflects on the main case Schön presents in *The Reflective Practitioner* (1983): the communication between an architecture student (Petra) and her teacher (Quist) in design learning. Petra is a novice at the University of Architecture, and she listens to an experienced practitioner. Their communication includes switching between Petra arguing for her own knowledge and being open to Quist's (the lecturer) coaching. Molander (2015) mentions four tensions that characterise the action in the dialogic structure: part-whole, commitment/involvement-detachment, criticism-confidence, and action-reflection (p. 286). In the Working Together project, the dialogue between the participants went back and

forth between individual parts and the whole task and between practical activities with materials and reflections about those activities. In time, new discussions and new choices became necessary.

In this project, the main goal was to raise awareness of the differences between cooperation and collaboration in higher education (cf. the models).

Cooperation consists of several parts that work towards the same goal. Collaboration is characterised like gears in that it requires closer contact and work amongst all parts along the way towards the goal. After the students become teachers, they will be able to make conscious use of these methods in their own teaching.

Exercises with drawing, ceramics, and hand embroidery

One major advantage in working with students is that they can be included in lecturers' research and development work.[2] Their first year of their bachelor degree studies includes several material-based periods, including a five-week period in drawing, ceramics, and textiles. Students take all three periods in turn. Each group (A, B, and C) consisted of 17–21 students who were required to collaborate on solving challenges related to the task and the practical work. They learned different activities during these periods and studied individually for most activities. To meet the curriculum for these material-based periods, the research-based training on cooperation and collaboration included the introduction of techniques and materials. They learned the craft, including artistic and formal issues; were able to be creative; and were able to test new ideas on short notice.

The lecturer's role in the project switched between facilitator/observer and designer/researcher. The study was an introductory task for the students to become familiar with OsloMet and to become known at OsloMet. The projects took from two days to three weeks, depending on the material. The main goal was to learn cooperation and collaboration in groups—a professional didactic approach using practical material work.

Drawing together: An exercise

The three-step exercise called Drawing Together was given during the start of the semester. Getting to know each other was therefore an underlying motive for establishing interaction between the students. The purpose of the assignment was twofold. Along with promoting drawing skills in observational drawings, the exercise showed how they could explore and participate in drawing processes where interaction and improvisation were promoted, and how others' drawing skills and ideas could include, inspire, and challenge.

Figure 3: Step 3: Ink and marker on paper. Photo: Ingeborg Stana, © 2018 OsloMet

Working individually

In step 1 of the exercise, the students chose a motif and worked alone. The aim was to draw pictures from the area outside OsloMet's buildings. The teacher's instruction consisted of the practice-based terminology of composition to explain the organisation of visual elements. Each student worked for 30 minutes on individual sketches using graphite pencils and size A5 paper.

[2] Norwegian Centre for Research Data approved the research project.

Working cooperatively

In step 2, the students formed groups. The size of the groups depended on the size of the class, and the teacher determined how students would be arranged in groups as needed. Together with the students, the teacher analysed the drawings, which included naming and discussing the use of visual elements. The students found common topics, mood-creating elements, and a suitable title for the drawings they planned.

Working collaboratively

In step 3, the students drew together on the same piece of paper and created a selection of sketches using pen, ink, and A1 paper (figure 3). The step resulted in a large image created from a selection of sketches. In the summary and review of the students' work, the students analysed the results and examined the pros and cons of using graphite and ink. The teacher asked the students to implement instruments through academic language and to compare and explain the difference between cooperation and collaboration, drawing either individually or together.

Challenges (Pros and Cons)

In terms of results, the main differences between steps 1, 2, and 3 of the exercises consisted of two different approaches. In the first phase (steps 1 and 2), the teamwork was focused on working together to create a product; however, doing so required that all participants contribute individual work. In other words, cooperation was initiated if all participants did their assigned tasks and contributed individual drawings. The second phase (step 3) was characterised by collaboration and involved direct interactions between people to produce an end result: a big picture. Being challenged by others' ideas and defending their own ideas made the students vulnerable. In the end, however, the process forced the group of individuals to complement their weaknesses and build on their strengths. The process was a synchronised activity in which the participants continuously tried to develop a drawing; the activity involved negotiating, discussing, and listening to each other's perspectives. The two approaches to collaboration amongst the students had two main effects. First, drawing together on the same piece of paper created new insights into the drawing skills of everyone involved; second, drawing together was a way of capturing creativity. Creativity is often seen as something extremely personal that is done by one person only. While working together on the same picture, the students gained a new understanding of creativity; that is, the final drawing was different from what they could have produced on their own.

Drawing on clay: An exercise with ceramic colours and glazes

In the ceramics portion of the project, the students worked with two-dimensional expressions. Each student made a ceramic tile to be assembled in a common composition. The purpose of this exercise was to improve their ceramic skills by drawing with ceramic colours on a clay tile and then glazing and firing it. In this exercise, sketches from the first drawing task in the OsloMet's buildings served as the starting point for the drawing on clay task. They were encouraged to use other artists as inspiration in their creative process; Keith Haring and Andy Warhol were given as examples. The process started with an introduction in which all the techniques for making the ceramic tiles were demonstrated, including how to use ceramic colours. The various criteria for the design, size (18 × 18 cm), and motif were explained as well.

Working individually

In step 1, the students contributed individually; every student processed his or her motif into a clay tile with ceramic colours (figure 4). They worked individually with their tiles in accordance with commonly agreed-on guidelines and worked towards a common goal.

Figure 4: Examples of individual work in clay. Photo: Gunhild Vatn, © 2018 OsloMet

Working cooperatively

In step 2, to make an interesting composition, the students determined common rules for the design and colour on each tile; a joint strategy for the choice included the use of certain visual elements and colours. Everyone cooperated and made their own tiles for a common purpose, where each student was responsible for his or her own part of the common design (Roschelle & Teasley, 1995). All the students had their tiles ready in time, and they were motivated to do their individual share because those who did not finish in time would be excluded from the rest of the process.

Working collaboratively

In step 3, after the ceramic tiles were finished, the students worked collaboratively to create a common composition of the tiles((figure 5).This phase featured a discussion of various strategies for the common design and the use of visual elements. The students had to listen to and reflect on each other's perspectives in order to complete the composition, which was included in the exhibition at the end of the project.

Figure 5: *Members of the group discussing composition. Photo: Gunhild Vatn © 2018 OsloMet*

Challenges (Pros and Cons)

A challenge concerning group dynamics in the collaboration part was in making the students participate equally, especially in large groups. Disagreements arose about the criteria for the composition, and often the majority decided. Some of the students may have been afraid to raise their voices in discussions. The students also pointed out these challenges in their reflections.

The ceramics field in general evolves through faults. Technical challenges often occur when working with clay. However, through working a great deal, making mistakes, and using different ways of approaching the clay, artists gain new insights and experiences. In this project, the accident occurred when the students received the wrong type of clay, which led to a series of problems, including more than half of the tiles exhibiting large cracks. The accident was useful for learning, however, both professionally and didactically. It was interesting for the students to experience how a mistake became something positive through joint interaction in composition. During the collaborative process, the idea arose of using the crack as a formal element in the artistic process (figure 6). Despite the crack, the creative process led to something new and unexpected, where the negative became a positive impulse. The students found their own tiles to be less valuable because of the cracking, but their attitudes changed during the collaboration part, when they composed a whole out of all the individual tiles. The students experienced that the whole became better than the sum of the parts. In the exhibition (see figure 11 later in this article), the audience and the artists' fellow students expressed great interest in the cracking.

Figure 6: The final composition result from Class B. Photo: Gunhild Vatn, © 2018 OsloMet

Textiles: An exercise in co-design embroidery

During the textile period, the students were given a task in hand embroidery, where the aim was to practice embroidery and make a design via co-embroidery. The thesis was based on similar tasks that were given to

first-year students in 2013–2016 (Kvellestad, 2017) but now with a different task. In a two-step exercise entitled 'Close in Close', each class (A, B, and C) of students was divided into two teams. Team 1 worked cooperatively, and team 2 worked collaboratively. Each class was provided with one piece of off-white wool and different black threads.

Working individually

The students had drawn individual sketches of objects in OsloMet's building that served as the starting point for the embroidery.

Working cooperatively

In step 1, team 1 discussed, picked out sketches, and made a joint composition of the figures. They cooperated on the selection of sketches, composition, and stitches. Each member of the team then embroidered each figure from the composition (figure 7). Everyone used black thread, but they varied the stitches and thread types.

Working collaboratively

In step 2, team 2 discussed, chose, assembled, and embroidered flat patterns between the figures; the goal was to make the characters appear tied together. Team 2 had to collaborate on and embroider the same pattern (figure 8). They were very busy because the composition from team 1 had few figures, and they were small. The work of linking the characters together led the students to physically sit together and embroider, paying attention to each other and discussing, changing, and approving the work. Exploration continued via their dialogues about simple stitching and by looking at previous works. As many of the students wrote in their reflections, this process became collaborative (figure 8).

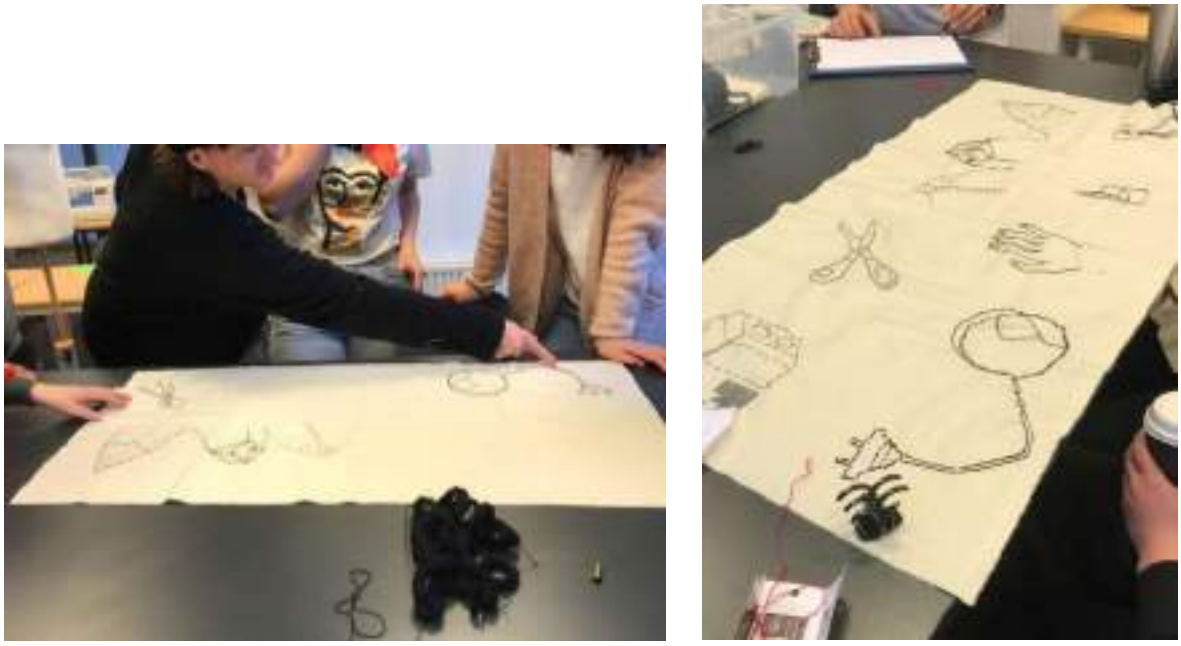

Figure 7: *Members of team 1 cooperating and discussing sketches and composition. Photo: Randi Veiteberg Kvellestad, © 2018 OsloMet*

Figure 8: Members of team 2 collaborating with a flat pattern between the characters. Photo: Randi Veiteberg Kvellestad, © 2018 OsloMet

Challenges (Pros and Cons)

In both teams, the students alternately cooperated and collaborated by either discussing and planning or embroidering individually or together. Figures 9 and 10 show how the teamwork evolved and the results concluded.

The textile exercise had an extended mission to provide the students experience with interaction in embroidery (i.e. co-embroidery). The students were users and designers during the completion of the embroidery as a whole; team 2 worked with a sense of co-owning and sharing of responsibility. The recurring challenges gradually disappeared. The students had collaborative relationships and dialogical conversations about the material and the designs. They interacted with one another in almost mutually responsive ways, and several new possibilities emerged. They experimented extensively with thread and stitch possibilities. To take the material seriously, the students had extensive practice in working patiently and purposefully, which was important for creating quality. Quality is a likely outcome when people spend time and have patience with the embroidery in the design process. The students experienced that the material-based creation process was slow, so courage and patience were important factors (Robach, 2012). The greatest challenge to interaction was the students' time limitation; their evaluations suggested that they would like to have had more time to do a better job. By working practically and physically with materials, the students also achieved a better feeling for touch and a sense of the material and the needle. They may have also remembered the activity better because co-design embroidery is a long-term process (Kvellestad 2018).

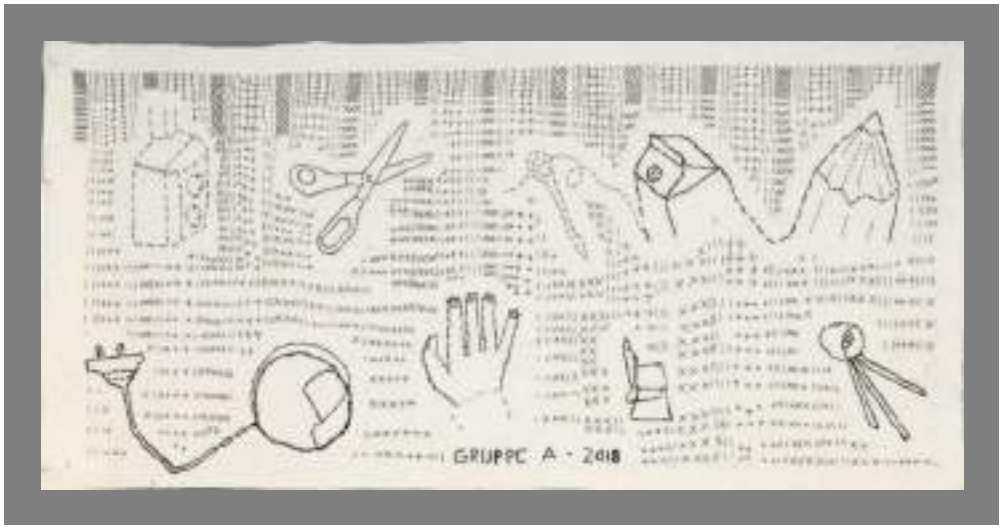

Figure 9: Class A's finished and signed embroidery, 50 × 100 cm. Photo: Helle Stølevik, © 2018 OsloMet

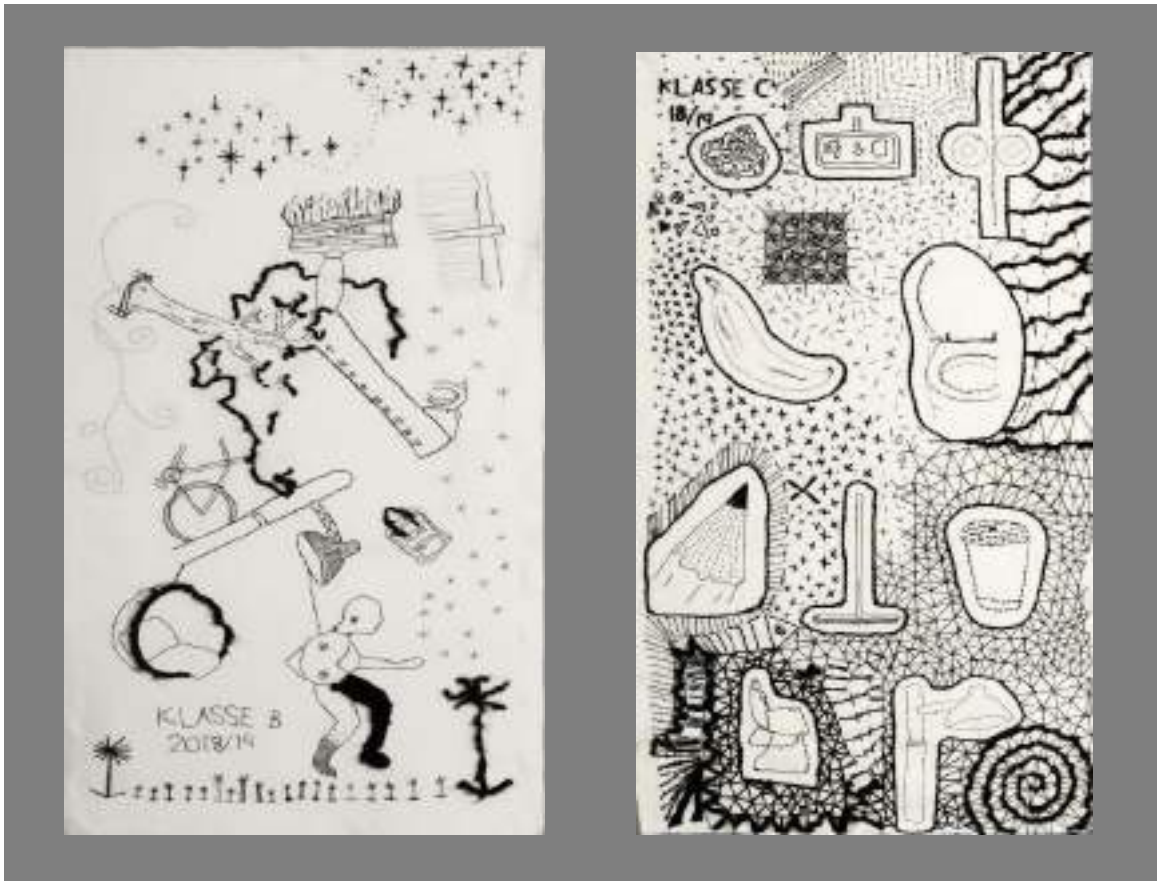

Figure 10: Class B's and Class C's finished and signed embroideries; both are 50 × 100 cm. Photo: Helle Stølevik, © 2018 OsloMet

Outcomes: The whole becomes better than the sum of the parts

Completion of the Working Together project ended in December 2018 with a collective exhibition at Gallery PP33 at OsloMet (figure 11). The differences between the resulting pictures were obvious. Some of the motifs from the beginning thesis were visible several times throughout the various materials. Both the audience and the students recognised the motifs, which created a connection in the exhibition. Recognising creates affiliation and coherence in a study programme, especially when time is limited. It was a good didactic idea to

have an overall theme over a longer period. Students may bring this experience into their own professions at a later time. A product created by collaboration prepared the students for a synergetic experience in which the whole was greater than the sum of its parts. Differences were notable between cooperation and collaboration, although the role of the lecturers underlines the influence of the group dynamics.

Figure 11: From the exhibition at Gallery PP33. Photo: Randi Veiteberg Kvellestad, © 2018 OsloMet

The role of the lecturer

Research context always includes reflection and judgement. During the project, the lecturers' communication with the students played an important role by initiating the activity and precisely articulating the tasks. The role switched among tutor, observer, and researcher. A binding working relationship existed between the tasks and the students. Questions were asked, tests were evaluated, and new tests had to be made, followed by new questions. In this way, the work and research were established. Carnera (2012) writes beautifully about a binding working relationship in the meeting between skill development and experience formation that adds to the learning process an assessment of both poetic and aesthetic judgement. During the project, the students put this lesson into practice with the lecturer; thus, the students' experiences and reflections were an important part of the research material.

The lecturers guided the students towards understanding the concepts that were used to enhance their cognitive abilities. As the interpreters and designers of learning programmes, instructors bridge the gap between learners and the new environment in which students can access learning materials and enhance their knowledge. At the same time, the lecturers were in charge of the administrative process in a class setting where they supervised the students' activities and interactions between learners (Entwistle & Ramsden, 2015).

From this realisation, it is evident that a teacher should use several resources to fill identified gaps by making difficult-to-understand concepts clear. Because students need support when taking in new information, lecturers should assist learners in areas where they experience problems, without demonstrating bias. Students have differing cognitive abilities that require instructors to respond to their varied needs to help them overcome pertinent issues in the learning environment and to participate in entrepreneurship, as one example. As one of the students mentioned, weak communication leads to weak interaction.

To ensure better interaction when the students collaborate, the lecturer's role as leader and supporter is crucial. In this research project, the collaborative phase featured a discussion of various strategies for composition and the use of visual elements, where the students had to reflect and respond to each other's perspectives in order to complete the design. The teacher's influence became especially important in this phase for ensuring proper interaction in which everyone participated equally.

Develop design literacy

Through the students' participation in the project, they learned to compromise and to respect each other's ideas and attitudes. Their professional dialogues about composition and material understanding led to new ideas and design literacy. However, as one of the students said, one of the key challenges in the collaborative tasks was attaining equal participation. Collaborative projects can be both evolving and motivating if the task is well designed, which was confirmed by the students' own reflections related to cooperation and collaboration in a school situation:

> You can get results that turn out to be better than if you'd worked individually. (Student, 1C)
>
> You learn to create something with other people and to work from a common idea, not just your own thoughts and opinions. The result can provide a new and exciting expression that you wouldn't be able to create on your own. (Student, 1B)

The students were encouraged to be critical and to reflect on the challenges of collaborative tasks. These examples critically reflected the disadvantages of collaborative tasks in a school situation:

> There may be conflicts and unfairness, and some of the students may disagree with the common consensus if they feel they're not being heard. (Student, 2B)
>
> It may end up that one or more of the group don't do what they should, so those who remain in the group suddenly end up doing everything. (Student, 3B)
>
> Those who are shy and don't speak loudly don't participate in the discussions. (Student, 2C)

These statements show that a well-functioning collaboration can be stimulated. The students have to be a part of the community, sit together, and contribute in the moment, and then new ideas will arise without being planned. Further, the development of skill-, craft-, or design-related knowledge takes time. All experience and mentorship contributes to insight and understanding. Mentorship enables students to realise their potential and to accomplish specific objectives that will define their careers. In this regard, design education could inspire students to become leaders in society who can formulate good policies and be critically important to addressing problems that affect people's lives.

Løvlie (2011) claims that the foundation of experience is developed within an educational environment when we have a reflective relationship with our own practice. If we participate in a process over time, then innovation and development will occur. The action-research project reaffirms that the teamwork methods stimulate the students' design literacy. However, collaboration helps and inspires the community to achieve a higher result.

Benefits of teamwork in workplace and learning environments

In the design process, practitioners take part in collective creativity applied across the entire span of the process. This collective creativity is one of the strengths of the co-activity method (Anderson, 2012). In this case, company managers should identify the strengths and weaknesses of workers when sharing workloads to ensure that tasks will be completed quickly and effectively (McClellan, 2016). Teamwork also promotes innovation in the workplace, which enables individuals to realise their objectives and to develop viable solutions that a company can use in times of crisis.

Designers and lecturers have ideas and begin a project, but when other users, students, or technicians become involved, those ideas will change. New ideas, materials, and technologies that arise in the process then influence the outcome. Co-activity is not rigid or static but rather is characterised by flexibility and fluidity, which allow for change and a greater appreciation of the product (Anderson, 2012). Through collaboration in educational contexts, lecturers lead the students in their actions, guide them in adapting to changes, and provide support for their creations (Kvellestad, 2018). Such interactions challenge lecturers to ensure that their students take ownership of their tasks and become users and designers in the process.

A good dialogue involves interactions with mutual enquiry—sharing, exploring, discussing, and weaving new ideas—through which newness and possibilities emerge. In responding to one another, a critical aspect of dialogue is by nature an interactive process (Anderson, 2012). Thus, examining the lecturer's influence on the design process is important.

Individuals are more productive in an organisation when their input is recognised. For businesses, creating an enabling environment for employees where they can interact and approach tasks as a team increases the prospects of a company overcoming competition from other industry players. When the workload is shared amongst employees, they accomplish more than they could achieve on their own: a move that results in employee satisfaction (Driskell, Salas, & Driskell, 2018).

Collaboration allows people to help each other and to approach situations from a common point of view in which employees can focus on their goals and their career objectives. The Working Together project had features common to those in Wenger's (1998) social theory of learning, which can be used to describe and understand elements in a partnership. According to Wenger (1998), learning is created by social acts or within processes between people. Learning is characterised by the situation an individual is in and takes place in every practice community. From this realisation, it is imperative to ensure that the application of teamwork in education or business environments promotes harmony and increases an institution's or organisation's productivity regarding accomplishing specific objectives.

In the learning environment, students are typically encouraged to approach problems as a team because doing so will help them explore viable solutions that they can use to solve immediate issues. Compared to their engagement with instructors or teachers, learners can exchange ideas more effectively and improve their communication skills when they interact with their peers. Students can understand issues better when their peers teach them, compared to when they interact with their tutors (McCutcheon, Lohan, Traynor, & Martin, 2015). From this observation, lecturers must create an enabling environment where students can interact amongst themselves and solve various problems that affect their learning process. The student groups in this project had a short deadline, and they had to think and act quickly; they may have found it easier if the design had already been planned and drawn before the work began. Routines and rules streamline a creative process. A good example may be found in the children's education context, where having clear tasks is vital: Pupils must know what they are to do and what is expected of them (Kvellestad, 2018).

Co-activity in the classroom context gives students the responsibility of applying the concepts they learn from their instructors. Lecturers can understand the ethical grey areas that should be explored because of their direct impact on learners' cognitive abilities. Thus, learning institutions should encourage their learners to form groups according to their strengths and weaknesses in order to boost their performance in class. In a school situation, teachers influence their pupils by offering advice and suggesting improvements. The same thing happens amongst students. The students in the Working Together project had to have discussions, make choices, and defend their views with professional arguments, just like Petra in Schön's (1983) *The Reflective Practitioner*. In the project, students had to trust people with whom they did not agree. Knowledge was maintained and even evolved within the dialogue structure (Molander, 2015). The lecturer provided advice, but the students had to make their own choices. They helped each other, made compositions together, combined designs, explored material knowledge, and developed design literacy.

Future views in design education

Further research on the topics discussed in this article could focus on the teacher's role in teamwork, guidelines for interaction, equal participation, or conflict management. Professional education based on both academic study and hands-on practice is closely linked to educational occupations. OsloMet's goal is to develop and stimulate this interaction. Jarning (2011) characterises the educational institution as a knowledge triangle, with education/research/knowledge, sharing, and innovation forming the three sides. The institution will offer education based on research, professional and artistic development, and experience. Professional employees can apply for time to be allocated for research and development work, which then provides opportunities for diverse and non-stagnant work. Jarning (2011) also addresses trends in today's Norwegian education race in which practical work is in the process of being removed from education; he points out that performing more research at the expense of gaining experience leads to practical skills and training becoming less valuable. Even when educators complete their own research and development work, student participation can help in a practical way as well as allow for research-based teaching.

In a larger didactic context, the present project on teamwork supports the three themes that the Norwegian government has promoted in upcoming subject renovations: democratic citizenship, sustainable development, and health and life skills (2016). The last item, health and life skills, will be especially salient in projects such as the Working Together project in which everybody participates, thus stimulating skills and positive attitudes.

This knowledge has both academic and social aspects. Interaction is an important activity in almost all professions. Teamwork and participation characterise political work, education institutions, and health services. The Education 2030 international project is a framework for the qualifications that pupils will need in Organisation for Economic Co-Operation and Development countries by 2030. Some of these skills include professional knowledge, cognitive skills (e.g. creativity, problem solving, critical thinking), and social competences (e.g. interpersonal skills and communication).[3] The project can serve as an example of the type of interaction in which these competences are important to the progress of the task.

OsloMet has started an interdisciplinary project called Interprofessional Interaction with Children and Youth (INTERACT),[4] which has the goal to improve (a) the coordination of services aimed at children and young people, (b) collaboration between professional practitioners, and (c) cooperation between children/youth and professionals. The value of the project discussed in this article will be a practical exercise for students before they participate in INTERACT across the studies.

Concluding remarks

This project has revealed that the factors of cooperation and collaboration in this instance led to successful teamwork and stimulated innovation. Teamwork plays a vital role in the learning environment when students are allowed to experience challenges that can affect their cognitive skills and design literacy. When the lecturers guided students in a structured manner, the students made informed decisions, found innovative solutions, and achieved higher aesthetic goals. Surprisingly, the project also showed that collaboration was noticeably more effective than cooperation for stimulating their creative abilities.

From this realisation, it is evident that instructors can enhance their students' performance by requiring them to work in groups where students explore each other's strengths while they attempt to accomplish their objectives. For this reason, working together has a significant impact on students' class performance. The students who participated in this project learned how to successfully manage and complete a body of work. By applying this knowledge, they will be able to transform the competences they gained and apply them to teaching pupils of all ages, as well as participate in social tasks in general.

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Social innovation for modified consumption by means of the school subject Art and craft

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In this paper I will take a look at how one can facilitate the change in consumption through social innovation, based on the subject of art and design in Norwegian general education. This paper will give a presentation of books, featured relevant articles and formal documents put into context to identify different causal mechanisms around our consumption. The discussion will be anchored around the resources and condition that must be provided to achieve and identify opportunities for action under the subject of Art and craft, a subject in Norwegian general education with designing at the core of the subject, ages 6–16. The question that this paper points toward is:

"How can we, based on the subject of Art and craft in primary schools, facilitate the change in consumption through social innovation?"

Keywords: Consumption, production, biology, pedagogy

Introduction

The world's population is expected to flatten out around 10 billion people, and it will, according to Dag O. Hessen, require two planets to provide all an average Norwegian consumption and emissions. It is obvious that we cannot continue with such a consumption. The alternative to saving the planet must be either tomorrow's technology, or that we all take a little less space when it comes to consumption and emissions of greenhouse gases (2010, p. 224,253). In this paper I will take a closer look on how we might take a bit less space, therefore I have ruled out technology optimism, although it is an interesting topic in terms of consumption. To further refine the task, I will introduce some research around the Norwegian clothing consumption. According to Statistics Norway (SSB), the volume of our clothing consumption increased despite the fact that our clothing spending has decreased (1999, 2013, 2014). In Pål Strands' Article *We buy more of the most*, it appears that we have had a quadruple in the consumption of clothes and shoes since the 1980's, and he is putting imports from low-cost countries in Asia to the basis of this development (2014). According Carbon Trust, production and laundry of clothes account for 3% of global emissions, measured in CO2 equivalents (2011). This excludes chemicals, working conditions, energy, and resource usage. Carbon Trust also points out that the longevity and quality of clothes is a major factor for the Environment (Carbon Trust, 2011).

This paper is about people's relationship with their own consumption, what causal mechanisms that affect our consumption, and how we can relate to future challenges. As Matthias Kaiser and Ingrid Louise Ugelvik (2000) writes, we perceive things from our personal assumptions such as life history, experiences, values, attitudes and knowledge. Therefore, it will be natural to me, as an art and design teacher in the subject Art and craft, a

subject in Norwegian general education with Designing at the core of the subject, ages 6–16, to implement the interdisciplinary aspect. I would therefore give an insight into why, and how we can use this in a teaching context. Gunnar Vittersø and Pål Strandbakken (2016, p. 23) points out that knowledge about the environment and climate challenges requires an interdisciplinary approach, which I will try to do here. I will not derive any theories, but present a hypothesis on how we, through the arts and craft, can facilitate social innovation for modified consumption.

> *"How can we, based on the subject of Art and craft in primary schools, facilitate the change in consumption through social innovation?"*

Approach Method

This paper is based on what Runa Patel and Bo Davidson refer to as theoretical anchoring (1999, p. 11). The method I have put to use is a qualitative literature study, in which I have systematic review of selected literature around the issue. One might say that I have worked out from the hermeneutical spiral (Patel & Davidson, 1999, p. 26), where I read and interpret texts, then put them in context to each other, to form an understanding, and we get a new text production, a new interpretation and a new understanding. My empiricism is therefore based on various articles, formal documents and books. Which I attempt to put in context with each other in an effort to identify possible causal mechanisms influencing our consumption and reflecting on what actions that can contribute to change our action patterns. The selection of literature is mainly the book of Dag O. Hessen, professor in biology, *Nature-What are we going to do with it* (2010), a book on the topic of pedagogy and philosophy, as *The anxiety of the upbringing* of associate professor of education and environmental science Per Bjørn Foros and professor of philosophy at the University of Oslo Arne Johan Vetlesen (2015), as well as articles on relevant research related to this topic, and formal documents. This is to achieve the interdisciplinary approach I want.

Causal mechanisms and our consumption

Cultural and social causes of consumption

In the book *The anxiety of the upbringing,* Foros and Vetlesen (2015, p. 144) points out, that we cannot solve climate problems without looking at the cultural and societal causes. Children grows up in a globalized culture, in which there is an asymmetrical power relationship between the individual and global society. They write that consumption has become a key to self-realization, and that self-realization works as a requirement from society. The individual's freedom and the right to choose weigh heavy, and with wrong choices, the individual alone is left with the blame. Foros and Vetlesen points out that this social feature is in the way of political solutions, where interventions can be perceived as a limitation of personal freedom (2015, p. 63). Something like Vittersø and Strandbakken confirms in their article «Consumption and the green shift» (2016, p. 17). Hessen writes that Norwegian politicians avoid pointing at individual responsibility, because they believe it is an impossible political task (2010, p. 246,247). This image of the reluctant politicians is being confirmed by Sjur Kasa (2016), which describes political attitudes toward the consumer; as unable to make environmentally friendly choices without economic intensives. At the same time, Hessen draws a picture of people wanting to contribute to a better environment, but that they want a stronger political will (2010, p.240). This creates an error in politician's argument, who arrange to just continue as before.

Evolution, action patterns, consumption and producers

Why is it important to understand the role of evolution in our actions? Why is it important with an individual focus on consumerism? As I interpret Kaiser and Ugelvik is the individual the most fundamental size in the modern society (2000). According to Hessen (2010), we cannot get away from evolutionary influences on us, but at the same time, modern society requires some rather different characteristics form us, than what was important for survival earlier. We have been hunters and collectors in 99 percent of human history, and these impulses are not easy to change (Hessen, 2010). Hessen points out, among other things that «… We are abundantly equipped with gas pedals, but few brake pedals» (2010, p. 251). We are evolutionary adapted to "Here-and-Now Options" (Hessen, 2010, p. 230), which was beneficial as we lived on the savannah, but that is not as beneficial in a modern society with access to everything we need and desire of goods. As Hessen writes, it is the sum of our individual action patterns which contribute to the state of the globe (2010, p. 222). Foros

and Vetlesen stressed that the problem lies in the volume of commodity production (2015, p. 113). As I interpret Hessen, does increased consumes equals increased waste, increased CO2 emissions and Increased greenhouse gas emissions which threaten our globe.

So why don't we decrease consumption? Could it be that manufacturers are looking to increase our consumption? "It is a market-driven, but unwanted dynamism and business-Darwinism in the society development that makes the current solutions passé before we have grown accustomed to them" (Hessen, 2010, p. 121), with the result that the rate of exchange increases (Hessen, 2010, p. 122). Pål Strandbakken also writes about this theme, with the explanation that when things are cheaper to buy new, than to repair, this affects the consumers choice. It must also be mentioned that according to the article *Product life and product quality that reduced consumption?* (Strandbakken, 2016), it will always pay off for the consumer, both financially and environmentally to emphasize products with good quality.

As mentioned initially, we are on a consumption that is in disparity to natural resources. Vittersø and Strandbakken presents various strategies that can reduce the environmental impact in which the reduction in the actual consumption of goods and services in the household, is identified as the most difficult to implement (2016). The question is, do we have this ability to readjust ourselves to a smaller consumption? As I interpret Hessen, there is an absolute potential for it since we humans have an impressive adaptability (2010, p. 248). We humans have the opportunity to change habits and identity, because we, as human beings are in an interaction between identity and society, as Rune Sarromaa Hausstätter and Sanna Sarromaa (2009) write in their article *A theoretical contribution to an in-law education*. Vittersø and Strandbakken (2016) expresses that the consumer perspective does not get enough focus in the green shift, and that adaptation of our consumption is critical in terms of environment and climate change. They look at social innovations as a prerequisite. I believe that the school can, and should play an important role here.

Abstraction to production

Hessen notes that urbanization leads to a form of abstraction to nature, and writes that the bill for consumption of nature is passed on to future generations (2010, p. 178). But I question whether or not the bill is also sent to the production countries, with a much closer time perspective?

I would think that modernization and our consumption habits to have had a form of abstraction in relation to the resources used. Take for example the production of clothes, with all of the different resource used, including the human labor, the local challenges, and the immediate impact of the environment in the vicinity of emissions of toxins. In order to not forget the use of energy and resources throughout the process of manufacturing the actual product itself, its material and raw materials. As Ingun Grimstad Klepp and Kirsi Laitala points out in the article *Clothes life-LCA on life and death*, these items are difficult to measure (2016). Based on Norwegian conditions, Hessen takes up that protection of land and species should have a local anchoring, ideally, and he points out that the conditions for this framework is changing (2010, p. 121). I am thinking that, yes, the framework for the conditions change, and that today we are responsible for the emissions that occur in other countries on behalf of our consumption, and thus also a responsibility for the protection of areas and species in a global perspective. Which Hessen himself points out, the average Norwegian have the same high Co2 emissions in China, as the average Chinese (2010, p. 229). To change this, we must contribute to these good social innovations such as Vittersø and Strandbakken calls for, previously mentioned in section 3.2.

How about appealing to humanity and empathy? Will we then be able to fight lack of understanding and sympathy for the future generations? Hessen points out that we, as social beings, have empathy that extends beyond ourselves. He is questioning how far this empathy and immersion can be stretched (2010, p. 126, 128), both when it comes to species and the future generations. I think it certainly should be able to stretch to reach living people, and that this can cause upgrowing generations to feel and relate with workers in Bangladesh. The Starting point for biophilia is, as I interpret Hessen (2010, p. 147) that we as human beings are more willing to stand up for someone who is closer to us.

Can we, if we based on biophilia as phenomenon, combined with empathy and immersion, be creating a focus on people's working conditions and different environmental impacts that our consumption provides the local environment? Can knowledge and information on production in other countries Influence the individual's ability to act and work against the biological instincts?

As I understand Kaiser and Ugelvik (2000), our ability to judge situations is about our ability to experience them through different perspectives; If one is introduced to different contexts, one also gets new insights, we understand better and can justify our choices better. Foros and Vetlesen points towards Kant's Distance ethics, that a principle cannot only apply to anyone, it must be able to apply to everyone. So that when we are facing a choice, then we have to imagine that everyone else does the exact same thing, and form that, consider whether we can bear the consequences (2015, s.201).

A look at the future

Future optimism or future determinism?

The location of man at the top of the hierarchy has long traditions from antiquity to the present day (Chalmer, 2013; 4. Kaiser & Ugelvik, 2000; Hessen, 2010). There were little changes at most people in ancient times, but after the renaissance the belief that future generations would get better than previous generations arose (Kaiser & Ugelvik, 2000). Hessen is on to something when he writes that the human cultural project is mainly about cutting the ties to nature (2010, p. 96), but that we must now move from being man against nature, to protect the nature against people (Hessen, 2010, p. 27). This increased focus on the climate crisis is about to take away the belief in the future. This is being replaced with increased concern for the future (Foros & Vetlesen, 2015). Hessen uses the term "meta- concern" about the concerns for the planet's future, and as I interpret him, it is a concern that is difficult to do something about (2010, p. 214). I believe this can contribute to a powerless and hopelessness among up growing generations, which will contribute to a "give damn attitude".

The question is then how children and adolescents can get outlets for these feelings, and how I as an adult person and teacher, can create hope? According to Foros and Vetlesen (2015), all adult persons are responsible for educating and raising children and adolescents, conveying joy of life and faith for the future without concealing the seriousness and urgency of the situation. What seems daunting and incomprehensible needs to be explained, both how it has become so and how it can be better (p. 103). The way I interpret Foros and Vetlesen, it is important that the children get the tools they need to make good decisions on their own. This can prepare the future generations for the life they will live and the Society they will become a part of. Experience of opinion creates greater hope and vigor (2015, s.208). Hausstätter and Sarromaa mention that pedagogy with an environmental focus is an important element in the environmental challenge (2009). They point out that the pedagogy largely puts man in the center, but that the pedagogy must seek away from this starting point with increased focus on the relationship between people and the environment. I think these are important elements for social innovation through the school system.

Tendencies in formal documents

If we take a look at some formal documents, we might see some tendencies presented in the future school. In the white paper *Motivation-Mastery-Possibilities. Lower secondary education* (Kunnskapsdepartementet, 2010, p. 38) they write that Art and Craft subject is one of the subjects the students are most satisfied with, nevertheless it is not embroidered the importance and usefulness of the subject, but is emphasized as a method to use in other subjects. This shows that the subject's specificity is not communicated clearly enough from the field.

According to *Knowledge for a Common Future. Strategic plan*, the Revised Education Strategy for Sustainable Development, education is going to influence people's mindset and attitudes towards more focus on fair and sustainable development (The Ministry of education, 2012). UNESCO, which is the United Nations Organization for education, science, culture and communication, is conducting measures for increased expertise in the field. They emphasize that all subject disciplines support this goal. (Ministry of education, 2012). But I have to point out that subjects such as mathematics, language subjects, social sciences, science, religion and philosophy were mentioned in the strategy plan, but not the Art and craft subject, which I find strange.

In Norwegian public inquiry *School of the future* (NOU 2015:8). They write that the practical aesthetic subjects are carriers of important skills for future workplaces, and for the students' ability to make ethical considerations and good decisions in one's own life, referred to as a life skill and everyday competence (NOU 2015:8, p. 25).

The politicians in *Subjects-Depth-Understanding,* want it to be made easier for individual subjects to be seen in the context of other subjects that have related topics (report. St. 28, 2016, s. 32,37).

In the *General section- values and principals* the overall goals for education in Norwegian primary school are presented. This should be the basis for the education in all subjects. Based on the purpose law of the Education Act (Kunnskapsdepartementet, 2017, p. 2). The values of the education are based on human dignity, culture, identity, diversity, critical thinking and ethical awareness, in addition to creativity, commitment, exploration, democracy and participation. Principles of learning and development is all about the development of students' formations, holistic competence, knowledge about learning and presentation of interdisciplinary topics. It is pointed out that the practical work and the theoretical reasoning is important for understanding, reflecting and thinking critically in subjects (Ministry of education, 2017a, p. 11). One of the points in the value base is about respect for nature. That the students will gain knowledge to learn about nature, developing ethical awareness and develop respect for nature. The school shall facilitate for students to develop a willingness to care for the environment, and the will to make changes in our way of life, and thereby take care of all life on Earth. They Should be made aware of how the human way of life affects the nature, the climate and our society (p. 8.)

As we can see here, the politicians are trying to increase the focus on sustainability in the education system. Still I am afraid that the Art and craft subject's potential in educating upcoming generations within the topic of environment and climate issues will continue to be under communicated. This made me think that my field of expertise needs a greater understanding of the global environmental issues, so that we can more clearly convey our skills and opportunities to contribute to solving parts of the climate problem.

Why the subject of Art and craft?

I will try to show how art and craft subject are important and useful, as more than a method to support other subjects, and try to communicate some of the subject's specificity that lacked in *Motivation-Mastery-Possibilities. Lower secondary education.* At the same time, it is important to show the interdisciplinary related topics that *Subjects-Depth-Understanding* calls for to give the students' knowledge of the environment, the human impact on nature, climate and in a globalized world that *General section- values and principals* expects the school to facilitate. And that the Art and craft subject also can influence people's mindset and attitudes towards more focus on fair and sustainable development, even though not mentioned in Knowledge for a Common Future.

Hessen points out that the curve of life happiness in this country flattened out in the late 60's, while our consumption has continued to grow (2010, p. 229,254). This has been confirmed by Foros and Vetlesen, who points out that the psychological happiness does not follow materialism, but that it rather appears as an obstacle to perceived happiness (2015, p. 21). The western population is increasingly seeking freedom from the materialism (Hessen, 2010, p. 255). At the same time our clothing consumption increases. This shows, as Christine Løkvik and Janne Beate Reitan (2017) points out that sustainability and fashion are important for the general public as critical consumers. According to Monica Shlanbusch Orheim and Liv Merete Nielsen (2017) the conscious consumer needs to be trained, and points out that one of the challenges is "…how to bring these ideas into educational practice in a way that connects to students' choices in their everyday lives." (2017, p.2). Strandbakken (2016) notes that clothing creates identity, and as we have mentioned previously, consumption is a key to self-realization. But are there other, more sustainable alternatives to self- realization through clothes?

«When is life good to Live? » Hessen asks (2010, p. 259) as he continues to ask questions around what gives us people a sense of well-being and what makes life feel meaningful. He explains about the feeling of happiness that occurs in ski tours associated with toil and sees it in the light of both endorphins, moral reward and not to mention the feeling of being alive (2010, p. 79). Hessen writes that nature experiences provide and creates deep emotions and feeling that life is good to live, that the origin of the feeling is not the most important thing, but that the quality of life is the essence (2010, p. 100). If we focus on the feelings and the essence of life quality and moral reward, can this feeling occur within the walls of the classroom? It makes me wonder if this cannot be transferred to students, when they have to produce their own item, such as clothing?

Let us take a starting point in that they must sew or re-design a piece of clothing in the arts and design subject. When the students must spend their time, physically and mentally designing a product, creating, making mistakes and mastering, the question is if this will contribute to a feeling of well-being, a reward after the toil?

Will mastering sowing a garment promote the feeling of life quality? Mia Porko-Hudd, Sinikka Pöllänen and Eila Lindfors (2018) share this point of view as they write that craft is often connected to the concepts of wellbeing and quality of life connected to sustainable crafts. But could this project also contribute to the ownership of their own things, to regain love and the emotional affiliation to things? I wonder if re-design and self-produced clothing can contribute to the garments increased emotional value, that things can have value in virtue of themselves? Hessen specify that empathy, also in the form of sentimentality has a cultural side (2010, p. 137). Something Klepp and Laitala also punctuate in their article (2016). They point out that it appears that the age of clothing is related to frequency of usage and to what extend we like the garment, not to mention the technical durability (the quality, as I interpret it), which does not have the context of price. We take much better care of the things we like. So, will the experience of sowing their own garment, facilitate for an emotional attachment as well as increase its value for the students, which in turn will motivate them to take better care of the garment?

Vittersø And Strandbakken (2016) believes that we can reduce the number of products if we put more emphasis on quality and longevity. One of the solutions for environmental benefit is to reduce the number of garments we own. Furthermore, they write "It is our assertion that if the effort was aimed at increasing the valuation of clothing and other lasting consumables in terms of better quality and longer durability, it would lead to more knowledge and interest in how the things we surround ourselves with are made" (Vittersø & Strandbakken, 2016, p. 19). The way I interpret Vittersø And Strandbakken, they claim that quality and longer durability in clothing will lead to a greater interest and knowledge of how they are made, which in turn contributes to more care and maintenance, with increased lifecycles for the clothes and less consumption as a result. I think we need to turn this around. Whether students get physically aware and master what it is like to create a garment, preferably with conversations around a quality perspective, then I think this will help build up around understanding and knowledge of how clothing is produced, quality and respect for the work that is behind a garment. And this, again, I think can help that they become more conscious of their own consumption. I believe that making a garment, combined with conversations around the quality perspective, will help to build up understanding and knowledge of how clothes are manufactured, quality and respect for the work behind a garment. As Løkvik and Reitan(2017) points out, engaging in a continuous dialogue, the context become clearer and this open up for discussion on the contrast in the mass production of cheap clothes, and "…how rich countries outsource the production to poor countries and consequences this has on us as consumers, environment, economy and health."(2017, p.3). As is evident from Sinikka Pöllänen (2009), art and design subjects are a way to gain an increased understanding of cultural and ecological phenomena, as well as reflect on culture and society, it is about giving the students an individual and balanced relationship between yourself and the world it is part of. Seeing things from others' point of view is important for the ability to reflect and the student's personal growth. And this, again, I think can help to make them more aware of their own consumption and promote for a moral reward, when students can self-realize themselves through clothing without a guilty conscience. This is consistent with the basic values as creativity, identity and human dignity, in General section- values and principles (Kunnskapsdepartementet, 2017).

Orheim and Nielsen (2017) points out that motivation of students is a challenge. On the other hand, real world environmental problems tend to engage students (Løkvik & Reitan, 2017; Pöllänen, 2009). It is important and motivating for the students to explore and find their own answers to what makes things sustainable (Løkvik & Reitan, 2017). As I interpret Løkvik and Reitan (2017), it is important to have different approaches to the topic in order to motivate the students and facilitate the students to make their own reflections and engage them to think for themselves. Introducing craft training that supports the full and versatile development of the student's personalities requires understanding of important features of different pedagogies that models and the ability to draw from them in a conscious manner (Pöllänen, 2009).

Foros and Vetlesen points out that there is not much time for reflection in a busy school day (2015, p. 251). And it is exactly there I believe the arts and design subject is in a special position. Because when you are in the process designing and creating, and you get into a flow where you can work with the products, and let your mind wonder of. Which allow you to reflect in a subtle way. If you facilitate for a short conversation with students in the beginning of the task, or during the process, it creates both space and time to think. Example of conversations that can be conducted with students: How would you feel if you wash this garment that you have spent a long time making, and the fabric turns out to be of por quality, and that the shape of the garment is ruined? How would you feel if someone throw this garment away after using it twice? The question is if the garment they have invested work and time on, will get the increased value for the students, which in turn provides increased care and maintenance that provide longer lifespan mentioned earlier.

Another challenge is that failed projects that fall into the garbage conflict with the environmental focus. (Orheim and Nielsen, 2017; Pölännen, 2009). Løkvik and Reitan(2017) as well as Pöllänen, (2009) raise basic exercises, training and knowledge before the project as an important basis for avoiding this. I believe that exercises in crafts and proper selected materials will give students the skills to see the connections between what they have learned earlier and can affect the quality of the garment. As Orheim and Nielsen (2017) specify it is important that the garment is of good quality, awareness around material use, knowledge and abilities for implementation are important both in terms of production and assessment of quality, therefore the teachers must transfer this knowledge through demonstration and testing. If you give the students a goal that the garment is to be used by themselves, or given as a gift to someone special, the students take the task more seriously and make something they want, not something they need (Orheim & Nielsen, 2017). Granted that students summarize the project in the end, and explain words and concepts such as sustainability, the teacher also receives feedback on what they have learned during the process (Løkvik & Reitan, 2017). However, as Orheim and Nielsen (2017) points out, we do not know if the students will actually use their garments and if they don't, some of the expected learning outcome is not achieved.

As Foros and Vetlesen themselves identify, conversations about consumption are important preconditions for the upbringing. Knowledge and an understanding of the world combined with impressions and experiences, can promote the meaning and actualize value choices are important prerequisites for the upbringing. Experience of choices and opinions creates greater hope and vigor in people (Foros & Vetlesen, 2015). The question is whether such conversations and practical tasks affect how they identify themselves as a consumer in a global community? Will this do something about their consumer perspective, both in terms of relationship to quality, use of materials, time and resources spend use in general. Can this influence their attitudes both to price, quality and their own consumption of mass-produced goods? What experience does the students get through sewing a garment? I think they will get an insight into how demanding it is and how much time it takes as well as a better understanding for the performance of a piece of work. Porko-Hudd, Pöllänen og Lindfors mention that “Craft, design and technology education may help people to see the potentials of sustainable consumption and individual satisfaction of developing one’s skills and accomplishing something concrete with one’s own hands (2018, p.34). This can create a foundation for biophilia, and create a focus on people's working conditions and different environmental impacts that our consumption provides the local environment. The starting point for biophilia is, as I interpret Hessen (2010, p. 147) that we as human beings are more willing to stand up for someone who is closer to us. I think it certainly should be able to stretch to reach living people, and that this can cause upgrowing generations to feel and relate with workers in Bangladesh, which in turn provides a meeting with the basic value in *General section- values and principles* (Kunnskapsdepartementet, 2017), the value of human dignity.

And as Hessen is writing, you also get life's content through what you do (2010, p. 257). "Impression through adolescence will shape the brain, in which much of the human flexibility lies, but it is also where what makes us creatures of habits, lie" (Hessen, 2010 p. 100). Therefore, it is important to lay a good foundation for environmentally conscious reflections and teaching around our consumption into school life. Here, dialogue and reflections important as Løkvik and Reitan(2017), Foros and Vetilesen (2015) as well as Pöllänen, (2009) underlines. I believe this will promote the students' ability to make ethical considerations such as *School of the future* (NOU 2015:8) points out that the practical aesthetic subjects are carriers of. I think this will contribute to the combination of practical and theoretical teaching that, according to *General section- values and principles* (Kunnskapsdepartementet, 2017), facilitates understanding, reflection and critical thinking.

A challenge in the Finnish school Porko-Hudd, Pöllänen og Lindfors (2018) points toward, is lesson hour distribution in craft education to amongst other things influences pedagogical innovation processes, time to develop ideas, design and useful products of good quality. In Norway there is a possibility to do interdisciplinary collaborative projects, thus merging hours with other subjects, but how widespread this is in the Subject of Art and Craft in practice I have not found research on.

Another challenge is that surveys show that a minority of teachers in Norwegian art and craft subject have formal qualifications; in addition, fewer number of teachers being educated with formal qualifications now than in previous years, and continuing education in the subject is minimal (Lagerstrøm, Moafi & Revold, 2014; Espeland, Arnesen, Grønsdal, Holte, Sømoe, Wergwdahl & Aadlamd, 2011; Perduco Kultur, 2008; Opstad, 2013; Neuberg & Digranes, 2017). Formal qualifications and continuing education affect teachers’ focus on concepts, their repetition, and their attitudes toward the subject (Neuberg &Digranes, 2017). I think this can create a challenge for the transfer of knowledge through demonstration and testing, as well as conditions for production and assessment of quality, and not least how the teacher facilitates reflection and dialogue.

As I interpret Hessen (2010), does increased consumes equals increased waste, increased CO2 emissions and increased greenhouse gas emissions which threaten our globe. And as previously mentioned, the framework for the conditions change, and that today we are responsible for the emissions that occur in other countries on behalf of our consumption, and thus also a responsibility for the protection of areas and species in a global perspective. We should present to the students how our way of living affects the nature, the climate and our society, as *General section- values and principles* (Kunnskapsdepartementet, 2017) calls for, presented with the knowledge that humans have the opportunity to change habits and identity, because we, as human beings are in an interaction between identity and society, as Hausstätter and Sarromaa (2009), Hessen (2010) Løkvik and Reitan(2017, as well as Pöllänen (2009) specify.

Summary

What influences our consumption is the culture and society in which we are a part of, as well as the individual's action patterns, that are based on instincts and habits. But we humans have adaptability to change these habits.

Politicians refuse to focus on the individual's responsibility. They can, as we seen, under the direction of their mandate, help to increase the focus on the environment and consumption perspectives in the school trough the white papers. This can provide to bring about a change in attitudes form the bottom up. Social innovation in schools can thus become the key to raising awareness around the topic of consumption. Especially in the subject of Art and craft, which is in a special position for combining knowledge and an understanding of the world, combined with impressions and experiences.

If one assumes that through letting students sew their own garment combined with dialogue around of how the human way of life affects the nature, the climate and our society, one can facilitate for reflection, understanding and empathy in a global perspective, both in terms of human working conditions and an environmental perspective. This can be easier to convey, than a perspective on future generations. But with the climate crisis hanging over our head, it is necessary that we give the students hope for the future. We have to emphasize that there is hope, and that there are choices to be made as well as giving them tools to make them.

These impressions and experiences through sowing a garment can affect attitudes and habits, because students experience a close proximity to the production and will gain new insights and new perspectives. Experiences from sewing a garment will be able to lay a good foundation for environmentally conscious reflections, critical thinking and ethical awareness and can add a basis both when it comes to quality, maintenance and they're own consumption. Sewing a garment is not at least a way to self-realize through clothing without buying clothes. If you make a product, you're proud of, it increases the sentimental value of the garment and can contribute to a heightened desire to care for it. Life should be good to live, and creative processes can contribute to the sense of coping with a difficult situation and facilitate for hope, creativity and identity in a world facing environmental and societal ethical challenges. Therefore, the subject of Art and craft can form an important basis for a multidisciplinary approach to environmental issues around consumerism.

Suggestion for further research is to undertake such projects in practice, investigations of the implementation in such a sowing project with successive interviews or surveys of teachers and students.

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Adaptive digital capability development: Professional learning for educators across disciplines

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In a cross-university project, a mixed methods approach was adopted to design a learning model for digital work practices in line with evolving industry needs. Drawing upon industry input (*n=50*), developmental learning and technology affordance theory, a model was trialled with Design, Journalism and Engineering students (*n=78*). Workshops were held at five universities with educators (*n=66*) and this paper discusses their perspectives on the model. Their responses indicated a predominantly functional digital capability focus in their current learning and teaching practice; rather than integrating functional, perceptual and adaptive digital capabilities, which are in high demand but short supply in industry. The educators highlighted a need for their own professional learning and we offer practical suggestions for moving beyond a functional digital focus. We argue it is vital for students and educators to learn and use the vocabulary of technology affordances, to strengthen professional learning for digital work futures.

Keywords: digital enterprise learning, adaptive capability, technology affordances, professional learning, academic development

Introduction

At a time of ongoing technological developments and change in the world of work, graduates need enterprise (21st Century) skills spanning communication, collaboration, critical thinking, design thinking, creativity, complex problem solving and entrepreneurship; the ability to select appropriate technology; and data literacy, including analytics, security and the ethics of data use (PriceWaterhouseCoopers, 2018). In this context of rapid technological change, lifelong learning as an attribute of workers is paramount (WEF, 2018). Evolution of the learning continuum concept, including preparation for work and ongoing career learning, is increasingly cited in higher education circles. Examples include the University of the Future Report (Cawood et al., 2018); the University of Queensland discussion paper on higher education trends and implications (Matthews et al., 2018); and re-imagining professional learning models in collaboration with industry (Peterson et al., 2018b). Understanding the digital literacy of entrants to higher education (Coldwell-Neilson, 2017), and shifting the focus of assessment to 21st Century requirements such as teamwork but also resilience (Sonnemann & Goss, 2017), are other examples of ways in which higher education thinking has responded to the changing needs of the workforce.

We, too, argue that enterprise or 21st Century learning, especially digital enterprise learning, needs to be uppermost in the development of curriculum and pedagogy, to ensure that students in higher education are well supported as they prepare for their work futures and ongoing learning. However, there may be a gap

between this aspiration and some current practice in learning and teaching, according to research undertaken in an Australian cross-university project with stakeholders in industry and education. The Digital Work Practices project revealed that adaptive digital capabilities are in high demand yet short supply in industry, where changing workforce needs continue to be exacerbated by technological developments. At the same time, however, a key finding was that the focus of educators and students in higher education may be too much on digital capabilities that are functional, rather than perceptual and adaptive. *Functional* is the 'what and how-to' or operational level; *perceptual* is knowing the 'when and why' i.e. discerning use of technology in *known* contexts; and *adaptive* involves imagining possibilities for the use of technology in new ways or *emerging* contexts (see Peterson, 2018a; Peterson et al., 2018a, c).

The project team suggests that a different approach is needed in higher education, drawing upon affordance theory (e.g., Best, 2009; Evans et al., 2017); as well as deep and transformative learning about technology affordances, where critical engagement and reflection underpins the development of students' understanding of their experiential learning (e.g., Fullan & Langworthy, 2013; Marton & Säljö, 1976; Mezirow, 1997). A Digital Affordance Developmental Learning Model has been developed as a rapid prototype in the project, involving iterative engagement with industry stakeholders, educators and students.

This paper focuses on findings of the five workshops about this Model conducted with educators. Our initial response to the educators' feedback is addressed, including their call for support with professional learning for teaching in relation to the Model. The authors of this paper are the leader and two members of the project team involved. All three authors are experienced educators in Design, Communication and/or Business at different universities.

After explaining the research aim and methodology, we discuss the educator participants' written responses to questions in three broad areas: the key digital capabilities identified by industry participants in the project; the possible strengths and challenges of the proposed Digital Affordance Developmental Learning Model; and ideas for its implementation in teaching practice. Then we outline suggested approaches with examples to enhance teaching capability, for scaled-up implementation and transition to an adaptive digital capability development focus with students. Finally, we discuss some of the wider implications and highlight further research needed.

Research aim and methodology

The aim of the project was to create a useful model for deep and transformative learning and teaching practice to support the development of digital capabilities in Design/Creative Arts, Communication, Business Management, and Engineering, with potential application in other disciplines. The intention was to meet new industry needs, whilst positioning graduates for emerging digital work opportunities in the globalized world of work.

A mixed-methods approach informed the learning model developed in this project from April 2017 to June 2018, including literature reviews and iterative stakeholder interactions. Data analysis was documented initially in a series of six reports available in the project website (https://sites.rmit.edu.au/digitalworkpractices/) and in journal and conference papers focused on different aspects of the research and findings.

Qualitative and quantitative analysis and synthesis in the project spanned employment information; five consecutive industry roundtable discussions in Melbourne, Sydney and Brisbane (*n=50*); the design, implementation and refinement of pilot activities with Journalism and Design students at one university, and Engineering students at another (*n=78*); and teacher reflections from the pilots. Educators at universities in Melbourne, Sydney, Brisbane, Perth and Adelaide were invited to participate in an online survey (*n=91*) to ascertain what digital capabilities were being taught, practised and assessed; then, six months later, face-to-face educator workshops were held (*n=66*) at the same five universities for feedback and further input to the Digital Affordance Developmental Learning Model. Discussions were also held with the project's Critical Friends Group during and at the end of the project. A final symposium involved an Expert Panel responding to the project findings and Model in relation to work futures, institutional strategy and learning futures.

In this paper, the insights gained from the educator workshops underpin our suggestions about professional learning for educators to support their students' adaptive digital capability development. The educator workshop participant input was first documented in the project website in a preliminary report (Peterson, 2018b). This paper draws and builds upon excerpts from that report.

The face-to-face workshops were held at universities in Melbourne, Brisbane, Sydney, Perth and Adelaide in March 2018, following the earlier online survey undertaken at the same universities in September/October 2017. The 66 educators who attended the workshops were from several disciplines: Design/Creative Arts (19); Business Management (15); Education (11); Communication (3); Engineering (3); Science/Health (3); and Information Management (2). Ten participants did not identify their discipline. Project team members designed and facilitated the workshops collaboratively, underpinned by the team's own different disciplinary perspectives from Education, Design, Communication, Business, and Engineering. A common format was used for the workshop presentations and activities, facilitated by different members of the project team.

Workshop participants were introduced to the research, including findings from the online survey of educators six months earlier. Workshop activities and discussion then focused on staff/student capabilities and applying the digital affordance concept, which is integral to the learning model proposed by the research project team. In the final stage of the workshops, participants were invited to provide individual written responses to seven questions, which yielded 320 written responses overall. The questions related to three areas: key themes from the project's industry roundtable discussions on the key digital capabilities needed; possible strengths and challenges of the learning model; and ideas for its implementation in teaching practice.

The educators' written responses from all locations were then grouped under each of the questions to explore any patterns emerging. As a phenomenological method, we used theme identification as a "sense-making tool" to generate meaning and reveal different ways to think about problems and solutions (Dorst, 2011, p. 528). Specifically, a social phenomenological approach was adopted in analyzing the educators' written responses. In this approach, "people living in the world of daily life are able to ascribe meaning to a situation and then make judgments" (Fereday & Muir-Cochrane, 2006, p. 81). As an experienced educator and leader of learning and teaching in higher education, one of us undertook to interpret patterns and initial themes emerging in the subjective data (i.e., in the participating educators' written responses). Reading and re-reading the grouped responses "provided the opportunity to sense and take note of potential themes in the raw data," where both single and repeated comments were important (Fereday & Muir-Cochrane, 2006, p. 86).

The study is limited to the initial themes thus identified; and to the educators who chose to participate in the workshops, providing written responses to our seven questions in the worksheet. Whilst there were some 'early adopters' in teaching for new digital work practices, many participants in the different locations and disciplines said they were less experienced, particularly with technology affordances. Insights to their written comments are provided below, together with sample responses in italics and attributed only to a workshop participant's identified discipline (see also Peterson, 2018b). These insights and participant comments informed our development of resources to support educators, discussed later in the paper.

Educator workshops

Educator responses to industry themes on digital work/capabilities

Prior to the educator workshops, industry participants had highlighted the importance of two key themes: a) analyzing and making sense of data, particularly to inform customer experience and engagement strategy; and b) artificial intelligence (AI) and machine learning (ML), particularly in terms of business and social implications. At the educator workshops, participants were asked to indicate if these industry themes were familiar or surprising, and if they could suggest ideas for addressing the themes with their students. Many educators responded that, although they were familiar with such industry trends, they did not have well developed understanding of AI and/or data sense making for customer or audience experience and engagement, and many were not addressing these themes in their teaching. Some indicated that they had a stronger understanding of these areas and were already addressing them with their students, at least to some extent.

> *The degree I'm teaching, is IT and data analytics. We are just beginning to develop a sense of the true capabilities and business capacities for these. - Business participant*
>
> *Data analysis in Internet of Things is key – so in fact people learning about Internet of Things will learn (hopefully) to understand different types of data, communication of data, data processing, data storage, data services, data visualisation…in other words it's a good carriage for understanding things like data, also machine learning, and even customer experience because it drives you to think about it in an adaptive way. - Communication participant*

Ideas were put forward for maximizing student learning in relation to the industry themes above. Some educator workshop participants encouraged self-directed learning activities and assessment. Many recommended multiple authentic projects for students working with industry to undertake research and problem solving specifically targeting customer or audience engagement. Many also underlined the importance of having such projects throughout the programme of study, rather than 'once only' experiences.

> *Getting students to conduct interviews with customers and their experiences of a product/service and then make recommendations for a solution. - Education participant*
>
> *Engagement data, creating significance and understanding how the creative production is received is a crucial part of the discipline now. These may be addressed whole of course through iteration. - Creative Arts participant*

Learning model

After inviting the educators to respond to the industry themes identified in the project, responses were sought to the learning model proposed. An overview of the model concept had been explained at the workshops, which has also been disseminated in reports in the website (https://sites.rmit.edu.au/digitalworkpractices) and other publications (e.g., Fray et al., 2017; Jollands et al., 2017; Peterson, 2018a, b; Peterson et al., 2018a, b, c). Excerpts are provided below.

Model concept explained

The Digital Affordance Developmental Learning Model integrates technology affordance theory and developmental learning. Affordance theory defines a technology in terms of the uses, interactions and possibilities that the technology affords to its users; and affordances can be categorized – according to their potential for achieving outcomes – as Functional, Perceptual, Maintenance and Contextual (Best, 2009; Evans et al., 2017; Fray et al., 2017). These categories were adapted in the project and re-named as functional, perceptual and adaptive, defined as follows:

- Functional affordances relate to the operation of technology; this includes naming, knowing and operating the features of a technology/technologies to perform tasks.
- Perceptual affordances relate to interpretation and being discerning about technology tools and practices for their suitability and in-context operation for outcomes in known contexts.
- Adaptive affordances relate to imagining, adapting and extending technology use in previously unexplored and emerging contexts for innovative outcomes; this requires some functional knowledge/skills and perceptual experience.

(Source: Peterson et al., 2018c, adapted from Best, 2009; Evans et al., 2017)

As explained in Peterson (2018b), the developmental learning ideas integrated with affordance theory are underpinned by educational theory, including hierarchies and stages of learning with acknowledgement of the learner, environment, outcomes and increasing complexity; and highlighting the importance of reflection-in-action for professional learning and practice in unpredictable and new circumstances (e.g., Piaget, 1936; Bloom, 1956; Biggs & Collis, 1982; Schön, 1983; Gagné, 1984; Anderson et al., 2001; Scott, 2016).

Peterson et al. (2018c) describe a spectrum of capability within the functional, perceptual and adaptive layers, and suggest different emphases as follows. Each affordance layer spans introductory to advanced levels. Realistically, in the adaptive layer, we can emphasise imagination and 'seeing' possibilities, rather than expect that all graduates will be capable of true innovation with technology. We recommend multiple opportunities for students to practise integrating functional, perceptual and adaptive thinking, rather than see these separately forming a linear path. Affordance layers can also be emphasised at different times to suit the needs of students; however, as adaptive digital capability is highly sought after in industry, it would be vital for final year students to focus on this and be able to critically reflect upon and discuss their work accordingly.

Digital Capabilities Descriptors illustrate ways in which affordance theory can be interpreted for scaffolded or developmental learning about industry-relevant digital work practices in different disciplines. Descriptors interpret affordances in sample domains, which are categories of practice and related capabilities for existing and emerging jobs or work roles. In the Digital Capabilities Descriptor for Design, for example, one of the practice domains identified by the project Design team is Persuasion; and within Persuasion, the work activity of 'Storytelling' could be interpreted as follows (see Peterson et al., 2018c):

- Name and define narrative approaches, use software for visualization and interface design to illustrate/present/argue (Functional digital capability for Storytelling).
- Analyze data to tell stories, develop content using techniques appropriate to a range of media, critically evaluate stories (Perceptual digital capability for Storytelling).
- Work with generative systems, artificial intelligence/machine learning to tell stories, developing new tools and platforms (or new uses) to tell and disseminate stories (Adaptive digital capability for Storytelling).

Digital Capabilities Descriptors scaffolded in this way, using disciplinary language in a work context, can guide the design of assessment and learning activities to enhance existing curriculum, or for new programme and unit development. The team deliberately wrote the Descriptors for each sample discipline, as illustrated in the example above, to encourage embedding the scaffold in the curriculum for both existing and new courses/subjects/units with direct relevance to contemporary industry practice.

Educator responses to learning model: strengths and challenges

Applying functional, perceptual and adaptive lenses to using technology was noted by many of the educator workshop participants as a clear strength of the proposed learning model approach, which would address potential gaps in their own teaching practice. Building upon the earlier questions about industry themes, some participants also made further connections here to address industry developments such as artificial intelligence, the interpretation of data for customer experience, or application for social benefit.

> *Useful in qualifying expectations of students and for students. - Engineering participant*

> *I like this model – I think we can use these terms to explain to students where they currently sit on the digital capability spectrum and where they need to be to be employable in 5-10 years; the adaptive affordance can be used to develop creative approaches to problem solving i.e. how can big data be harnessed to map disease prevalence or public health programme take up. - Health participant*

There was wide support for the usefulness of the model, in terms of providing a framework for mapping curriculum in a whole programme of study. Through constructive alignment (see Biggs, 2003), the learning outcomes, learning activities and assessments would be clearly linked, with encouragement for students to make sense of their learning about technology affordances now and in future. Some participants saw the model as a useful way to emphasize the functional, perceptual and adaptive capabilities more at different levels such as first year versus final year, or undergraduate versus postgraduate. The student would move through learning outcomes of increasing complexity over time; for example, move from 'describing' something to 'proposing' as a more sophisticated outcome.

> *Well-structured approach to categorise learning outcomes. Allows alignment of assessment and content. Allows scaffolding across different units. - Business participant*

Some participants were more cautious in their responses, indicating that they saw the model as being necessarily linear and prescriptive. There were clear signals to the team to clarify, for educators and students alike, that the model reflects hierarchical but integrated affordance layers. Adaptive capability requires some functional knowledge/skills and perceptual experience. This may mean knowing enough at the functional level to interact effectively with specialists and imagine the possibilities, rather than having advanced knowledge and skills oneself. Furthermore, encouraging an integrated approach to affordances does not preclude emphasizing different affordances in the hierarchy at different times, depending on the learning situation and learner needs. Several respondents appeared to be more comfortable with the integrated affordance aspect of the model, encouraging other educators and students to be brave. The significance of motivation and positive feelings about learning and teaching in a supportive environment, for students and educators, was evident in several responses.

> *Work on own (and students') fears…move from functional pure focus to integrated focus between the affordances (functional, perceptual, adaptive) - Creative Arts participant*

> *Scaffolding from functional to adaptive. Self-driven experimentation, problem solving and collaborative oriented creative process/activity. - Creative Arts participant*

> *Students as co-creators of engaging assessments; using coding skills to build models that explain physiological processes like insulin's actions, action potential generation - Health participant*

Grappling with assessment surfaced in many of the educators' responses. Some indicated that the Digital Affordance Developmental Learning Model provides a useful way of thinking about scaffolded learning for capability development and assessment.

> *Could be scaffolded over several assessments. Helps us move beyond functional, which is where it mainly sits at the moment. Develops digital fluency, rather than mere skills. - Information Management participant*

However, assessing adaptive digital capabilities was identified by many participants as a real challenge with workload implications, especially where their own and students' adaptive (and other) digital capabilities might currently fall short.

> *Time and effort, staff capability, student acceptance and ability to learn especially adaptive affordance. - Business participant*

> *Students' resistance to move away from conventional 'job readiness' definition based on mastering of functional skills. - Creative Arts participant*

Educator responses to learning model: ideas and recommendations

When participants were invited to suggest the most useful aspects to focus on for student learning, several suggested that data analysis and interpretation should be prominent for perceptual and adaptive digital capability development, although functional cannot be ignored.

> *Adaptive and problem solving. We probably do a lot of 'functional' affordance teaching but need to ensure that digital tech features in our problem solving exercises, such as my capstone project. - Science participant*

Many participant responses underlined the importance of communicating with students about their digital capability development, using the vocabulary of functional, perceptual and adaptive affordances of technology; and of graduates being able to discuss their capabilities for digital work in affordance terms.

> *Opportunities to practice. Connect digital capabilities to job outcomes. - Business participant*

> *Create a matrix to cross check the functional, perceptual, adaptive across subject learning objectives. - Creative Arts participant*

Participants suggested ideas on student/educator interconnections, together with promoting attributes such as lifelong learning and resilience. There was again acknowledgement that educator capabilities need to be developed. Safety for risk-taking – by students and educators – was seen by many as an important consideration in implementing the model.

> *Ensuring that students are rewarded when they want to experiment. - Communication participant*

When asked about the first thing they would need to do, to make the model work for them with their students, many of the educators advocated again for a whole-of-programme action plan. Many intended to look at their curriculum for possible links to the model. They said that revisiting learning outcomes and assessment would need to involve discussion with discipline and industry contacts, for contextualization and identifying core technologies needed. Overall, there were renewed calls for closer connections and collaboration between education and industry, with encouragement for risk-taking raised again.

> *More collaboration between universities and industry i.e. learn about their needs; develop units on data e.g. Design and Big Data. - Business participant*

> *For specific disciplines, show where digital work practices are in the curriculum…how many [work integrated learning] projects relate to the digital future? - Education participant*

> *Find a way to collaborate among academics, students and industry participants that goes beyond current practices. In other words: reward new, daring projects. - Communication participant*

Respondents continued to return to the significance of motivation and positive feelings about learning and teaching in a supportive environment. Time for educator reflection emerged as a common theme. Some also described students as co-creators, and prioritized developing confidence in students.

> *Bring them along on the value of their understanding, and deploying of these affordances e.g. How will these affordances make me more employable? - Creative Arts participant*

Evolve it, i.e. using an action learning context, giving the power to the class/students. Have them as a student-centred approach to digital literacies and competencies - run an evolving development, self-generated learning environment. - Business participant

Incorporating more choice/options for choosing technology to complete assessment tasks. Equipping students with the confidence to explore digital tools to complete tasks and problem solve. - Information Management participant

Finally, we asked the participants how we could build on and improve the model, to help graduates prepare for work and meet industry needs. What should happen next? Several respondents underlined the importance of broad take-up of the model, supported by senior management as a priority. The needs for professional development and adopting a whole-of-programme or whole-of-school/institution approach were often raised. Some also said they were reluctant to engage in yet another 'fad' or university mandated curriculum mapping exercise.

Adaptive affordance area is enormous task. Need whole school approach to teaching. All staff need to know how to incorporate these skills. - Science participant

Developing confidence among educators for motivation is clearly a priority for many respondents, who often said they 'get' the learning model concept but need practical examples for its translation into practice. This need for examples also proved to be a strong common theme in the workshop responses.

More professional development for staff to have confidence to deliver. - Creative Arts participant

Practical example of each i.e. functional, perceptual and adaptive in different disciplines and how assessment is applied. - Communication participant

Enhancing teaching capability

The Design, Journalism, Music Industry and Engineering examples of Digital Capabilities Descriptors developed during the project are provided in the website (https://sites.rmit.edu.au/digitalworkpractices). The website also includes documentation of planning, learning activity and assessment ideas, and teacher reflections from pilot interventions undertaken with students, when elements of the Descriptors were aligned with actual curriculum in action. We believe that these samples of disciplinary contextualization may provide a starting point for colleagues to debate, adopt or adapt in their own teaching practice.

Professional development

A toolkit was created to support facilitators to run their own workshops to help other educators incorporate the Digital Affordance Developmental Learning Model into their teaching. The development of the toolkit built on the resources created for the project team's own educator workshops and incorporated feedback received from those workshops. The toolkit was designed to provide a guide, resources and ideas for running short workshops (1-2 hours). Suggestions were given for structuring a workshop with ideas for discussion and activities. These were supported by further resources and hyperlinks to relevant areas on the research project's website. Sample worksheets and slides that are easily adaptable were also included in the toolkit.

Three main topics were covered in the toolkit: first, an introduction to the learning model; second, selecting and developing digital descriptors for units/subjects; third, using the learning model in teaching.

Topic 1. An Introduction to the Learning Model

The first topic provides an overview of how the learning model was developed and why: a 'walkthrough' for the learning model, broadly exploring how the tools could be used and applied in the participants' own situations. Activities in the toolkit aim not only to introduce what the model is and how others have used it, but also why participants might want to use the model themselves.

Topic 2. Digital Descriptors for Your Unit/Subject

The second topic focuses on using and adapting the existing digital descriptors developed by the project team, with the possibility of extending the workshop to practice in creating new digital descriptors for the educator participants' units/subjects. The toolkit provides resources to guide educators through the process of identifying relevant domains of practice needing digital descriptors, checking the project website for existing

digital descriptors to use or adapt, and practising development of new descriptors if no suitable descriptors already exist in the website.

Topic 3. Using the Learning Model in Your Teaching

The third topic supports educators by developing and sharing ideas for how they might use the learning model in their teaching. The toolkit guide encourages workshop facilitators to ask participants to bring along their subject outlines and learning outcomes/objectives to work on them during the workshop. The toolkit provides resources to 'walk through' how to apply the learning model to the participants' curriculum and lesson planning, including activities to collaboratively develop ideas for using digital descriptors to adapt and create unit/subject learning outcomes/objectives and assessments. The toolkit also provides resources to identify challenges to implementing the model and brainstorm ways to overcome those barriers and constraints.

Encouraging flexible and adaptive uses

As the participants in the project's educator workshops came from a variety of disciplines and were attempting to apply the model to a multitude of different units/subjects, the toolkit aimed to support flexible and adaptive uses to help fit individual needs.

The toolkit was not intended to provide prescriptive direction; rather, it encourages facilitators to view it as a menu from which they could select (and add to) to develop workshops for their own requirements. For example, a workshop could cover all three topics sequentially, or focus on one aspect in depth. Discussion questions and activities could be selected, added to and tailored to the workshop focus and participant needs. The worksheets and slides were unbranded to further support facilitators to make them their own.

Integrated learning process

The investigators who piloted the teaching model in their classes as part of the research project reported how their understanding of the Digital Affordance Developmental Learning Model developed, through applying and shaping the functional, perceptual and adaptive concepts to their actual teaching context and practice (Peterson et al., 2018c).

We recognized that other educators may go through similar learning processes and could be supported by the toolkit and guide. On the functional level, the educators needed to know what the concepts were and how they could be used, so we provided an introduction to the model and core concepts, as well as examples of how the model could be used in teaching and why. On the perceptual level, educators needed to be able to develop the capability to discern and apply the model to known contexts. To support this, we designed activities to work with digital descriptors already developed, which had been tested previously. However, we found that most educators' contexts had differences from the researched cases. Educators needed to be supported in developing adaptive capabilities to be able to shape the model and tools to their own unique and emerging contexts. Thus, we created activities to support educators to devise their own digital descriptors in the workshop and then share and discuss them in the group, along with challenges and opportunities for applying them to their own situation. Just as the learning model encourages real-world projects to develop digital capabilities, so too does the toolkit encourage hands-on practice and reflection-in-action (Schön, 1983) during the workshops. Through use, application and adaptation, educators can develop their capabilities to use the learning model and tools across the functional, perceptual and adaptive layers. While these layers are hierarchical, they are integrated and are not simply linear.

Similarly, we developed the toolkit with the recognition that other educator workshop facilitators may also be learning about digital affordances and the learning model, in the process of designing and delivering these workshops – not just their participants. Teaching has long been acknowledged as an effective way of learning (Cohen et al., 1982, Fiorella & Mayer, 2013), so running workshops provides opportunities for educators to develop their understanding of the concepts and capability to use the model and tools. In undertaking the pilot research studies and developing the toolkit, we observed our own processes of capability development and found that working at the adaptive level further developed our capability at the functional and perceptual levels. We developed more nuance at depth at the functional level through application at the adaptive level, which in turn helped us develop that nuance and depth in perceptual capability for the contexts we already knew!

Hence, we endeavoured to design the toolkit to be simple and easy to understand for those who were new to the concepts, while linking to further resources that could be explored if facilitators and participants wanted to extend their learning. We acknowledged that this is an emerging area where we are all developing our

understanding and capabilities, so we encouraged facilitators and participants to learn from each other as they explore ways to support learners in new contexts. We shared teaching resources, such as lesson slides, from the pilot projects in the research study, as examples of different real-world applications rather than as exemplars. We invited facilitators and educators to share the resources they create back with the community for the project website.

Implications and further research

This paper has focused on the findings of workshops on the Digital Affordance Developmental Learning Model, with our initial responses to the participants' feedback in terms of developing professional learning support for educators. As experienced educators ourselves – in Design, Communication and/or Business at different universities – we have revealed our own team's professional learning journey in the design, development and implementation of the learning model.

The preparation of new graduates for emerging jobs that have new definitions and activity requires a differing approach to how they may have been educated in the past. Graduates need the ability to frame their skills and abilities in industry-relevant terms. What we have explored in this paper has focused on supporting educators with the implementation of a Digital Affordance Developmental Learning Model, designed to support the growing need for explicit incorporation of digital capabilities into subjects/units and mapping across a whole programme/course experience for the student.

Our work with educators highlights an opportunity for programme/course teams or universities to take the lead in shaping emerging practice further with industry, in relation to aligning learning and teaching practice with industry needs. As an example, an ability to interpret data for strategic decision making and customer/audience/user engagement, as well as using artificial intelligence and machine learning, is highly sought after in industry (e.g., CEDA, 2018; WEF, 2018). However, as one educator workshop participant lamented:

> *There doesn't seem to be a sense of urgency in some parts of Higher Education to respond and adapt to these emerging [industry] themes. - Education participant*

Whilst it appeared that not all workshop participants are addressing these trends in their teaching practice, they did suggest ideas such as industry projects based on speculative scenarios. There was also mainly positive feedback about the proposed learning model, with participant suggestions for teaching practice ranging from introducing a functional 'bootcamp', to elevating perceptual and adaptive digital capability development through collaborative 'messy' problem-solving projects related to data, and work integrated learning projects specifically related to digital work futures. Creating 'self-generated learning and development environments' for students, and helping students to learn and use the vocabulary of affordances including their industry relevance, were also seen by the educators as being especially important. Several considered this would strengthen professional learning and counter any student perception of all jobs requiring only functional skills.

Furthermore, the educator workshops revealed the need for professional development and resources to underpin new approaches to preparing graduates for a changing world of work. We found the workshops created a valuable space for educators to reflect on, share and co-create new teaching and leadership practices.

The approaches suggested to enhance teaching capability for transition to an adaptive digital capability focus highlight further research needed. This includes scaled-up implementation of the Model with students. Longitudinal studies would be vital to evaluate outcomes for graduates who have experienced the Model. Further research on the professional development of educators and how they can be supported to apply and adapt the Model in their professional practice is also needed across disciplines. At a time when 'quality' in learning and teaching has different meanings and is under-researched, despite the increased focus on quality and implications of its measurement in higher education (Strang, Bélanger, Manville & Meads, 2016), it is vital that we continue to explore ways in which the actual student learning experience can be enhanced with tangible outcomes, in terms of work futures and digital work practices.

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Democratizing Design: Can higher education survive?

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The tools and techniques of graphic design have become accessible to the public at large to such a degree that the profession itself may be threatened with extinction. At the same time, design literacy — the knowledge and reasoning beyond the use of those techniques — does not seem to be experiencing the same widespread dissemination. In order to re-establish its value, the design profession must introduce a higher level of insight beyond the mere the decoration of artefacts – an ability to understand "big picture" concepts and to work across disciplines to become involved in every step of a project, from concept to completion. Thus, U.S. undergraduate design education must change as well. Educators must be innovative in order to prepare a new generation to evolve quickly and continuously. Programs must be fluid and adaptable, which requires educators to treat their curricula as design problems, to be solved with radical thinking and creativity.

Keywords: design education, design curriculum, graphic design, visual literacy, critical thinking

Introduction

The democratization of design refers to an increased access by the public to graphic design tools and the proliferation of digital venues in which to use them. The software is readily available. Fonts, image manipulation tools, page layouts, ready-made graphics, are all instantly accessible. Herbert Simon suggests that everyone is a designer (1969), but not meaning anyone with a computer and internet access, but in a deeper sense, that anyone who solves problems and improves situations into better, preferred ones. On the social media site, Dribbble.com[1], which promotes itself as a platform for graphic designers, over half of the users describe themselves as having little to no formal training in design, yet they are practicing design (Hemsley, J & Kelly, R. 2019). They have access to the relevant tools and thus identify as designers. However, in *Design Literacy: Understanding Graphic Design*, authors Steven Heller and Rick Poyner highlight the challenges of developing creative proficiencies and conclude that formal aspects such as type and image comprise one small portion of a much larger framework of literacy competencies that includes persuasion, identity, mass media applications, and much more (2004). Yet many people walk through their careers unable to see its influence – and thus unable to harness the power of design to make their work and businesses more effective. By giving non-creative employees the tools needed to improve their design awareness, their ability to explore it in their work, and a structure for collaborating productively with internal and external creative teams, everyone benefits.

Sites such as this reflect a "preoccupation with 'form'" that limits designers to the act of two-dimensional decoration (Welch, 2011). Focused on the treatment of formal elements, they merely regurgitate the known—what has been done before—instead of conceptually reinterpreting the known to create something new. This

[1] https://dribbble.com/

distinction is significant; without context and concept, form becomes far less meaningful and the role of the designer becomes devalued as the boundaries between amateur and professional are blurred (Fleischmann, 2013). The consequences of this practice can be precarious for the profession. “True design literacy requires a practical and theoretical understanding of how design is made and how it functions…which takes years of learning and experience to acquire” (Heller, 2004).

So where does design education factor in the current paradigm? Programs that focus on teaching the technical aspects of design, the tools and techniques and software proficiency, may run the risk of being supplanted by online resources that can offer the same or more up-to-date training at a lower cost and greater convenience. As it becomes more difficult to ignore online learning sites, programs are faced with limited options: acknowledge and incorporate these sites as parallel teaching tools or split entirely from teaching technique and leave that responsibility to the internet. So, the value of a higher education in design may lie in teaching higher-level skills such as the ability to engage in design thinking, build a foundation of visual and design literacy, and direct those skills toward preparing the designer of the future as not just a problem-solver but a problem-seeker proficient in design and critical thinking. What Welch refers to as “creative insight,” the ability to use both associative and analytical thinking, and toggle easily between the two, allows the designer to make new, unexpected connections which leads to novel solutions (2011) that transcend the technique-oriented online resources. In addition, higher education can, and should, emphasize design thinking as a human-centric means of approaching problems from different perspectives, not only in design but as an approach to education in general. In a wider sense, design programs should produce “’critical minds and creative thinkers,’ a skill that cannot be attained from online courses or in self-study mode,” unlike the basic fundamentals. (Fleischmann, 2015a). Technology has altered the way in which we work as designers. Perhaps it has a role in providing instruction up to a point, but design education must find a way to either work alongside (Fleischmann, 2015b) or completely separate from and beyond the online resources to maintain relevance and value.

Background. The relationship between technology and design.

What was once the best friend of the design profession—*technology*, with its essential tools greatly simplifying demands of the job while allowing for boundless excursions into new levels of creativity—is now a challenge to its very existence. In the visual design field, technology has played a supportive role, simplifying a designers’ daily routine tasks and responsibilities — a role it has played so well that in many ways it now appears to be on track to replace the designer entirely. Stock photography, stock illustration, web templates, business cards, billboards, banners, packaging, presentations, publications, animation, logos, layouts—practically all of the artifacts a designer typically creates - can be obtained at little or no cost by anyone with a computer.

The state of traditional design education, as well, is under threat of replacement by technology in the form of workshops and lessons on YouTube, Skillshare, Lynda and inLearning, to name a few. (Fleischmann, 2013) In the early part of the twenty-first century, online learning was already making the traditional education system “extremely uneasy,” with the potential to trigger “evolutionary” changes in the establishment (Singh, O’Donoghue and Betts, 2002). While Massive Open Online Courses (MOOCs) have not yet replaced higher education, their impact is significant enough to warrant a reevaluation of current education practices (Fleischmann, 2015b). It can be assumed that their influence will only increase with technological advances (Fleischmann, 2015a). The rise of these resources, and the fact that there is a legitimate concern over quality control stemming from a lack of skill verification of their “instructors” has led to discussions of certification or accreditation (Karnjanaprakorn, 2012). Were this to happen, it would become even more imperative for university programs to evolve in order to maintain relevance to the profession in order to compete with the entities offering certificates meant to set them apart with more substantial validation. A study of the impact of online resources on the profession and education needs to be pursued, and, in fact, further research into this subject is ongoing and will be included in a subsequent phase of this project.

Due to the revolutionary changes in the industry, design education must evolve, but to what degree (Fleischmann, 2013)? The industry understands that evolution is natural and, in this paper, we are investigating what education is doing to remain relevant. Initially, design was developed as a “trade” in response to the industrial revolution and its alignment with the masses—in this case, communication to the masses. So, what began as an “applied art” during the 1920s moved from a follower of production to a formal

field of study of higher learning with the development of the Bauhaus (Cabianca, 2016)[2]. And design has remained in this position, working with technology, both as leader and as a partner depending on the moment, during which education in the U.S. has generally made small adjustments while many maintain the traditional Bauhaus model. To be sure, the dialogue concerning the need to evolve in response to technological advances has continued for over a decade, (Fleischmann, 2015b) with the issue becoming steady more urgent until there currently exists a "need for radical change in design education" (Fleischmann, 2013). Attempts have been made in the form of experimental program models at various institutions, but a definitive answer in the form of a solid curriculum shift has yet to surface.

According to the *AIGA Designer 2025* report entitled, "Why Design Education Should Pay Attention to Trends," technology is relentlessly reshaping the profession as we know it. Where designers might have once been masters of this technology, "design approaches of the past will struggle in keeping design relevant and…the field risks losing influence to other disciplines" (2017). As technology presents new and revolutionary ways of communicating, the traditional designer risks falling behind and becoming irrelevant. There is a certain danger in following trends; designers can easily become dated and passé as technological, cultural and visual trends cycle more and more quickly. There is a certain danger in not following trends as well. When designers become stagnant and unresponsive to the audience they attempt to reach, they risk being left behind altogether. Trends can be misleading, however, especially when looking at the short-term (within five or even ten years) when programs are producing professionals who plan to stay in the field for several decades (Davis, 2008). Vast, global trends, or paradigm shifts, must be identified within the constant stream of changing ways in which we communicate and interact in order for design—and design education—to once again take the lead.

At one time, designers were the trendsetters, the pioneers who influenced what would become cutting-edge and culturally-defining in the visual landscape. Now, it seems that role is being appropriated by entrepreneurs, engineers, and executives. The designers follow, taking their ideas and beautifying them — however, algorithms may take this away as well. Matías Duarte, VP, Material Design at Google, predicts that "in five years machine learning will enable computers to make the kinds of aesthetic choices that humans make today" (LaBarre, 2016). In fact, it has already happened (Leow, 2018). Where does this leave the designer? It is no wonder that the "prevalent belief in design as a service industry permeates…the culture of design as a whole." (Welch, 2011) This is exemplified in the social media site, Dribbble.com, with its "designer" users "caring only about form" and aesthetic decoration without concept or function being considered (Abehsera, 2013). Where does this leave the educational system that still focuses on this model?

Considering the pace of technological changes in design, how does design education prepare students, in a four-year program, to stay relevant in a networked society (Fleischmann, 2013)? How do we teach them to not only survive but excel as leaders and forward thinkers throughout the commercial sector? As referenced in the AIGA Designer of 2025 report, the traditional curriculum that involves teaching skillsets that build upon each other toward communicating a message to a passive audience no longer reflects the reality the designer will face upon entering the profession, (2017, Flew 2008), and yet colleges still utilize this approach as the basis in their classes. On the other hand, building a curriculum based primarily upon teaching the software *du jour* only compounds the central problem of designers becoming followers of technological trends rather than leaders and forward thinkers. In order to not only maintain design sustainability but regain the leadership role in driving visual communication, something more dramatic, more revolutionary must take place. The curricula developed within serious design programs must address the sea change facing our industry—the speed and efficiency within a university's design curriculum must improve, and not "bury their heads in the sand" (Davis, 2008). To survive, educators must be open-minded about the extent to which the nature and function of classroom must change, dramatically and quickly. It is imperative that educators remain in touch with the industry, through personal work experience or communication with alumni, in order to track the changes as they happen. And it is equally important that they implement changes based on their observations into their teaching methodologies and project development to equip students for the environment they will encounter post-graduation.

A current trend in design education is for universities to focus more heavily on research and theory as a form of validation of their area of focus, as opposed to practice. While this direction is a kind of response to the

[2] The Bauhaus School was developed roughly around 1920. The school was a movement of higher-level thinking about the blending of art and design in response to mass production; a fear of a loss of purpose for art and design. It was founded by Walter Gropius in Weimar, Germany.

evolving field, it may in fact further weaken the impact of education (Werner, 2015), and add greater separation between education and practice for the students ultimately entering the workforce (Friedman, 2016). If professionals in the field largely ignore the research being generated through academic institutions, no matter how applicable or prescient, what value does it bring? Alternatively, professionals who engage in research largely fail to disseminate their work to scholars or collaborate with students in the process (Davis, 2008). This mutual exclusion further exposes the division between the two, as well as the fact that education is potentially losing its relevance to the practice and vice versa. A survey conducted among 35 professionals across the U.S., at different stages in their careers and possessing a variety of design-related job titles, strongly suggests that academic research is not reaching those in professional practice, which is further supported in additional studies (Huber, 2017).

RQ1: How do you stay current within the design industry?

A: Non-academic articles, professional conferences, online training

RQ2: Do you stay current with design research from academic institutions?

A: No (77.14%), Yes (22.86%)

Paradigm Shift. Obsolescence can lead to new opportunities.

So, technology advances, jobs and industries die out. This process makes sense. We no longer need blacksmiths other than at 19th century village reenactments; we no longer require the services of the samurai, except perhaps in Hollywood. However, when the process is occurring right now, with a speed seemingly unmatched in history, the fear of the unknown can easily overpower objective logic and reason. The need to predict what will occur and plan accordingly becomes urgent for those affected by change.

To follow his theory regarding the loss of 50 percent of existing jobs, Erik Brynjolfsson concludes that "hopefully another 50 percent of new jobs will be created at the same time" (What Parts, 2017). Historically speaking, there is reason to be optimistic. As coal and the fossil fuel industry began to decline, entirely new positions surrounding renewable energy have sprung up. According to the 2017 U.S Energy and Employment Report, "nearly one million Americans are working near- or full-time in the energy efficiency, solar, wind, and alternative vehicles sectors…almost five times the current employment in the fossil fuel electric industry" (2017).

In another example, the sharing economy, which has grown out of technological advances, has affected a variety of industries. Ride sharing, for instance, has clearly impacted the income of taxi drivers in urban centers. However, according to Forbes, "Uber has created more jobs than it has destroyed, demonstrated by the staggering expansion of self-employment following its introduction" (Study Explores, 2017).

In the design field, new positions are becoming more and more prevalent. Among them, design researcher, integrated designer, digital designer, UX (user experience), UI (user interface), social media designer, and a continuing stream of emerging titles, such as service designer and usability expert, (Dziobczenski, Person & Meriläinen, 2018) stand out as emerging distinctly from current technological trends. All of these titles surround the same basic responsibilities: developing a targeted profile of a particular user of a specific digital technology, and/or customizing the interface in order to create the most visually and functionally inviting experience. The fundamental principles[3] are the same as they have been since the dawn of design: to communicate a message in the clearest and most visually-interesting way to its audience. There now appears to be a distinct difference in one of the factors affecting this long-standing model: the audience itself. Traditionally, the group which a design was intended to reach has been defined in "broad demographic terms, targeting them as passive consumers of segmented marketing" (AIGA Designer 2025, 2017). But with new technology, the audience is able—and eager—to provide constant feedback, responding in real time to the visual and verbal messages presented to them. They are involved in developing and disseminating those messages as well, and for the designer, there is no longer time to track the results of a campaign, analyze the return-on-investment, or handle unexpected crises when everything is happening live with no down time. The audience is simultaneously huge and solitary, with potentially massive amounts of people on a network and

[3] The fundamentals of design are the proficient use of the principles and elements of design: The elements of design generally include line, value, color, texture, form, space and type. The principles of design – balance, isolation, proximity, contrast, hierarchy, repetition and movement describe how they are employed in a composition, in addition to the communication of the message to a specified audience.

everyone expecting a personally tailored experience.

Further, there is evidence of a shift from design as a service industry, merely answering to specific requests of a client, to a more "cooperative model" in which the designer engages in the process much earlier on, working with the client at the beginning stages of a project to help direct outcomes (Welch, 2011). The T-shaped model for design expertise, in which the designer is familiar with a broad spectrum of related fields, and an expert at one, may be giving way to a "reverse-T," in which designers are rising vertically through a corporate structure to use their problem-solving skills for more than visual design solutions (Baratta, 2017)**.** The skills developed though the process of design thinking become applicable in all facets of an institution's operation and designers are thereby imbued with a unique added value. According to Terbo, a Pi-shaped model described the most effective designer thinkers, who "go deep in two areas and are able to find unexpected connections between the two" (Baratta, 2017). The ability to make novel and unexpected connections can be useful regardless of position and discipline, and truly sets this new designer apart from those of the past.

What skillsets must be taught, then, in order to exist and thrive in this new paradigm? The basic process of developing effective visual imagery that was once at the core of the profession could shift or become secondary to a new mandate. At some point in many programs, the focus on the "why" was replaced with merely teaching the "how" through software and technical skills. High-level thinking, theoretical insight and analytical skills have receded as a consequence. In a survey of 45 students at various stages in their academic careers at multiple universities, the following question was posed:

RQ3: Is it better to understand the "HOW" or "WHY" with respect to design?

Fifty percent of the students named the "how" as the main thrust of design education, while only twenty-five percent thought the "why" was most important. Without experiencing the reality of design responsibilities in the profession, do these answers reflect only what the students are being exposed to in the classroom? A survey of 55 design professionals yielded contrary results. Generally, once in the field, more value was placed on skills that could be derived more from studying the "why."

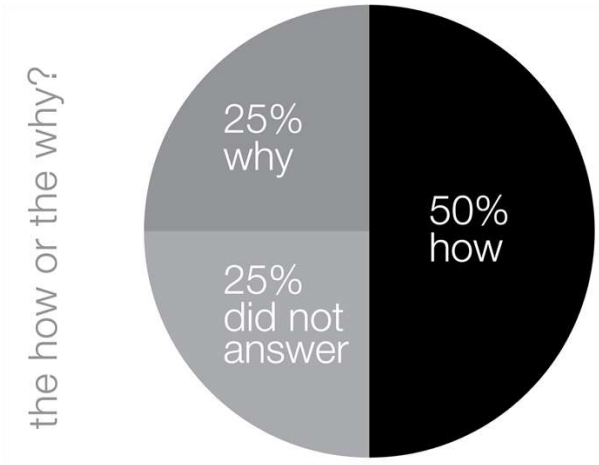

Figure 1. Student survey results: Is it better to understand the "HOW" or the "WHY" with respect to design?

RQ4: What are the qualities the professional world values in new hires?

Answers included "far more than just communications design," (Kelly, 2019) such as critical thinking, active listening, empathy and ethics, storytelling, and co-creative functionality, as well as the ability to face larger, unknown challenges, understand the enterprise user, contribute from a corporate angle, work with experts from multiple fields, demonstrate a global perspective, partner at planning stages—a hybrid professional with skills and formal education in two or more disciplines.

The disparity of what seems to be happening in the classroom and what is currently valued in the workplace is made clear in a comparison of answers to the previous questions. Dating back to the early 2000s, educators have indicated that design education was in danger of becoming outdated or at least threatened by emerging technology, lamenting that digital media had "rendered obsolete what we thought we cared dearly about" as far back as 2001 (Fleischmann, 2013). Without question, a reconsidered approach to teaching a new generation of designers is warranted. Adaptability, collaboration, and a certain affinity for the unknown

(Monahan, 2002) now seem to be the attributes most central to the success and sustainability of the new designer. Would the evolved practitioners of “communication design” even be recognizable to their counterparts a mere 20 years ago?

Starting Points. Preparing the new designer through higher education.

Where does this leave the design educators? How does one teach students to adapt, stay ahead of trends, and maintain relevance in a networked society? According to NPR’s Ari Shapiro, a liberal arts education may provide one of the best chances to keep creative industries such as design from becoming extinct (What Parts, 2017). The classroom experience provides unique opportunities that are notably absent from online learning. In a studio environment, many factors come into play, including an element of chance (Crowther, 2013) and random associations derived from critiques or conversations with faculty and fellow students. The classroom affords a flexible pedagogy (Crowther, 2013) that can be tailored to best suit individuals or groups, and present unplanned lessons in response to classroom dynamics. But finding the most effective approach to educating the new generation is far from guaranteed.

It is the mindset of the entrepreneur that drives technology, not necessarily the other way around, and this mindset can help position designers as leaders and big-picture thinkers in a way that will make the field less threatened by automation. Designers have always been problem solvers, taking the directives and conditions of a client and brainstorming creative visual solutions. But this, too, must be elevated in order to add value to the field at large. Instead of passively waiting for others to present their problems, designers must seek out problems to solve—beyond those which require a logo, a packaging system, website, annual report design, or other typical project staples that remain relatively unchanged. Actively addressing prominent issues with global implications and using their inherent ability to approach them from unique, creative perspectives would help designers secure their role in the emerging economic landscape.

Collaboration—an idea not unfamiliar in agency and studio settings—also becomes a critical concept beyond the traditional designer/art director/account service/copywriter partnership. Collaboration beyond the designer’s inner circle is becoming a key to survival. The founder of Fuseproject, a leader in product experiences and cohesive branding, Yves Béhar emphasizes the key point, “Design is more and more central to the success of the modern business; designers are no longer being brought in at the end of the process to make things look pretty, but rather are providing essential insights from the ground up” (LaBarre, 2016). If it is such an important factor, why does it not play more of a central role within a greater number of university systems? More and more often, designers are expected to understand principles of business, economics, sociology, statistics, psychology, and data science, to name a few. Part of Herbert Simon’s proposed theory of design involves the “organization of complex structures” which necessitates collaboration among participants with diverse experiences to achieve variety within solutions (Simon, 1969, Santos & Tschimmel, 2018). Design itself can connect individuals across disciplines as a “common creative activity” (Simon, 1969), whose processes can be understood to have significance for problem-solving in any context. It breaks down boundaries and provides a common language between professional fields. Therefore, designers who move to a more diffused type of thinking can expand the relevance of their work beyond their immediate discipline. The new designer must embrace understanding and working with disparate areas of an industry whose audience has moved from mass communication to a “networked communication model” (Cardoso, 2008). With the audience more connected than ever, within that realm of new modern demographic mapping, how can tomorrow’s designer begin to truly understand how to reach, speak, and design for this unique market Collaboration (Fleischmann, 2015b)?

Design programs that refuse to acknowledge this reality and continue to focus solely on visual aesthetics may soon find themselves falling behind and unable to catch up. As Tim Brown, CEO of IDEO, explains, “‘Design’ is no longer a discrete stylistic gesture thrown at a project just before it is handed off to marketing. The new approach taking shape in companies and organizations around the world moves design backward to the earliest stages of a product's conception and forward to the last stages of its implementation—and beyond” (2009). Merely concentrating on well-designed typography, eye-catching imagery and clever messaging—even expanding to include the latest technology and trends—may not be enough to sustain undergraduate programs when the designer’s role is becoming much broader. This change in role and the accelerated evolution of the profession presents a difficult situation for design educators. If students are entering a program with increasing amounts of technical knowledge, how is faculty expected to keep up? (Fleischmann, 2013) More so, in college and university programs where curriculum updates can take an average of two to three years from idea to implementation, keeping up with the industry—much less, leading it—seems

practically impossible.

It begins to become apparent that certain steps must be taken to address the obstacles facing design education under the current conditions within the industry. First, based on observations and studies regarding university programs across the U.S., a lack of consistency permeates the naming conventions of course descriptions, course titles and programs themselves. The table below illustrates some of the myriad ways in which facets of visual design are described within higher education.

degrees	program titles	housed with
	Graphic Information Technology	Engineering College
Studio Art: GD Emphasis	Department of Visual Arts and Media	
Bachelor of Design, in GD	Design Department	
GD Programme	School of Art + Design	
BFA GD	School of Art	
BFA Emphasis GD/BFA Visual Art	Department of Art	College of Fine Arts
Bachelor of Design	Visual Comm Design Prog: Div of Design	School of Art, Art History, Design
Bachelor in Graphic Arts	Design Department	
BA, BFA, MA, MFA,	School of Vis Comm Des	College of Comm and Information
	Visual Comm Design	Art, Art History, Arch, L Arch, Urban and Reg Planning, Environmental Design
GD, UX, Game Design	School of Design	College of Comp. and Dig Media
BFA: Communications Design, MFA Exp	Department of Art	College in the Creative Arts
BA	Integrated Media Arts Program	Media and Integrated Arts
BFA concentration GD, Digital Media	Dept of Art and Design	
BFA GD, Interactive Adv, I Print/Screen	School of Design	
AAS, BFA Design	Communications Design	
BA GD, Inter, AAS, Visual Communication		
BFA GD	Department of Art	School of Art
BFA GD		
	Communications Design, School Design	College of Design, Arch, Planning
	Vis Communication Design	Communication
	Vis Communication Design	School of Art and Design

Figure 2. A small pilot sample of differing names of degrees and programs within visual design

Even the departments with which visual design is aligned within colleges can be telling. Some institutions associate design with fine or performing arts, others may combine it with architecture or other design disciplines, while yet others may be aligned with business and marketing schools. This, in itself, demonstrates the identity disconnect with which design has been plagued over the past decades. Further study comparing programs within the U.S. and abroad, including curriculum structure, course content, outcomes, etc. will be conducted in order to gain a broader view of the ways in which design is currently being defined and implemented. For the sake of consistency and clarity, it would benefit the field to consider agreed-upon titles and definitions that would be used to describe itself. If a field which counts branding and identity development among its most basic functions is unable to clearly communicate its own nature to its practitioners, how are others outside the field expected to understand and respect its role?

Once the naming conventions have been established, the dichotomy between the traditional, form- and technique-based model and the newer model dealing with complex interacting systems—what Davis describes as "design as a craft and design as a discipline" (2008)—may be examined. Ultimately, it becomes evident that including everything in a single program's curriculum is unrealistic and the two must diverge as separate paths with trajectories toward building completely different skillsets. As addressed in the *First Things First Manifesto 2000*[4] (Lasn, 1999) the idea of shifting the mindset of designers from simple commercialism toward "broader contexts" with farther-reaching social and cultural goals illustrates a need for this type of philosophical separation (Kelly, 2005), irrespective of technological considerations which were at the time just beginning to be felt. The types of higher-level projects in which some programs may be engaged at the graduate level need

[4] Lasn, Kalman, et al. 1999, URL: http://www.eyemagazine.com/feature/php?id=18&fid=99/

to be provided to undergraduates, as practicing designers typically do not go on to earn graduate degrees, but such skills are becoming more and more vital in the workplace. Of course, there is no proven correct way to approach an education that prepares students for increasing complexities and constant technological advances, but the need for an attempt is more urgent than ever (Fleischmann, 2013). Perhaps changing the mindset of educators and curriculum developers is a place to start (Santos & Tschimmel, 2018).

In order to expect our future designers to be innovators, this new curriculum path must be designed and innovated as an emerging field. So, what might a study to effectively build an undergraduate curriculum for the new design look like? If problem-solving is the act of representing the problem in a new way that makes the solution evident (Simon, 1969) would it not make sense to treat a design program as a design thinking exercise (Santos & Tschimmel, 2018)? With a diverse team of experts asking better questions (Monahan, 2002) challenging existing methodologies, projecting what does not exist, analyzing, comparing and contrasting philosophies, inverting, substituting, poking holes, prototyping, revising and starting over again, a new approach to the curriculum should present itself. A carefully considered series of steps could help narrow the focus on the most relevant skill sets and build a curriculum responsive to the demands of the evolving profession.

Treating curriculum development as a design thinking project, the first step is to define the desired outcomes, i.e. what we want the designers of the future to be able to do. With the formal/technical branch of design more than sufficiently fulfilled through many existing programs and MOOCs, this new direction would focus on the higher-level problem solvers, able to facilitate any wicked challenges, regardless of context, situation or discipline. The new curriculum would begin with a process of deprogramming the students entering the program; un-training them from previous teaching methodologies (Kelly, 2019) that may not have taught them how to adapt, apply knowledge to different situations other than to repeat from rote memory, (Kainose, 2014) and to fail successfully (Sutton, 2007). The tendency to teach to the test in grade school has severely limited students' ability to think *beyond* the test. With all emphasis being placed on coming up with the correct answer, to get the "A" by any means necessary, students have been robbed of the opportunity to experience failure as a teaching tool (Sawyer, 2018), to discover knowledge on their own through trial and error, and, most importantly, to recover from setbacks and adapt their thinking as they receive feedback and data that indicates their first solution is less than perfect. When the world is presented as correct or incorrect, with no gray areas or shades of meaning, and when being correct leads to promises of eternal success, it becomes all-important to avoid being incorrect. Surveys of current design students established that the fear of the unknown is a key factor in their classroom behavior. Additionally, the goal of getting the "A" is the top priority for the majority of students across many programs and grade levels (Kelly, 2019). These results justify the need for further large-scale studies and warrants discussions to begin to address these issues in the overall higher education curriculum conversation.[5] As put by Ken Robinson, international advisor on education in the arts, "If you're not prepared to be wrong, you'll never come up with anything original."

Even more importantly, a deprogramming of the faculty must take place. Faculty behavior, like that of their students (and people in general) shows a psychological reticence to engage in new and innovative processes – even while most acknowledge the changing environment for which they are supposed to be preparing students (Davis, 2008). There is an inherent defensiveness when confronted with the concept of "learning" (Tagg, 2012) and they do not want to appear unprepared to teach; therefore, they fall back on the safe, tried and true curriculum, but their resistance to evolve is amplified through ties to an industry that tends to evolve seismically in short periods of time. "Four-fifths of provosts at doctoral research universities reported greater faculty engagement as their number one challenge" (Kuh, 2009). So, the task of deprogramming and energizing faculty to meet the demands of the new field may be as daunting as it is imperative, but students cannot evolve if their teachers fail to do so.

Success and failure, target audience, visual aesthetics, messaging and idea generation would be redefined and no longer considered in the traditional sense. Student learning and experimentation could actually improve without the distraction of a grade and the fear of failure weighing on them (Flaherty 2019). New forms of project evaluation and grade assessment would be explored. The design process itself would act as a vehicle for assessment (Crowther, 2013), engaging in the steps necessary to invent, test, and reinvent a solution or multiple solutions. Failure along the way would be expected as an "unavoidable part of the creative process"

[5] Of the students studied, 78% said that receiving an "A" was very important to them and 62% commented that their "fear of the unknown" with regard to the potential success of a project or the opportunity of submitting a less creative solution for a guaranteed passing (but not exceptional) grade.

(Santos & Tschimmel, 2018), and rewarded to a certain extent in order to remove it as an obstacle to experimentation. An "A" is not an option. Integrated design teams and interdisciplinary courses with students in revolving roles would be employed, positioning engineers as designers, business students as engineers and designers as business majors. As the "core of all professional training" (Simon, 1969), design offers a common language to the different groups, a starting place for the exchange of ideas on which they can build unexpected solutions. Innovation and entrepreneurial courses, research-driven courses, and adaptability-centered projects would be established, with "What if?" problem-solving curve balls thrown in the mix.

There is much work involved in creating any curriculum; developing one with such revolutionary overtones in an industry that has very strong traditional practices seems extraordinarily challenging, but the profession is undoubtedly changing. More and more responsibilities of the traditional graphic designer are being automated, devalued and digitized. Like it or not, the design survivors are those adapting to the changes, and the educators would require the built-in ability to adapt as well—and adapt quickly. Although design thinking has rarely been used to develop an educational system (Santos & Tschimmel, 2018), it seems particularly appropriate in this case. The process of self-evaluation would be necessary at regular intervals, possibly following each semester. Obsolete or ineffective courses would be removed, and new courses included, based on the trajectory of the field as indicated by professional and graduate feedback. This degree of flexibility is not typical of institutes of higher education, so implementing it in practice would most likely face plenty of hurdles. However, designers are the makers, the trendsetters, the pioneers of an unknown future and as educators, we are responsible for enlightening and inspiring the design thinkers of tomorrow. If successfully preparing our students to survive the ongoing paradigm shift means a separation from stagnant traditions, we should honor our past by celebrating our future.

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Design Thinking Mindset: Developing Creative Confidence

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While knowledge of design thinking (DT) processes and familiarity with its tools can be achieved relatively quickly, few educational programs foster a DT mindset. This study examines the effect of an experiential DT learning environment on the development of a DT mindset. We analyse the extent to which key attributes of a DT mindset are understood, evaluated and assessed. We show that the general value and related challenges of learning a DT mindset are well understood. However, students perceive the importance and value of particular mindset attributes differently; in particular, postgraduate student reflections provide a nuanced and interlinked view of different mindset attributes. We provide a framework for learning objectives and exemplary activities to teach and encourage designerly ways of thinking and doing in business education. We argue that a mindset that embodies DT can address deficits in business school education, better preparing students for future work.

Keywords: Design Thinking, Mindset, MBA, Creative Confidence, Education

Introduction

To help managers develop innovation capability, many business schools have started including design thinking (DT) in their curriculum (Garbuio, Dong, Lin, Tschang, & Lovallo, 2018). The Financial Times describes DT as 'the skill that every MBA students' needs (Stigliani 2017). However, to realise the full benefit of innovation initiatives, educational DT programs have to do more than convey knowledge about DT and its tools; they must also develop creative confidence (Kelley & Kelley, 2013) and foster an innovation mindset. Hence, we wonder how business schools can teach DT to encourage designerly ways of thinking and doing.

DT is as much a mindset as it is a process and set of tools. Both aspects have important implications for the improvement and innovation of businesses. As a process and set of tools, DT informs and shapes practices of dealing with complexity and solving issues. Applying the iterative stages of a typical DT process includes deep empathy with end users, reframing of the problem area, ideation, prototyping and testing. As a mindset, DT refers to the underlying values, cognition and resulting behaviours that, over time, find their way into the beliefs of people and culture of organisations. While individuals and whole organisations can adopt the processes and tools of DT and learn new innovation practices over time, it is the mindset that helps innovation objectives to be achieved at a deeper and more sustainable level.

Micheli et al. (2018) identify key processes, methods and tools of DT. While not explicitly distinguishing these from the cognitive and behavioural attributes of DT, they raise a number of research questions for further study, including 'what constitutes a design thinker and what kind of training and practice is needed to become one?', 'what is the relationship of DT with organizational culture?', 'how can the acquisition and effectiveness of design thinking skills be assessed?' and 'what are the results of introducing design thinking in MBA curricula?' This study explores these research areas through analysis of an experiential learning program that employed instructional methodologies and activities to facilitate the learning of DT.

We explore the value of DT for postgraduate business education—that is, we explore whether and how participation in a DT curriculum affects a student's ability to innovate, and whether a DT mindset can be taught and practised via experiential learning.

Literature Review

Design Thinking as a Mindset

Innovation literature has placed increasing importance on design as an integral capability for innovation and adaptation (Dodgson, Gann, & Salter, 2005). Organisations are trying to integrate the design approach to solve complex social problems and issues of organisational management, and to explore greater synergies between business strategies and product and service innovation (Martin, 2011; Sobel & Groeger, 2013). Design is no longer viewed as a problem-solving activity; rather, it is viewed as a knowledge generation and integration activity (Hatchuel, 2001). The starting point for many scholars looking at design (thinking) within management and organisation studies has been Simon's (1969) assertion that design is an activity undertaken by many professionals.

In recent years, management scholars have recognised and reconceptualised the role of design and DT in business, generating a new sub-field (Carlgren, Rauth, & Elmquist, 2016; Gruber, De Leon, George, & Thompson, 2015; Hobday, Boddington, & Grantham, 2012; Weick, 2004) based on the fact that many organisations achieved positive results using DT (Bevan, Robert, Bate, Maher, & Wells, 2007; Body, 2008; Chang, Kim, & Joo, 2013; Lafley & Charan, 2010; Leavy, 2012; Meyer, 2011). Much of this research has focused on describing DT by means of phases and modes that illustrate the various activities that a team is engaged in. However, these activities are guided by a set of principles or mindsets that recur in many of these modes.

An emerging research stream explores the 'design state of mind' (Beverland, Gemser, & Karpen, 2017; Carlgren et al., 2016). This stream has started to conceptualise the enactment—or the *thinking* and *doing*—of DT on the individual and team level. The underlying assumption is that a DT mindset has a positive influence on individual, team and organisational culture and, ultimately, innovation performance. (Liedtka, 2011) builds on the fixed and growth mindset dichotomy (Dweck, 2012) to explain why some managers succeed and others struggle to innovate based on the differences in mindset. Johansson-Sköldberg et al. (2013) distinguish between the discourse of 'designerly thinking' rooted in the field of design research, which considers DT as a 'practice'—that is, an integrative framework for creative and analytic modes of reasoning supported by a process and set of tools and techniques (Liedtka, 2015)—and the more nascent management discourse on DT. However, fundamental attributes of a DT mindset have been consistently noted in the literature. While definitions may vary, the views are not as inconsistent as they may seem. Various attempts have been made at assimilating knowledge about DT into a general description.

Kimbell (2011) builds on the notion that DT is a cognitive style, a general theory of design and an organisational resource. Hassi and Laakso (2011) make a similar attempt at unifying an understanding of DT, identifying it as a form of practice, thinking style and mentality. Carlgren, Elmquist and Rauth (2016) operationalise DT on three levels: principles, practices, and mindsets and techniques. Summarising 70 articles on DT, Di Russo (2016) identifies 17 commonly cited characteristics and concludes that 'most definitions present design thinking as a mindset, method, process, attitude or a combination of all four' (p. 259).

Schweitzer et al. (2016) identify 11 DT mindsets based on expert DT practitioner interviews: having empathy towards people's needs and context, embracing collaboration and diversity, being inquisitive and open to new perspectives and learning, being mindful of process and thinking modes, embracing experiential intelligence, taking action deliberately and overtly, being consciously creative, accepting uncertainty and being open to risk, modelling behaviour, having the desire and determination to make a difference, and being critically

questioning. These mindsets confirm a set of commonly understood and applied attributes, and reveal organisational constraints on translating cognition into behaviour.

DT practice and research offers many descriptions of design principles, thinking modes, and creative behaviours and postures that are often subsumed under the term 'mindset'. The definition of 'mindset' varies; most authors seem to agree that, while a firm can adopt DT processes and learn new innovation practices over time, it is the DT mindset that enables innovation objectives to be achieved at a deeper and more sustainable level.

Conversely, some authors report that some companies are so fixated on process that DT is turned into a rigid plan, which is implemented like any other efficiency-based process (Nussbaum, 2011). If it is the design state of mind that enables the process and activities that successful practitioners of design thinking employ to create impact and value, more research is required to clarify the specific attributes of the DT mindset as well as the relationships between relevant factors.

Design Thinking Education

The most popular pedagogical model for teaching DT to business students involves project-based learning (Glen, Suciu, Baughn, & Anson, 2015). This is consistent with the increasing use of project and problem-based pedagogical frameworks in other professions, such as engineering, medicine and law (Dym, Agogino, Eris, Frey, & Leifer, 2005). The DT approach reflects the move away from passive teaching approaches towards more engaged and experiential problem-based learning that is taking place in tertiary education (Glen, Suciu, & Baughn, 2014). Teaching DT via experiential problem-based projects entails numerous challenges. For example, providing the experience and iterative practice needed to develop DT skills while accommodating students' desire for structure and predictability of outcomes. DT is not a rigid, predefined series of orderly steps (Brown & Katz, 2009). In practice, DT students gain benefit from going back and forth and in between as understanding of the problem space increases and solutions are refined. While some structure is necessary, DT requires a phased developmental process, enabling multiple cycles of repetitive practice.

Glen et al. (2015) report how reliance on soft skills, such as observation, empathy, intuition and non-linear processes, leave students of DT feeling that the process is more about chaos than technique. Similar concerns have been raised by businesses encountering DT for the first time. Business students, being used to a more ordered and structured learning environment, find the DT process uncomfortable and unfocused (Welsh & Dehler, 2013). Businesses, like faculty, usually focus on the process and tools of DT when starting out; that is, they tend to manage the learning experience via the phases of the DT process (problem finding, observation, sense making, ideation, prototyping and testing) while dealing with any challenges as they arise. This approach helps to alleviate frustration and confusion, provides reassurance, and emphasises how the phases and techniques work towards an outcome. However, it also limits students' opportunity to explore the various principles and mindsets of DT that help achieve innovation objectives at a deeper and more sustainable level.

In a recent study of experiential learning and entrepreneurship in education, Garbuio et al. (2018) emphasise the importance of design cognition, including the cognitive acts of framing, analogical reasoning, abductive reasoning and mental stimulation. They find that teaching thinking modes and mindsets is more effective than teaching processes and demonstrating tools, which are often not easily transferable to other domains. Hence, their study provides some initial support for our proposed emphasis and mindset. The authors recommend teaching design cognition to MBA students in a studio setting and incorporating critical reflection, with lecturers acting as coaches and practising designers supporting the teaching.

Overall, this nascent stream of literature provides valuable insights about how to create active, reflective and engaging programs by combining experiential learning with DT. However, it fails to acknowledge learners' responses to a DT mindset. How do students interpret the different attributes of a mindset? Which attributes are perceived to be relevant and valuable? How should an organisation implement a DT mindset and where should they start? Our research aims to shed light on these questions.

Research Context, Data and Analysis

Research Context

Our exploratory study was conducted on the back of a 10-week postgraduate DT course, comprising 40 hours of face-to-face class time spread across five full days and two block weekends, starting with two consecutive days, followed by field research and a second three-day block. Participants (*n* = 58) were a mix of part-time and full-time MBA students with five to 15 years of professional experience in a wide range of industries, including retail, financial services, manufacturing, pharma, public services and business functions, such as procurement, research and development, production, operations, finance, human resources, marketing and sales. None of the students were already experienced in the application of DT.

During the course, students worked in randomly allocated teams on a living case study with an external partner organisation. The course followed Liedtka and Olgivie's (Liedtka & Ogilvie, 2011) process with students working through the phases of inspiration, ideation, implementation and what works. Accordingly, the course focused primarily on the DT process and corresponding tools and practices. The DT mindset was introduced on the first day—after students had already gone through their first DT experience as part of a two-hour introduction to DT, which involved an exercise called 'the commute challenge'. The course instructor followed Schweitzer et al.'s (2016) classification of 11 DT mindset attributes. However, for purposes of simplicity, the following five key attributes comprised the main focus:

1. Empathetic towards people's needs and context (EMP)
2. Collaboratively geared and embracing diversity (COL)
3. Inquisitive and open to new perspectives and learning (INQ)
4. Optimistic and modelling behaviour
5. Making things tangible (T

Large posters of the symbol attached to each attribute provided a visual reminder in the classroom throughout the course, acting as a reference point or discussion stimulus when a particular attribute was relevant during an activity or project phase. In addition, Schweitzer et al.'s (2016) article was part of the required course readings.

The first three in-class sessions focused on discovery; framing and reframing of the challenge; conducting field research; synthesising data; developing insights; and defining a human-centred problem statement. All teams worked with the same broad design challenge and project partner. However, as part of the learning experience, each team was tasked with defining the scope and focus of their project. Experienced strategic designers from a leading consulting firm coached teams during one of the sessions, providing hands-on advice during analysis and synthesis.

Teams focused on ideation, prototyping and testing solutions during the last two in-class sessions. During the final in-class session, instead of presenting an ultimate solution, teams tested their solution with their project partner, receiving feedback on how they had defined the user and problem statement, and their solution prototype. Teams then had another three weeks to conduct further user research, develop and test prototypes, and run co-creation workshops with stakeholders, before submitting a final prototype and 3,500-word research report. Two weeks after completing the team project, all students submitted an individual reflective journal; these constitute the primary data source for this study.

Reflective Journal

Reflection is used in many fields, including design, architecture, product design and engineering, and is relevant to other professions as well. Drawing on Kolb's (1984) experiential learning theory and Schön's (D.A. Schön, 1983; Donald A Schön, 1987) work regarding reflective practice, we understand experiential learning as a process in which actions result in sensing new information, which stimulates insights and learning. Schön (1983) differentiates between reflection-in-action and reflection-on-action; the former is 'action present', which means reflecting on the incident while it can still benefit that situation. By contrast, the latter involves reflecting on how practices can be developed (changed) after the event.

We designed the assessment for our DT course to encourage and facilitate individual reflection-on-action; specifically, we asked students to think back on their project-based experience and to consider how various attributes of a DT mindset contributed to their project outcomes. Schön (1983, p.76) asserts that, through this

'reflective conversation with the situation', one can come to appreciate consequences and evaluate qualities that would not have been anticipated ahead of time. Consequently, we asked students to evaluate which attributes of a DT mindset were effective and to describe how they were effective. Following the experiential learning cycle of acting, reflecting and conceptualising, we then guided students to envisage future applications of a DT mindset within their own professional practice and organisational context.

The following questions were employed to stimulate student responses:

- Choose two mindset attributes that you believe are most relevant for your organisational context and discuss the behavioural manifestations (i.e., actual doing) of each based on your own experience as part of the design challenge. Be specific and reflect on how you engaged in certain behaviours that represent each mindset component; explain advantages, possible outcomes as well as challenges and pitfalls of each behaviour across the design thinking process.
- Pick one of the two described mindset attributes and justify how and why embracing and fostering such a mindset could be beneficial to your organisation. Discuss the how and why in the context of a very specific starting point (e.g., a particular department, team or process).

Analysis

Thematic analysis (Boyatzis, 1998) was carried out using the software Nvivo 11. Thematic analysis may be based on prior categories or on categories that become clear to the researcher as the analysis proceeds. The five attributes of a DT mindset represented our a priori themes; further codes were added as they emerged from the data, which was closely inspected for recurrent themes, topics and/or relationships. Following an objective research strategy (Marshall & Rossman, 2014), additional starting points for analysis were understanding individual challenges that may arise while practising an attribute of a DT mindset and suggested avenues for implementation.

Findings and Discussion

We review each DT mindset attribute and answer specific research questions before discussing this study's overarching research question: how does participation in a DT curriculum affect a student's ability to innovate, and can a DT mindset can be taught and practised via experiential learning? For the purpose of this article, we present the findings for three mindset attributes only. The examples of student reflections that we provide below are indicative of the total dataset and underscore the general nature of our findings.

Empathy Towards People's Needs and Context (EMP)

Value: Identifying People First, Then Understanding Their Needs

Gaining deep customer empathy—that is, putting people at the centre of the innovation challenge—was the single most valued mindset attribute in this study. Interestingly, the reasons why students chose this attribute varied greatly, indicating that while EMP is viewed as a foundational element of human-centred design, it is seen as having various benefits, challenges and practical implications. Kelley and Kelley (2013, p.85) define empathy as 'the ability to see and experience through another person's eyes, to recognize why people do what they do'. While this interpersonal aspect of DT (Howard, 2015) is understood to be extremely valuable during the research phase, many students saw its value at a much more fundamental level. They explained that being empathetic (or occupying an empathy mindset) forced the project team to focus on external customers and stakeholders rather than internal stakeholders. This was viewed as valuable in itself, and as leading to enhanced business outcomes in the long-term. Without being prompted, the majority of students juxtaposed a DT approach with current practice within their organisation to expose the value of a DT approach. The following excerpt is exemplary:

We are public servants, and we have a fiduciary responsibility to the citizens of NSW to ensure what we do benefits them; not ourselves. All too often, senior managers create policies for the sake of promotion or cost savings, not to fix problems that citizens face.

This respondent felt that a change in perspective would ultimately lead to 'addressing real world problems that citizens face; not our internally driven political issues'. A manager working for a large corporation involved in innovation projects explained that his team took inputs from senior leadership and did not consider the needs of the actual day-to-day users. In such circumstances, occupying an EMP mindset not only goes beyond

the practicalities of working closely together with customers, users and stakeholders through the application of ethnographic methods, but also shifts the focus and subsequent activities, resources and budgets to those relevant (future) customers and users. Notably, understanding customer needs and focusing on selected target segments are common principles taught in numerous core MBA units, which all students in this study had completed prior to taking the DT elective.

One might assume that basic marketing principles, such as 'focus on your customers', are well understood and applied in the corporate context. Yet, our results suggest that the personal experience of focusing on empathy while conducting field work, followed by reflection and evaluation of a related DT mindset attribute, leads to enhanced critical understanding of the value that a human-centred approach can bring to business and business innovation. Therefore, the value that an EMP mindset provides may not come from an intensified human-centred approach alone, but from refocusing activities on relevant external customers. The value of EMP may be less about gaining a deep understanding of users and their needs and more about understanding who to focus on in the first place.

Value: Empathy for Team Members

Unexpectedly, a small number of students viewed EMP as a necessary condition for effective team work, stating that it was not sufficient to be 'empathetic towards our customers' alone, and that it was necessary to be empathetic "also to our peers". This is interesting in the context of this study, as being *collaboratively geared* (COL) was presented as a separate key attribute of a DT mindset, yet students felt that these two mindset attributes were irrevocably connected.

In reflecting on the EMP mindset, students identified a number of challenges that can be categorised under two broad themes: solution mode fallacy and letting go of preconceived assumptions.

Challenge: Solution Mode Fallacy

Differences between the problem and solution space, as well as associated DT processes, tools and activities, were discussed with students during multiple short lectures. At the beginning of an activity that focused on problem space exploration, instructions were given (e.g., sharing field research data and focusing on capturing problems and opportunities) and students were cautioned against jumping into 'solution mode'. Yet, many experienced great difficulties staying within an empathetic 'problem space' mindset and could not resist thinking about and discussing possibilities. Based on previous experience, tools—such as the 'idea parking lot'—were introduced to capture solutions as they emerged without diverting attention away from understanding the problem space. The following statement encapsulates the conflict that many DT novices experience:

Being a senior director at a bank and having a day-to-day environment where we solve problems instinctively it took great personal discipline for me not to jump into solution mode. This ranged from the early steps of interviewing and in being careful not to put the solution in the question but also along the way as we identified an opportunity and developed ideas. I found myself going to an end state too often.

This statement supports the observations of an in-class instructor who reported that students appeared to feel physical pain when they were asked to stop imagining solutions and focus on exploring the problem further. This is not surprising, given the traditional focus in postgraduate management education on problem solving rather than problem definition (Glen et al., 2015).

Application: Setting up Interdisciplinary Teams

When students were asked to reflect on how they saw EMP being implemented within their professional practice and organisation, a number of views were expressed. Many students saw a causal relationship between occupying an empathetic mindset and embracing diversity, describing the latter as a necessary condition to gain deep customer empathy. For example, one student, who works at a leading medical device company, complained that, in her company, 'design teams comprise … scientists and engineers who design products on technical merits alone'. Believing that this decade-old approach was a major barrier to implementing an empathetic mindset, she proposed changing the set-up of teams to 'include people with diverse backgrounds who ideally represent the customer segments but also represent the functional areas of selling, marketing, finance, etc.'.

Collaboratively Geared and Embracing Diversity (COL)

Unlike the EMP attribute, which focuses on designing 'for' people, the COL attribute stresses designing 'with' people. Dunne and Martin (Dunne & Martin, 2006) argue that multidisciplinary teams are required to holistically understand a problem and expand the range of ideas available. Research shows that heterogeneous groups outperform homogenous groups on tasks requiring creative problem solving and innovation (Thompson, 2003). Given the diversity of students' professional backgrounds and their random assignment to team, 'fairly' heterogeneous teams worked on the design challenge in this study.

Value: Multiple Perspectives and Higher Productivity

Based on students' reflections and informal feedback, many found themselves outside their personal comfort zones as they experienced time-pressured, fast-paced activities, and struggled with different working styles in a newly composed teams. However, upon reflection, many acknowledged the value of team diversity for establishing the necessary broad perspective to work with the challenge. The following excerpt is indicative:

Our group had both success and struggles with this concept. We were lucky to have strong team diversity in ethnic background, occupation, personality profiles, gender, geographic living location, industry and life experience. This led to much debate but also varied thinking during our ideation and synthesis phases of our assignment. The advantages by incorporating this mindset were the broad experiences we were able to tap into and ensure that each member was soaring with their strengths.

Coaches encouraged team check-in and check-out sessions and facilitated intra-team feedback aimed at increasing team members' ability to embrace each other's differences, leverage individual strengths and collaborate efficiently. Teams were advised to define roles and responsibilities and openly discuss values and goals at the beginning of the project. Each student completed a FourSight © profile, which was shared and discussed to discover both their own and others' problem-solving preferences, and to leverage each other's strengths. As one student pointed out, sharing the profile was very helpful:

Being aware when someone was playing out of their preferred mindset, e.g., an engineer was having problems with 'wastage' resulting from the prototyping phase, but we turned this mindset into a strength when it came to check the logical flow in the final solution.

Embracing a more collaborative approach increased 'team morale, trust and enthusiasm', 'which led to improved quality of work'. However, this was not evident across all teams. For example, some teams actively sought project specific directions from instructors, trying to transfer a decision to a person outside the team, as they struggled to find common ground. Some students expressed concerns about the relevance of the exercise, pointing out that a truly collaborative, team-centred approach to executing a project was not relevant in their professional life, as there is 'always a manager who makes the final decision'.

Pioneering companies such as Patagonia and Zappos have long since embarked on a journey towards lean, self-managed organisational structures (Groeger, Bruce, & Rolfe, 2019; Laloux, 2014). Others have recently started using DT to become more agile, in the process highlighting the interdisciplinary and collaborative nature of the method. However, student's comments in this study suggest that there is a major gap between understanding the importance of collaboration and acting upon it. Our results suggest that this attribute of a DT mindset requires substantial efforts to ultimately change behaviours. It appears that some students viewed this attribute as a kind of 'necessary evil' that was part of the project, but something they would happily forego once they returned to the classical hierarchical structure of their workplace.

Challenge: Poor Match and Big Egos

A number of students explained that team members were generally motivated to work collaboratively, but incompatible views on what collaboration meant and how it should be implemented resulted in conflict. The following reflection describes two opposing views:

For me, it was about bunkering down in a room, walking through the possible scenarios, building on each other's ideas, and really stress test those ideas against customer needs. Another member felt that this was not a necessary step. They felt that all work could be done independently, with video conferencing to check in at certain stages.

Another student, who referred to a similar situation in which multiple team members 'wanted to break away to work autonomously without team delegation or support', concluded that collaboration could not succeed

unless teams shared the same view of what collaboration meant. For another student, being 'unable to shift our mindset from "I" to "we"' posed a major problem for the team: 'everyone was trying to prove themselves by pitching big ideas rather than collectively thinking together.' While such experiences were frustrating for students, they were also instructive, as they exemplify the problems faced by corporate innovation teams. According to Tuckman's (1965) group forming model, this can interpreted as the 'storming phase'. When, over time, a team overcomes this conflict, it moves into the performing and adjourning stages (Tuckman & Jensen, 1977). As such, blaming a negative collaboration experience on differences in working style misses the point that team conflict is a common and necessary phase that most teams go through. Overall, people struggle to realise that, in solving complexity, no one person is responsible for the final outcome. Given that some authors place collaboration at the centre of DT (Seidel & Fixson, 2013), and that novice learners in this study did not fully embrace this attribute, we conclude that a successful DT journey could be doomed if teams are not provided with sufficient learning and reflection opportunities in relation to collaboration and embracing diversity.

Inquisitive and Open to New Perspectives and Learning (INQ)

Curiosity and an appetite for learning are central to DT (Adams, Daly, Mann, & Dall'Alba, 2011; Kelley & Kelley, 2013). This includes learning about others, challenging existing frames of thinking and seeking out new contexts in which to learn (Cooper, Junginger, & Lockwood, 2009; Jenkins, 2010; Michlewski, 2008). Students saw value in how this mindset attribute helps to overcome cognitive biases but found it difficult to balance the pressure to deliver with the desire to understand and learn more.

Value: Overcoming Assumptions and Biases

Students experienced iteration as part of the DT process, yet many resisted engaging in multiple rounds of field research. This came as no surprise, as many relied upon their established practice of applying historical data-driven approaches to decision-making (Liedtka & Ogilvie, 2012). Repeated hypothesis generation and testing was a new experience for many participants. After an initial period of resistance, many came to appreciate the iterative nature of DT. Students saw how continued inquisitiveness challenged seemingly fact-based assumptions and either proved them wrong or provided validation. The students' reflections about INQ also referred to their evaluation of gaining empathy and the challenge of overcoming their own biases. To this end, some students saw great value and a strong and reinforcing relationship between their growing empathy for others and their openness to learn. This is in line with Liedtka (2014) who suggests that overcoming individual cognitive biases drives DT innovation outcomes. One student, who works in a creative advertising agency, commented that her creative department 'desperately' needed to embrace an INQ mindset:

The creative employees bring their egos to [the] office and assume that they know the consumer, and are designing ad campaigns on the basis of their assumptions and biases. It's surprising how our very own 'ideators' work without actually understanding the customer's needs.

She identified inquisitiveness and the drive for continuous learning as the foundation upon which DT and, ultimately, innovative solutions are built. This confirms Baeck's (2011) view that DT requires a strong desire to dig deeper and a curiosity to develop actionable insights that are beyond superficial observations.

Challenge: Balancing Continuous Learning and Outcome Focus

Throughout the learning experience, students felt that they occupied an inquisitive mindset by personally conducting multiple rounds of field research. Yet, there was also frustration when the project did not move quickly enough towards a final solution. Those students then jumped into 'solution mode' instead of exploring the problem space more rigorously. One student pointed out that, despite 'a deliberate effort to keep learning along the way' and an increased level of focus during a second round of research, the team felt as if they were even more uncertain about what they were looking for. This created tension for outcome-focused students, who felt they 'were overcommitting to the learning stage and underestimating the need for time allocated to implementation. However, despite these tensions, some team members felt that they were able to occupy an ACU mindset by allowing themselves to be uncomfortable with experiencing tension and by exploring different contexts with an open mind. One downside of being inquisitive is that it can cause people to deviate and become distracted, which can be perceived as a waste of time and resources. Yet, it is precisely the cultivation of curiosity and inquisitiveness that makes collecting and analysing data in a rigorous and human-centred way possible.

Application: Inquisitive across Departments

When considering the application of a INQ mindset attribute, students thought of the challenges associated with breaking down departmental boundaries and working across silos. Hence, some saw great potential in fostering inquisitiveness about other peoples' work or other departments. An engineer described this as follows:

Due to the nature of the company every employee was focused on his own work and even though many departments are interlinked for production, the employees never intervened or shared ideas at work. There were often many times where an employee from another department had problems due to the process followed but they never discussed it with the other department to find a solution because they felt that this was out of scope of their working.

She argued that a holistic approach and culture of being open to new perspectives and learning would 'greatly benefit [her] company'. In her view, engineers with expertise and information from 'the client side' would bridge siloed thinking, creating opportunities for innovation and improvement.

Summary of Findings

Overall, we found that the majority of students in the group developed a deep understanding of different DT mindset attributes and the value that each can bring to an innovation project. Yet, those perceptions of value are much more nuanced and interconnected than the current DT literature or instructors of DT courses suggest. While some students remained confused about the nature and purpose of a DT mindset, others came to appreciate the value of occupying a DT mindset for driving tangible business outcomes in their professional practice; these students were able to transfer their experience of living through a DT project in class to their current organisational context.

Our findings are generally in line with other research on DT; however, to the best of our knowledge, this is the first study to report the reflective voice of DT student learners. Previous research on learning has primarily focused on the role of doing (experience) in fostering progress over time. We follow DiStefano et al. (2015) who argue that a key element of learning is reflection—or the intentional attempt to synthesise, abstract and articulate the lessons taught by experience. Based on our reading of student reflections, we believe that their purposeful reflection on their accumulated DT experience led to greater learning, certainly more than any additional accumulation of experience may have achieved.

As they were 'living' through and experiencing the various attributes of a DT mindset, the novice learners in this study shared their personal and team-related challenges. These descriptions were rich and diverse, providing valuable insights for practitioners and educators, highlighting barriers to implementation and learning of a DT mindset. The recorded challenges varied depending on professional and cultural background, personal preferences and previous experiences. Yet, the majority of the challenges mentioned in this study mimic findings of other studies on barriers to innovation in organisational settings. This supports requests to embed DT in MBA curricula more firmly.

Our data suggest that some mindset attributes, such as COL are more difficult to adopt than others. We suspect that this is because experiential learning, by its nature, supports the development of mindset attributes like EMP. From this, we conclude that much more attention could be given to teaching DT with changing behaviours and attitudes in mind rather than by conveying processes, tools and methods alone. To focus on DT mindset learning more explicitly, we present some avenues for future research and learning design, and offer some suggestions on instructional guidance.

Towards a Framework for Learning DT

To facilitate a cognitive learning approach to DT mindset education, we recognise that a DT mindset and its attributes requires a succinct and distinctive definition. This involves assessing desirability and feasibility, as well as setting individual cognitive learning goals in the context of a DT course. Hence, in Table 2, we present three refined and exemplary definitions of DT mindset attributes based on students' reflections, make suggestions about the objectives associated with learning about particular mindset attributes, and describe how learning can be facilitated via specific learning activities. We propose this as a starting point towards designing learning experiences for DT that focus on acquiring a DT mindset in addition to applying the process and tools of DT.

Table 2: Three exemplary DT mindset attributes, learning objectives and instructional guidance

DT Mindset Attributes (Definitions)	**Exemplary Learning Objectives** ***WHAT Should Students Learn?***	**Exemplary Learning Activities** ***HOW to Facilitate Learning?***
Empathetic towards people's needs and context (EMP) The extent to which a person experiences another individual's needs and context from their perspective. The ability to place yourself, your thinking and feeling in the view of another person.	• Apply ethnographic research method to gain user insights • Separate one's own thoughts and assumptions from what one actually observes • Communicate problems and opportunities from a human-centred perspective	• Experience user research using cultural probes (e.g., whose life is it? a day in a life, mystery shopping or immersion) • Experience active listening via interviewing and observation • Make assumptions explicit and derive hypotheses to test them • Create personas and act them out to experience another person's perspective • Create empathy and journey maps to plot current and future user experiences • Involve users in prototyping and testing of solutions
Collaboratively geared and embracing diversity (COL) The extent to which a person buys into working together towards a shared solution and is effective in the service of the team's purpose, believing that no-one person is responsible for the final outcome.	• Recognise the role of self and others in achieving joint outcomes (IQ vs WeQ) • Apply team formation, management and conflict resolution approaches • Appreciate team members' diverse contributions • Create a shared vision for the team and project • Create psychological safety	• Make individual behavioural preferences in team contexts explicit by discussing and reflecting on different working styles and personality traits; setting team goals and defining a common vision • Coach teams with a focus on giving everyone a voice, leaving egos behind via team check-in and check-outs, defining and sharing roles and responsibilities • Facilitate open and transparent feedback within teams; provide external individual and team feedback (coach) • Facilitate team collaboration by focusing on gaining empathy towards peers
Inquisitive and open to new perspectives and learning (INQ) The extent to which a person displays curiosity and a desire to learn new things.	• Appreciate the existence and potential of unknown knowns • Question the status quo and appreciate the importance of continued learning and experimentation • Gain insights through iteration and testing of hypotheses • Create and evaluate low fidelity prototypes and small marketplace experiments	• Demonstrate and experience cognitive biases and practise using tools and techniques to overcome them • Identify and map knowledge, classify facts, opinions, trends and assumptions • Provide curiosity prompts, asking students to look for things that surprise them; double-down to explore the

DT Mindset Attributes (Definitions)	Exemplary Learning Objectives *WHAT Should Students Learn?*	Exemplary Learning Activities *HOW to Facilitate Learning?*
	• Apply system thinking to untangle complexity	issue; share the story within team • Practice creating experiments to test assumptions and gather facts • Use triangulation to critically evaluate information • Explore the value of making learning tangible via prototypes, showing artefacts to receive feedback and not to sell a solution

Conclusion

Our research explored the extent to which key attributes of a DT mindset are understood, evaluated and assessed in terms of their practical value for individuals and organisations. We took a student-centred approach and analysed individual student reflections. Our results indicate that students have a more nuanced and interconnected understanding of different DT mindset attributes than current literature suggests.

Our results also revealed that while some students remained unclear about what constitutes a DT mindset, others felt that occupying a DT mindset could drive tangible business outcomes. Our study introduced a framework for learning a DT mindset based on cognitive psychology, providing guidance for learning objectives and exemplary activities to teach and encourage designerly ways of thinking and doing in education.

We believe that a DT mindset can address deficits in business school education, better preparing students for the future of work. We encourage future research to explore the interconnectedness of DT mindset attributes, especially how these might be quantitatively measured to determine whether an attribute that is lived in the classroom is subsequently lived in practice.

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Stressors and creativity in Industrial Design practice

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Current literature suggests that stress influences creativity, however further research is required concerning this relationship with a focus on education. Current views are clearly divided on whether any negative effects on creativity are more dictated by environmental stressors or the reactions of individuals whilst under stress. For this study, participants completed a questionnaire comprising of a perceived stress scale and thematic questions, to give an indication of whether they were more influenced by environmental stressors or their individual reactions to stress. Two Torrance tests of creativity were conducted to assess creativity over a two-week period as time pressures increased. The results suggested that participants who identified as being more affected by their own negative reactions to stress displayed a lower calibre of creativity when time-pressure increased, whereas the participants who were suggested to be more influenced by their environment remained at a relatively constant perceived level of creativity.

Keywords: Creativity, Stress, Environment, Reactive, Industrial Design

Introduction

Within educational and professional practice environments, an atmosphere of pressure and stress is commonplace. At a time when innovation and creativity is highly valued, research on the imposed external and internal stressors that may limit this value are highly relevant. The debate continues as whether the effects of stress in relation to creativity are influenced more by the environment, or the individual's possible negative reaction to stress. Many difficulties exist in the study of creativity in design; its definition, protocol observation of action and levels of attainment are highly interpretable and subjective. Nevertheless, while creativity as an innate human propensity is considered to be an emotionally enjoyable act, other external and internal factors are known to depress motivation and drive anxiety, destroy confidence and elevate stress levels.

…artistic activity is a route to human well-being both for people who do not have mental disorders and who want to get the most out of life and for people with minor and major disorders who can find both solace and a way to a satisfying and meaningful life through artistic activity. Maybe those who believe there is a link between mental illness and creative genius are right – though I and others don't think so. But it's for sure that creativity has much to contribute to mental health and human well-being. (Friedman, 2014)

The aim of this small scale study was to investigate the extent to which stress affects creativity within a group of Industrial Design students and to examine whether any adverse effects on creativity are suggested to be driven by environmental stressors or the student's adverse reaction to stress. To gain these insights we

classified students into groups who were identified as having potential to be negatively affected by either a stressful environment or negative reactions to inherent stresses, and measured the extent to which individuals perceived they were stressed during a period of work. Abridged Torrance tests of creativity on these groups were repeated to examine if either group suffered a greater negative effect on their creativity as time pressure increased. By gaining insight into any adverse effects on creativity influenced by environmental stressors or the Design student's possible adverse reaction to stress, we aim to develop support strategies for designers in education and professional practice.

Literature review

According to investment theory, creativity is underpinned by; intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment (Sternberg, 2010). In the last 50 years a large body of work has evolved around the relationship between the characteristics of individuals and their creative performance. Research from Oldham & Cummings (1996) and Shalley, Zhou, & Oldham (2004) for instance, conclude that personality, cognitive style, and knowledge, are positively related to worker inventiveness.

The term *Creative Confidence* has become an important factor in nurturing creativity and understanding a person's belief in their own ability to successfully complete a creative task (Phelan & Young, 2003). As such, *Self-efficacy* provides a foundation for creative confidence as an innate belief in one's own ability to complete a certain task (Bandura, 1993). Individuals with a higher level of self-efficacy have been shown to exhibit greater persistence in overcoming obstacles (*ibid*.), and demonstrate elements of *designerly play* when approaching problem tasks. Designerly play can be considered a form of creative exploration without the fear of getting things wrong. Indeed, risk-taking has been shown to be one of the most significant resultants of play. It is important for any project involving creativity that those involved are prepared to take risks (Kelley, 2001), however in education such risks are often avoided (McCardle, Huskisson & Perry, 2018).

The causes and effects of the factors associated with creativity and its relationship with stress related issues is broad and widely known to be convoluted. But the consequences to and impact upon personal creative growth in HE, and further on into continual professional development for practitioners, should be of more concern. Not only for reasons of achievement, but in safeguarding personal wellbeing. More recently, there has been an acknowledgement of the importance of workload pressures, but an appropriate working environment as a component in supporting and nurturing creativity has also featured strongly.

The Environment

In 1979 Teresa Amabile published work that conveyed how evaluative environments can often lead to diminished creative output from students. Amabile conducted experiments that entailed leading a creativity-based task with two groups of art students. One group's members were told that work would be evaluated, whilst the other was not. Within the context of creativity defined for the work, Amabile concluded that the group members told they were being evaluated displayed significantly less creativity. It was consequently held as an example of where the stress of the environment can directly lead to a negative impact on creativity (Amabile, 1979). In continuing work, Amabile, Hadley, & Kramer (2002) examined in more detail environmental effects on creativity of 177 employees across 22 companies whilst under time pressure and stress. Their findings showed that an environment rich in time pressures resulted in multiple possible outcomes for creativity, both positive and negative. For example, an environment rich in time pressures that had a fragmented schedule, would likely produce a low creative output, surmised as being due to the presence of stress caused by a lack of allocated time available to seriously negotiate a task. The result is summarized in the time pressure/creativity matrix of Figure 1.

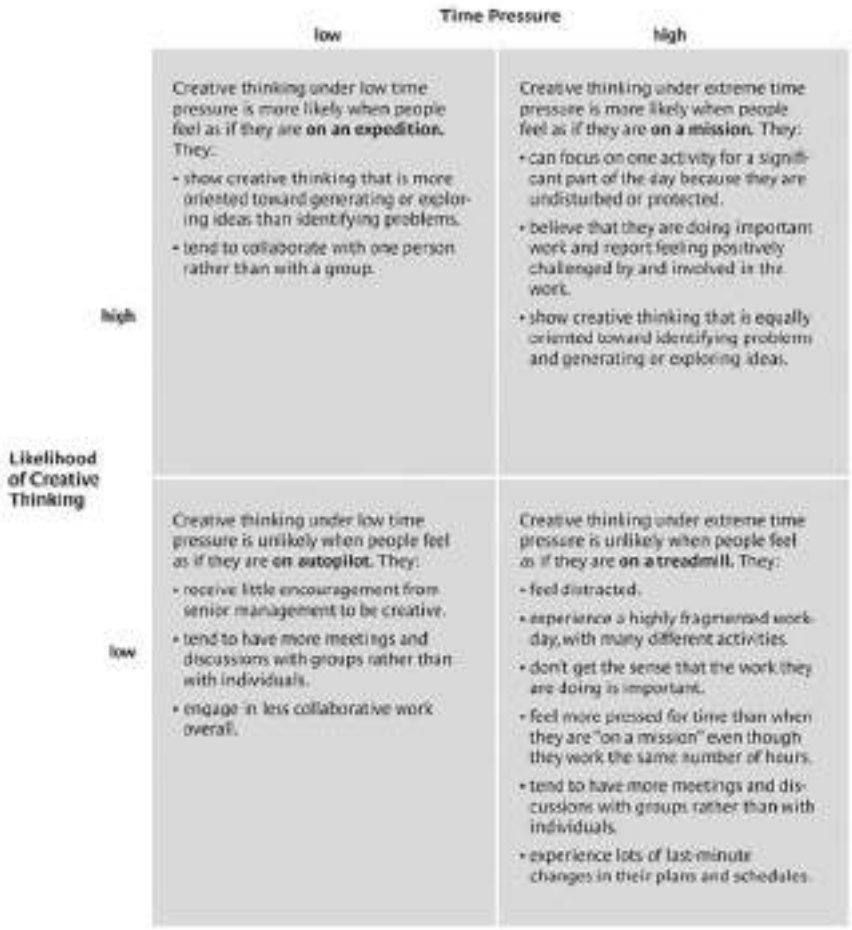

Figure 1: Time Pressure/ Creativity Matrix (T. Amabile et al., 2002)

However, the methodology employed here, whilst relevant, didn't attempt to measure creativity externally but relied on individual's self-perception and peer review.

Byron, Khazanchi, & Nazarian, (2010), have provided a meta-view of creativity and stress research. They concluded that stress is potentially both a contributor and a limit to creativity. Their overview confirms the existing arguments concerning the direct relationship between creativity and stress. The long held view of Wilke, Gmelch, & Lovrich (1985), is that this relationship is an inverted U-shape, in line with the Yerkes-Dodson Law (R. A. Cohen, 2011). That is, low stress results in low creativity, but which increases for a growth in stress, but at some point decreases again as stress continues to grow (see Fig. 2). Some studies however have observed the opposite. In certain disciplines such as engineering, increased pressure beyond that that would be generally acceptable to many, has been observed to increase creativity (Andrews & Farris, 1972). What decides the effect is down to the context of stress; for example, if there is high level of pressure for delivering success then this may produce stress in combination with high levels of anxiety, which was found to be detrimental to creativity. Byron *et al.* (*op.cit*) suggest that the uncontrollable aspects of environmental based stressors, such as deadlines, course requirements and expectations that are perceived to be outside of a person's control are detrimental. Moreover, environments high in external evaluations decrease creativity. Of course, in education or in professional practice, this raises a serious dilemma. The question also remains as to whether any adverse effects on creativity are driven *more* by environmental stressors or personal adverse reaction to stress.

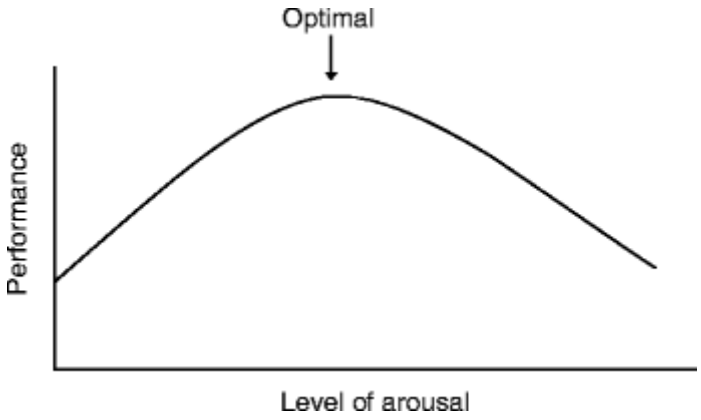

Figure 2: Yerkes & Dodson (1908) cited from (R. A. Cohen, 2011)

Determining a consistent method of assessing creativity is exceptionally difficult as the environmental conditions and cognitive personalities of individuals vary widely. However, the use of the Torrance Test of Creative Thinking (TTCT) (Wallach, 1968) is common. Using this test, the relationship between time pressure and creativity has been investigated by Hsiao, Wang, & Chen (2015), which concluded that long-term environmental stress and pressure induced by high workload and high pressure to succeed in a high evaluation environment, is incompatible with creativity. This is a view further supported by research undertaken by Ding, Tang, Tang, & Posner (2014), again using the TTCT, which found that Integrative Body-Mind Training (IBMT) breathing exercise as part of an environment that promotes calm thinking and removing time pressure, aids creativity, reduces stress and promotes creativity.

The view that the environment is primarily responsible for negative effects of stress on creative ability is, in part, agreed with by Nguyen & Zeng (2012). Their work suggests that mental stresses are directly related to the contextual and environmental workload of the specific design task, ergo, the limit of the creative potential is highly correlated to the size of the design task at hand. Importantly they further suggested that the designer's mental capacity whilst dealing with stress is also crucial in defining the overall effect of stress.

Reactive influence

Perhaps the most prominent counter view to the idea that the environment dictates the effects of stress on creativity is that creativity is more dictated by an individual's internal negative reaction to that stress. Ceci & Kumar (2016) maintain the view that positive and negative *emotions* are at play and unavoidable when engaging with creative tasks and that the key to maintaining a creative output throughout stressful periods lie within the individuals own ability to react to stress positively. With links specifically to motivation, their study used the Griffin and McDermott creativity checklist (Griffin & McDermott, 1998) to assess the creative accomplishments of a group of students self-reporting on motivation, happiness, creativity, and perceived stress. Amabile's 'Work Preference Inventory' (T. M. Amabile, 1983) was also used specifically to determine that motivation was the defining factor. Results suggested that the individual's reaction to stress dictated the influence more so than the environment. For example, two students who were experiencing the same amount of time pressure on a given piece of work reacted differently. The work concluded that an individual who takes the pressure as a motivator may perform more creatively, whereas the other may take the pressure as evaluative and perform less creatively. This work is key in introducing the theme of negative effects on creativity as not being derived entirely from environmental stressors, but also from individual reactions to stress.

This view has been further validated by Gutnick, Walter, Nijstad, & De Dreu (2012) who formed two propositions based on literature surrounding stress and creativity:

1) High work pressure strengthens "threat appraisals" = reducing creativity.
2) High work pressure enhances "challenge appraisals" = enhancing creativity.

Therefore the concept of varying *reactions* to stress, whether positive or negative, plays a major part in defining the resulting effect. This furthers the notion that an individual can feel threatened by work (Liu,

Wang, Ren, & Liu, 2017) and that an undelying motivation commonly falls victim to stress, with the consequential impact on the overall quality of a creative output.

The perception of formality can also contribute to the evaluative perceptions drawn by an individual. An investigation where participants were set tasks in a hypothetical scenario, acting as Human Resources directors, showed that the delivery or presentation of the task to the participants was influential for the motivation in creative tasks. When the delivery was formal and controlling, there was significantly less creativity observed (Shalley & Perry-Smith, 2001). The perception of confrontation or conflict also poses a risk to creativity. Work by (Carnevale & Probst, 1998) concluded that individuals who are expecting conflict rather than cooperation, are less likely to attain a higher level of creativity.

Reactive influence is therefore driven by the key aspect of innate perspective and the personality and behaviour of the individual. Sung & Choi (2009) found that extrinsic motivation contrastingly effected creativity for participants with 'agreeableness' or 'openness' traits. Individuals with high openness to experience seemed to perform better when they were motivated to complete the task through gaining rewards and acknowledgement for their performance. For people who were high in the agreeableness, extrinsic motivation was not beneficial for their creative performance. Given that agreeable individuals care about others and tend to prefer agreeing with other's opinions to avoid confrontation, their creative performance are considered to be further decreased if they are concerned about rewards, compensation, or other's evaluation of their performance. In contrast, agreeableness was positively associated with creativity when the person had low extrinsic motivation, and thus they were less concern about other's opinions. This could possibly indicate that agreeable people are less likely to be influenced by the social or physical elements of a given setting.

A dual-pathway model has been suggested as a way to identify two routes to creative outcomes (Baas & Roskes et al, 2013). Through defining a *flexible information intake* and a *cognitive persistence intake*, observations here indicated that individuals who maintain both these pathways through high pressure periods are less likely to have their creativity limited. In short, having personality traits of open-mindedness and dogged determination is more likely to result in creativity.

Finally, an individual's perception of support in being creative is also an integral factor for defining the relation between stress and creativity. Evidence suggests that innovative performances can be lower when an individual's perception of support in driving innovation is low (Leung et al., 2011). The lack of perceived support for an individual may lead to an apathetic attitude towards their creative tasks, drawing parallels to the motivation argument put forward by Ceci & Kumar (2016).

Methodology

The method for this work was conducted in three sections as shown in Table 1. Ethical clearance was gained before making any contact with participants for the study. An informed consent form was used to ensure participants were willing to take part in the research which also outlined the rules applied around anonymity of data collection and the purpose of the study. Participants were reminded that they were free to remove themselves from the study at any time.

The questionnaire consisted of two sections. The first section utilised the standardised Perceived Stress Scale questionnaire (PSS-14) to indicate the extent to which the participants perceived their current stress levels, (Cohen et al., 1983). The 14 questions asked the user about emotions and scenarios over the previous month, as a 4-point Likert scale format. The direct scoring system was used to determine the level of a participant's stress as ordinal data.

Table 1: Research Method

Methodology	Purpose	Limitations
Questionnaire Part 1 (PSS) (S. Cohen et al., 1983) Q1-14	The Perceived Stress Scale section quantitatively assesses the extent to which students are stressed	The possibility of missing an interesting insight that can potentially be achieved through focus groups or interviews.
Questionnaire Part 2 See Fig. 5 Q15-24	To group participants based on their leaning towards being affected more by environmental stressors or reactive stressors	Small group size. An online questionnaire, with the possibility of participants not fully understanding the questions.
Abridged Figural Torrance Test of Creative Thinking	Picture construction creativity test. Suited to visual creativity of industrial design students.	Preparations are needed. Time consuming to conduct.

The second section comprised 10 questions formed from the references provided in Figure 3. The questions were chosen to characterise the participants to facilitate grouping for the abridged figural TTCT. Five of these questions were linked to environmental stressors affecting creativity, and 5 were linked to negative reactions to stress affecting creativity (See Fig. 3). The responses to these questions determined the group membership, based on leanings towards either environmental or reactive affecters.

Figure 3: Thematic Grouping for Questionnaire

All sections were piloted with undergraduate Design students not participating in the full study. Figural drawing tests were *limited* to 6.5 minutes in the baseline and repeat tests; the duration of which was optimised from the pilot. The researcher was present to explain the test to the participants and answer any questions. The baseline and repeat tests were conducted with the participants over a 3-day duration in week 4 and 6 of a single semester. This was greatest amount of time possible between the baseline and repeat tests to measure the possible effects on creativity defined by time pressures increasing.

The creative task consisted of a simple geometric configuration from which the participants were asked to reconfigure as imaginatively as they could, within the time limit of 6.5 minutes. The output of the creative tasks was assessed on a numerical system whereby a mark between 1 and 5 was awarded for each section, for each participant's response, in line with the following criteria;

- **Fluency:** The number of valid responses offered based on the starting geometry.
- **Flexibility:** The number of dramatic shifts from one theme to another throughout the responses.
- **Originality:** The infrequency of themes offered relative to themes present in the rest of the participants.
- **Elaboration:** The graphical detail in each response.

Results

Seventeen total responses to the two-stage questionnaire from undergraduate Design students were completed. Table 3 shows the participants PSS score and leanings towards either environmental factors or individual reactions negatively affecting their creativity. Participants who were suggested to be more influenced by environmental stressors formed GROUP E and participants who were suggested to be more influenced by their individual negative reactions to stress formed GROUP R.

Of the 17 who participated in the questionnaire, 5 participants chose not to take part in any further stages of the investigation. From the remaining 12 participants, 10 were chosen based on two factors; those who scored highest on the PSS section, and those who sided most strongly with either environmental factors or individual reactions negatively affecting their creativity. Participants 9 and 14 gave an inconclusive result.

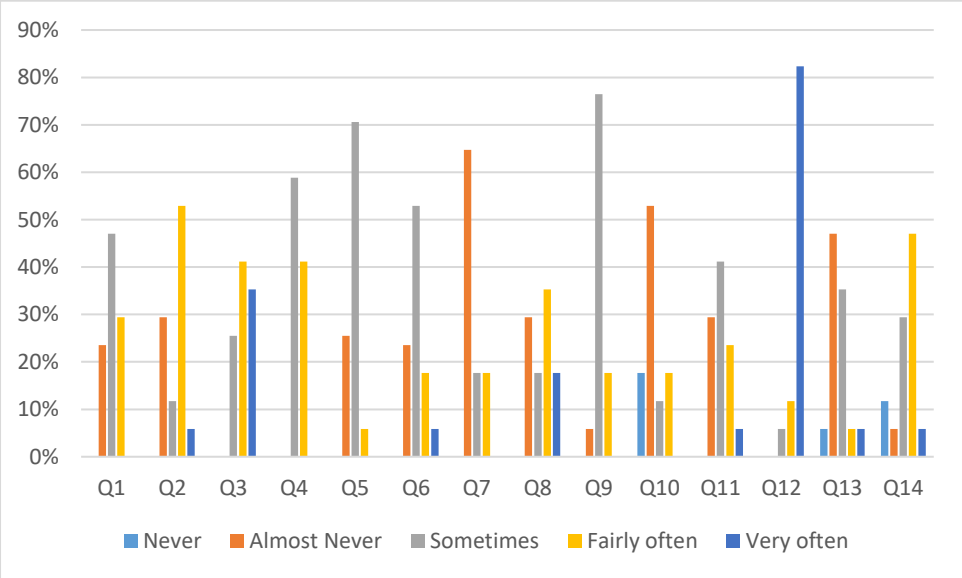

Figure 4: Overall PSS responses to Q1-14

Questions 1-14 for the Perceived Stress Scale:

In the last Month how often have you….

Q1 – been upset because of something that happened unexpectedly?

Q2 – felt that you were unable to control the important things in your life?

Q3 – felt nervous and stressed?

Q4 – dealt successfully with irritating life hassles?

Q5 – felt you were coping well with important changes in your life?

Q6 – felt confident in your ability to handle your personal problems?

Q7 – felt that things were going your way?

Q8 – found that you could cope with all the things you have had to do?

Q9 – been able to control irritations in your life?

Q10 – felt you were on top of things?

Q11 – been angered because of things that were out of your control?

Q12 – found yourself thinking about the things you have to accomplish?

Q13 – been able to control the way you spend your time?

Q14 – felt difficulties were piling up so high that you could not overcome them?

Table 3. Results of PSS Questionnaire

Participant	PSS Score Q1-14	Environment / Reaction Q14-24
1	36	E
2	34	R
3	32	R
4	34	E
5	35	E
6	34	R
7	36	R
8	18	E
9	**21**	**Inconclusive**
10	34	E
11	36	E
12	35	R
13	37	R
14	**35**	**Inconclusive**
15	36	E
16	27	R
17	31	E

The results given in Table 4 illustrate the difference in PSS scores between the two groups across both phases.

Questions 10-24 for Environmental/Reactive response:

Q15 – Do you think you have become more or less creative as the year has gone on?

Q16 – How motivated do you feel to work each day?

Q17 – Has your work often been interrupted by compulsory sessions?

Q18 – How often do you take breaks throughout the day?

Q19 – 'I feel on top of my workload most of the time'?

Q20 – I want to do as well for my degree? Or I want to challenge myself and achieve?

Q21– How often do you have time for personal activities?

Q22 – When do you feel most creative?

Q23 – I am at university to, a) be evaluated or b) learn new skills

Q24 – Do you fell more creative after meetings?

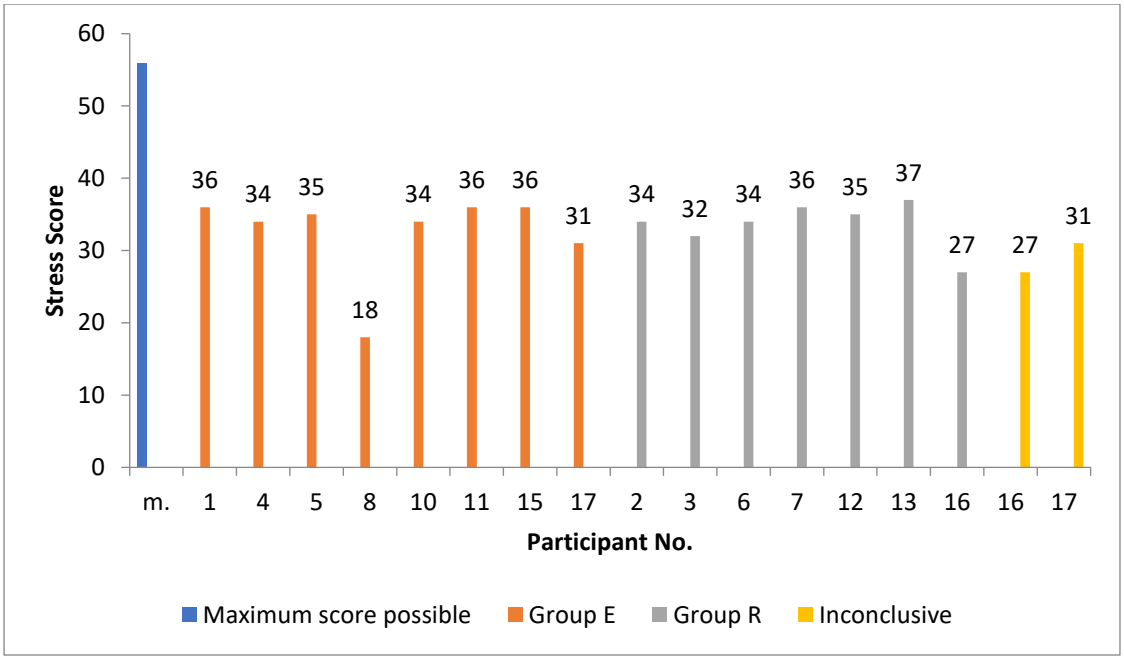

Figure 5: Individual Participant PSS scores and groupings

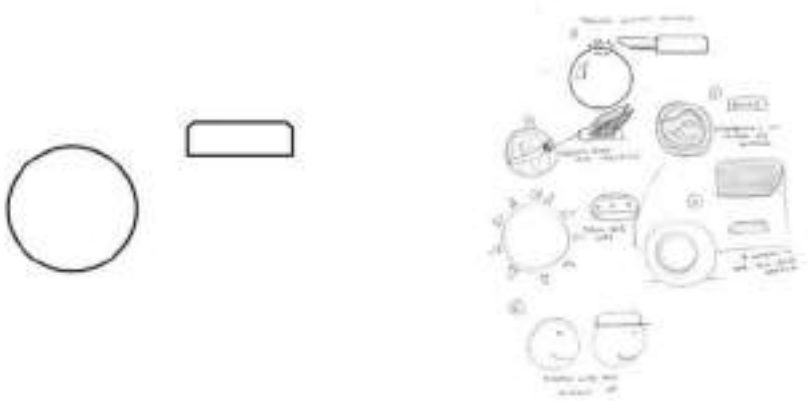

Figure 6: Phase 1 start geometry and associated creative expansion

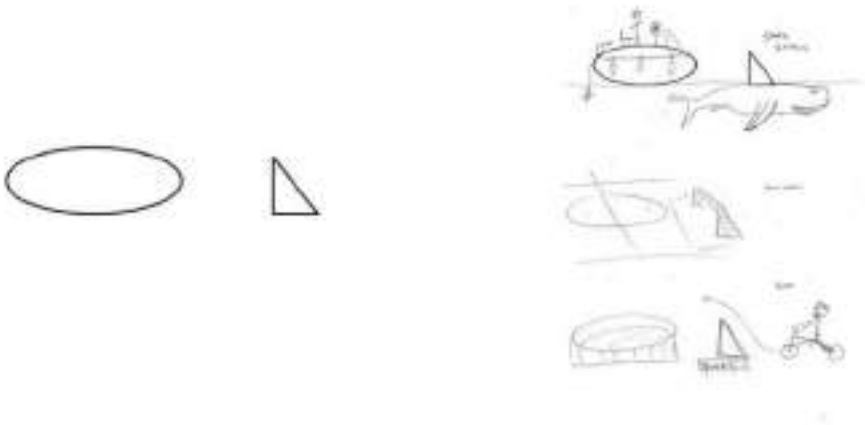

Figure 7: Phase 2 start geometry and associated creative expansion

Table 4: TTCT Results Parts 1 & 2

	Fluency		Originality		Flexibility		Elaboration		Total	
P. No	**Phase 1**	**Phase 2**	**Phase 1**	**Phase 2**	**Phase 1**	**Phase 2**	**Phase 1**	**Phase 2**	**Phase 1**	**Phase 2**
Group R										
2	4	4	2	2	2	1	2	2	10	9
3	3	2	3	1	4	1	4	2	14	6
6	3	3	3	3	2	2	3	2	11	11
7	2	2	4	2	2	2	2	2	10	8
12	3	1	5	1	4	1	4	3	16	6
Total	**15**	**12**	**17**	**9**	**14**	**7**	**16**	**11**	**62**	**39**
Group E										
1	3	3	2	3	1	2	3	2	9	10
4	2	3	2	2	1	2	3	2	8	9
5	4	4	3	3	4	4	2	2	13	13
11	5	4	3	2	3	2	4	2	15	11
17	3	4	3	2	3	2	2	2	11	10
Total	**17**	**18**	**13**	**12**	**12**	**12**	**14**	**10**	**56**	**53**

Figures 5 & 6 illustrate the starting geometries and examples of participant's graphical work in response to the request to develop a creative interpretation. Participants were not made aware of the marking criteria.

In the first phase, the results were of a similar standard for both groups, with the differentiation between the two groups overall creativity score being +6 for Group R.

Phase 1 Fluency

The marks for fluency at this stage were relatively uniform across the two groups during the baseline test. The modal score was 3 across both groups with individual high scores recorded on both sides.

Phase 2 Fluency

The marks for fluency showed the largest gap between the two groups in the second round. Group R performed considerably lower than Group E, with the modal score for the Group R = 2, in comparison to Group E = 4.

Phase 1 Originality

Originality showed a slightly higher score within Group R, with common an obvious themes such as human like figures and planets generally being avoided.

Phase 2 Originality

Group E performed at a higher level with regards to originality. Group R showed a pattern of keeping to common themes which surfaced several times; these included birds and cups.

Phase 1 Flexibility

Flexibility scores were relatively uniform with a deviation of marks between the two groups being recorded as 2 in favour of Group R. Group R showed a slightly higher ability to move away from themes they had already presented within their responses. Common themes displayed more by Group E included human like figures and planets.

Phase 2 Flexibility

The marks awarded for flexibility displayed a relatively large difference between the groups. There was a 5 point score difference between the two groups in favour of Group E, with Group R displaying a tendency to stick to a theme they had initial conceived and not stray from it in the rest of their responses.

Phase 1 Elaboration

Elaborative marks were of an average standard across both groups, with Group R attaining a slightly higher score by giving more detail in their responses than Group E.

Phase 2 Elaboration

Elaboration was the only section where Group R displayed a higher level of creative ability, however marks were not dissimilar between the two groups.

Comparative Summary

In Phase 2 the trends were of a notably different standard for both groups, with the differentiation between the two groups overall creativity score being +13 in favour of Group E. Figure 7 shows how Group R scored slightly higher in the first round, but then dropped below Group E's score at the end of the second round.

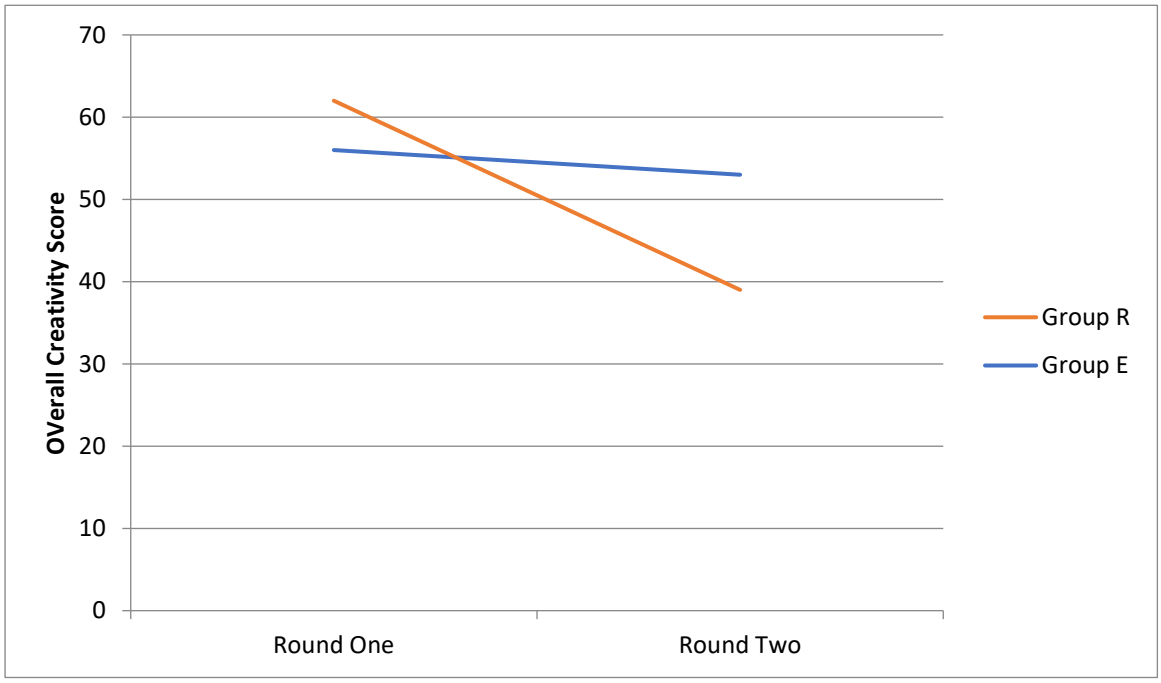

Figure 7: Creativity / Time group performance comparison

Discussion

It is well debated in current literature that stress is a criterion which has the potential to limit creativity, but subject to various factors including environmental and reactive tolerance. The results of the PSS section suggest that the participants may fit into a stressed category, with relatively high PSS scores recorded across all questions by most respondents indicating they were at possible risk of having their creative potential

impacted upon. When examining specific answers to the PSS, a trend is apparent that is consistent with students who are displaying negative psychometric thought patterns. Over 70% of respondents to the survey stated that they felt 'nervous and stressed' either 'fairly often' or 'very often' over the last month. When referring to recent studies such as that conducted by Hsiao et al. (2017), which found that long term stress is incompatible with creativity, the findings from this section of the questionaire alone point towards a situation where students may be at risk having their creativity stifled.

Question 12 (Fig. 3) of the PSS corroborates the theme of high mental stress among the participants. Over 80% of respondants answered that they were thinking about the things they have to accomplish either 'very often' or 'fairly often'. Hoeever, this may be indicative of a high intensity set of activities within a prescribed education programme with numerous concurrent tasks; and it is also arguable that this may not necessarily be negative behaviour, but a display of a proactive approach to time management.

The grouping stage of the questionnaire (Q15-24) was designed to divide respondents into groups who were more negatively affected by either their environment (Group E), or their reaction to stress (Group R). In general, the responses from the questionnaire gave rise to a marginal division in the participants regarding which determining factor they aligned with more closely. However, some responses suggest there is a degree of crossover, where participants indicated they may be affected by both the environmental stressors and their own negative reactions. For example, questions aimed at gaining insight of environmentally negative affect for the respondents yielded inconclusive responses. Eight participants, who identified as being influenced by the environment (Table 3), also responded that they feel they are not on top of their workload most of the time. This suggests that some of the participants who fitted into the bracket of being more influenced by their reactions still felt influenced to an extent by this particular environmental stressor.

This observation was furthered by responses to questions aimed at probing the participant's attitudes towards being more negatively affected by their reaction to stress possibly even threatened (Gutnick et al., 2012). When asked whether participants wanted to do well at university because it a) will determine their degree (environmental stress as a threat) or b) because they want to challenge themselves, nearly 70% of the participants sided with the answer that relates to being affected by their environment, a far higher percentage than the overall percentage of participants who were identified as being more influenced by their reaction.

From the results of the figural TTCT, within the context of this small scale study, both groups experienced a decline in creativity over the time period, however Group R displayed a much steeper drop off in creativity.

Summary of Group E

Although Group E was evaluated as having a drop off in creative output over the time period, it was not perceived to be as pronounced as Group R. A reduction in creativity due to environmental factors may have been logical to expect prior to the results. It is reasonable to suggest that the increase in time pressure may act as a catalyst for the environmental factors limiting the groups creative output. For example, a lack of time to relax, a known key environmental stressor (Ding et al., 2014) would in theory be exacerbated by an increase in time-pressure. Moreover, when considering creativity related to the size of the task at hand, it may be reasonable to expect this group's creativity to diminish as expectations of the students increased over the time period between the two tests.

With environmental stressors, it is possible to experience long term effects rather than purely immediate-reactive. For example, the negative outcome from a long term demand for creativity, as set out by Hsiao et al. (2017), could have been in place for the participant's entire university career. It is possible that over a two-week period alone there may not have been large fluctuations in levels of the participants' creativity at this particular stage. Furthermore, when considering the evaluative nature of Group E's collective diminishing creativity, the participants who were identified as being more influenced by environmental stressors have been in the evaluative environment since the beginning of their university career. Although it is arguable that the evaluative nature has become more important in the final year of their study, it has not changed in format since they started.

Summary of Group R

Regardless of whether or not Group E would perform better outside of their creative constraints, the results here have indicated that Group R appeared to reach a relatively lower standard of creativity overall as time-pressure increased. Superficially the results suggest that participants who identified as being more affected by

their adverse reactions to stress, may suffer more with regards to creative output. Factors such as lack of motivation (Ceci & Kumar, 2016) and viewing work as a threat (Gutnick et al., 2012) are much more dynamic than the environmental factors, and may also be more sporadic and unpredictable. For example, lack of motivation affecting creativity may be described as a phenomenon which is short term and variable rather than a key environmental factor such as long term demand for creativity (Hsiao et al., 2017).

The results of the TTCT lean towards an agreement with various studies that suggest an individual's reactions to stress dictate possible negative effects on creativity more so than environmental stressors. For example, in terms of personality traits and creativity, Baas et al. (2013) describe how individuals who react negatively to stress by losing mental stamina are less likely to attain a high level of creative output. As the participants were under considerable pressure for the weeks before and between the baseline and repeat tests, it may well have reduced the participants' mental stamina.

The results found in the TTCT further add to the suggestion of a lack of motivation leading to a lower calibre of creative output. As to whether or not the students' motivation influenced the results is debatable, however, when referencing both the results of the questionnaire and TTCT, there appears to be some connection between the participants who said they were less motivated, and those who scored lower on the TTCT. From the assessor's view there was a drop off in originality and elaboration in Group R. There were many consistent themes displayed in the answers of this group such as cups and birds, as well as a distinct lack of elaboration in many answers. Lack of motivation could be a logical explanation for this result, as the participants would be required to exert intrinsic motivation to conceptualise original ideas in a reasonable amount of detail.

Further possible explanations for the drop in creativity from Group R may come from the theme of evaluative circumstances impairing an individual's creative abilities as described by Byron et al. (2010). Prior to the tests being completed the participants were given an overview of the research and thus understood that their work would be under scrutiny once they had submitted responses. From the questionnaire it was clear to see that many participants from Group R suggested that they saw university as a system that evaluated them rather than taught and supported them. The results of the TTCT appear to support this argument from Byron (*ibid*.) and provide a further possible explanation as to why Group R appears to have had their creativity limited much more than the Group E as time-pressure increased.

Discussion in context

The relationship between stress and creativity is particularly poignant for educational institutions and professional organisations in the so called 'creative industries'. From the initial observations of this study it could be suggested that at present, practices are failing to enable some Design students to reach their creative potential by not recognising the barriers to creativity.

Some may argue that dealing with stress when creativity is demanded holds the key to being successful in the creative industries. Increasingly, educational establishments are strengthening their industry links, and it is arguable that stress does not dissipate as a student transitions from university life into a career. There are still deadlines to meet, there are professional creative requirements to be met, and there are environments strongly resembling that of university institutions or vice versa.

With that in mind, it is also debatable that whilst the stress within educational institutions may not be conducive to cultivating creativity in students, it is unavoidable. Preparing students for a realistic career in industry may be viewed as being just as important as sharpening their creative talent. This comes with the counter argument that if students are given the optimum circumstances to be able to grow their inherent creativity, this will make them far more employable than simply getting them used to working in high pressure scenarios.

The work here provides the briefest of insights into the link between creativity and induced stress, from environmental and reactive sources. Indications are that at university level, the environment invoke and its students can develop symptoms of these stressors with the inevitable effects on creativity levels. While there are some that maintain universities are a place to learn in a relatively low risk environment, others drive the notion that a university is a proving ground for industry. The Design profession is particularly susceptible to this dichotomy.

Limitations and further work

The limitations of this work relates to timing and scale. The timings in assessing participants may be crucial as there are continual peaks and troughs in demands of work throughout the year. Not all participants will be subject to the same deadlines and there are individual differences in time management skills and organisational ability will skew results, especially where there are low numbers of participants. With regards to the TTCT, it would have been ideal to, a) perform the tests further apart to allow for a higher increase in time pressure and b) to perform the baseline tests when there was a lower level of stress present in the participants. This would have been particularly useful for the Group E as their creative constraints may be less dynamic than Group R.

In terms of scale, the low numbers of participants is less convincing as a quantitative survey. To provide clearer evidence of expected relationships and correlation, work needs to continue to study bigger populations across different design programmes. This would support more generic conclusions on creativity but also facilitate subject specify studies.

The specific work presented in this paper has not dealt in depth with the myriad of issues surrounding creativity, behaviours and performance. There are many additional issues including; subject specificity, risk taking, research and exploratory failure and the nurturing of creative confidence. Personal traits, motivation, learning styles and fear of negative evaluation, are all areas that are open to investigation to gain further insight into the nature of stress related creativity.

Conclusion

The results of the questionnaire suggest that student participants of this survey were generally under a high level of stress, and may be primed to have their creativity limited as a consequence. Although overall there is a suggested divide between individuals who may be more influenced by either the environmental stressors or their own reaction to stress, the points of crossover between the groups suggest the relationship is more complex than previously outlined in the literature. In this case, the TTCT results suggest that individuals who are more affected by their negative reactions to stress are more likely to have their creativity negatively affected than those who are more influenced by the environment.

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Complexity, interdisciplinarity and design literacy

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In today's complex world, a variety of perspectives are needed to better understand and solve challenges. For decades, global organisations and researchers have pointed to interdisciplinarity as a way forward for educational systems. Educational research offers great possibilities and gains for students involved in interdisciplinary teaching and learning processes, and the interdisciplinary nature of design thinking and practice can play a vital role in interdisciplinary general education. This paper explores how future scenario-building, as part of general design education, can serve as a framework for inter-disciplinarity in general education and contribute to a better understanding of complex problems, challenges and design literacy.

Keywords: Interdisciplinarity, general design education, future scenarios, design literacy, design thinking

Introduction

With the world and societies changing rapidly, educational systems are challenged to make future citizens capable of solving increasingly complex problems and to teach them to create new opportunities for themselves and fellow citizens. The tasks ahead are enormous. Battling climate change, unemployment, possible social unrest and other geopolitical challenges demands an ability to understand today's world and the capability to create and innovate solutions.

Design education at both a general educational level and a tertiary level can play an important role in the development of learning necessary for sustainable societal development. We ask how interdisciplinarity in learning processes can contribute to seeing the broader picture and give students a deeper understanding of different phenomena. This paper discusses how the interdisciplinarity of future scenario-building school projects in general design education might contribute to such deeper understanding.

Background

The demand for interdisciplinarity

In the 20th century, education in Europe developed and transformed from a strictly divided disciplinary school system far removed from how individual selves experience the world and its complexity towards a learning ideal promoting a more holistic interdisciplinary explorative approach. In a report on interdisciplinarity, UNESCO stated:

> *From an educational point of view, teaching that is divided into separate disciplines runs counter to the pupil's natural approach to the exploration of his environment, and consequently it provides less incentive for the pupil unless he takes a particular interest in this or that subject. (UNESCO, 1986, p. 16)*

While multidisciplinarity is characterized by its sequential, juxtaposed and coordinated nature, interdisciplinarity (ID) is characterized by integrating, interacting, linking, focusing and blending (Klein, 2010). Most schools in the Western world teach multidisciplinary through subjects taught throughout the day in a sequential fashion and, '…when intentionally aligned, in a *Coordinating* mode' (Burns, 1999; Klein, 2010). A variety of educational research shows that ID teaching increases student learning '…including gains in the ability to recognize bias, think critically, tolerate ambiguity and acknowledge and appreciate ethical concerns' (Science Education Resource Centre, 2017).

Ronald Barnett (2012) argued that there is a need for a pedagogy that focuses on learning not in terms of skills or even generic skills, but in terms of human qualities and dispositions. Learning for an unknown future demands an ontological shift in education, as today's pedagogy does not address the 'supercomplexity' of reality (Barnett, 2012).

In a reality consisting of youth alienation, school drop outs, increasing polarisation and societal fragmentation, there is a need for a more integrated human focus on learning. The way general education in Europe has traditionally been organised does not achieve the ideal of interdisciplinarity. Phenomena descriptions and problem-solving within the framework of isolated school subjects does not necessarily yield the perspectives needed for a deeper understanding. Learning should be increasingly organised and facilitated in a manner that fits the complex reality of today and tomorrow.

The interdisciplinarity of design

The activity of design in the understanding of design as problem-solving can be interdisciplinary or transdisciplinary.

> *In order for the designed artefact to be truly valuable to all those who interact with it, designers have to consider issues of aesthetics, usability, ergonomics, safety, marketability, manufacturability, functionality and sustainability. This requires a wide range of skills and knowledge. Design has therefore been described as science and art, as communication and argumentation, and as thinking and inventing.* (Boradkar, 2010, p. 273)

The interdisciplinary nature of design and design thinking (Darbellay, Moody, & Lubart, 2017) allows us to see general design education as a framework for interdisciplinarity in general education. This is a possible argument for expanding general design education to achieve greater potential for learning outcomes and curricular activity.

Future scenarios, design activism, speculative design and critical design

Within the context of design, the term 'future scenario-building' can be understood as a working method that describes a possible future and provides fertile grounds for innovative and challenging design processes. In the professional design context, the goal is not the scenario itself, but, rather, the design process that follows (Willis, 2005). Scenarios are often narratives, and they follow certain approaches or forms. Future scenarios can help designers to avoid excessively favouring the present (Thorpe, 2007). Through scenarios, designers can free themselves from the idea of what a product is. Thus, scenarios are an important tool in creating a better relation between products and user needs (Willis, 2005). If designers focus more on user needs and detach themselves from existing technologies, they might create possible solutions that are more closely linked to these needs. A specific example is a car: A person does not necessarily need a steel structure with an internal combustion engine and four wheels; rather, he/she needs a method to get from A to B.

Scenarios and design also have common qualities. They are both future-directed and represent attempts at prefiguration (Willis, 2005). Following Willis (2005), we see future scenarios as pre-figurative thought exercises that are similar to design: having an idea about how something should be and actualising it. Through exercises and tools like future scenarios, students can practice pre-figurative thinking and actualising design. In a teaching situation in which students get to work with future scenario-building, opportunities to see products in a larger context might facilitate a greater understanding of such topics as consumption and environmental

impact. Liv Merete Nielsen stated that visualizing ideas and solutions not yet articulated presupposes a competence to visualize these ideas; that is, it does not happen naturally and needs to be trained or developed (Nielsen, 2013). We believe that a good arena for this is the general educational school system, in which citizens can work with a common set of teaching goals.

The concept of design is usually and traditionally thought of as giving form to an object or product for aesthetic and functional purposes. However, the concept of design has changed and is changing. Design is increasingly seen as beneficial to many other aspects of human life: For example, it can promote sustainability through material and manufacturing choices, how designers think and the framework of processes in which they work (Cross, 2011). Fuad-Luke (2009) saw the role of designers as one of an opportunity to change society, and he stated that design can be used as a tool for activism. He described this design activism as creating a counter-narrative that seeks to create and balance positive social, institutional, environmental and economic change, which can be created through fantasy, practice and a design way of thinking. According to Fuad-Luke (2009), design activism can also create a change in the activist him/herself. In this understanding of what design knowledge can be, we see design as an opportunity to actively change society for the better, either through fantasy, design practice or design thinking.

Design can be an opportunity to speculate about how things could be and to try out possible futures to create a ground for discussion and reflection about current society (Dunne & Raby, 2013). Possible futures created should not necessarily be positive ones, as a positive future might not provide the best material for discussion or reflection about today (Dunne & Raby, 2013). A focus on more negative and darker futures might spark more useful reactions, thoughts and reflections about what we see as negative developments in today's society. Scenarios also provide an opportunity to critique and use design to challenge existing paradigms. Matt Malpass (2017) saw design research as having the ability to provoke discussion about an object and to engage a public as an instrumental application. We further see this possibility in future scenario-building and design as a framework in education for insight, reflection and critique.

In this study, we ask: How can the interdisciplinarity of future scenarios in general design education contribute to understanding the complexity of phenomena? Furthermore, we aim to discuss how the interdisciplinarity of future scenarios in a general design education can play a role in students' reflection and critical thinking.

Research method

Action research

The research method used in this study was action research. Action research is a method to improve practice and produce evidence on how such practice can be improved (McNiff, 2013). Through the collection of empirical data, analysis and discussion, we wanted to explore and produce documentation of how scenario-building can contribute to the possible content and development of general design education. The data gathered through the study included participatory observation notes/photos/audiotapes, qualitative research interviews and the students' scenario work. We see the informants as social actors who interact with society on different levels. In this understanding, we saw the scenarios as narrative expressions that, together with interviews, could provide valuable information about students' attitudes regarding their work on the school project.

During the two-week period that the school project lasted, the teacher-researcher (Ringvold) acted together with the students' ordinary teachers. Ringvold had experience and a background in teaching and as a design professional. He did not have any prior knowledge of, or connection to the school or any of the students or teachers involved in the project. To gather data from observation, the classes were audiotaped, and notes and photographs were taken. Student work was photographed, and interviews were audiotaped and transcribed. The student interviews were organised in several focus groups, each consisting of three students. Ethical regulations of individual and parental consent was followed.

The school project 'Build Your Own Future' was conducted with a 7th grade class (age: 12 years) in the fall of 2013 in Norway. The development of the school project was based on an understanding of future scenario-building as a four-phase process (Ringvold, 2014):

21. Finding a focus area.
22. Identifying and describing driving forces.
23. Developing the scenario.
24. Presenting the scenario.

Over the course of two weeks, after choosing between transportation or health and nutrition as a focus area, the students worked on six main tasks. The work resulted in written and visual descriptions of society in the year 2043. The six tasks consisted of:

1. Interviewing an elder. During the interview, both the student and the interviewed elder completed a survey about society today and in the past. The survey covered such areas as technology, health, energy and consumer patterns.
2. Information gathering/context research.
3. Developing a future scenario and creating scenario descriptions.
4. Making a collage presentation of the future scenario containing the written scenario descriptions.
5. Developing design specifications.
6. Drawing and presenting a product design.

The scenario was the setting for future products designed by the students. The school project mainly took place during the students' art and design classes, but the project was interdisciplinary in its approach and framework, as it included an opportunity to work with competences in science and mother tongue classes through the scenario-building activity. This eased the planning of the project by allowing more time for the project. In the work with the scenario-building, the students researched and identified changes and developments within the fields of energy, technology, transport, environment, health and nutrition. The students' work and research interviews formed the empirical basis for the study. The interpretation of the empirical material revealed several types of learning and insights that could contribute to the discussion on the outcome of this study.

Discussion

Seeing and understanding complexity

In today's rapidly changing world, in which reality is described as 'supercomplexity' (Barnett, 2012), general education should help students understand the complex nature of our surroundings. This can be done by identifying what changes are happening, why they are happening and what their consequences may be. In this educational change to better see and understand the complex nature of our world, we see interdisciplinarity as an approach that can help students comprehend the interdisciplinarity of the world itself.

A variety of future stories

The students in the school project 'Build your own future' created different stories (figure 1) about what the future might be like. They based their future scenarios partly on what they identified as changes in society before and today; however, to a great extent, they also integrated their own fantasies and wishes. The futures could describe societies in which we have solved the problems we currently face by changing our consumption patterns and policies; however, they could also describe worlds in which we have not solved our problems and their consequences have been played out. In the interviews, the students reacted to this variety of future versions: 'It made me think of how the world is today and how it can be, and the differences of how it can be in the future' (Student I). Two other students also voiced how the project gave them freedom to speculate. One commented: '2043—there is a lot of ways to imagine it. That's something I have learned. We can imagine it being really good or really bad' (student D). Another commented:

> *What I liked about the project is that there was no right or wrong. That we could see the year 2043. You could see it the way you wanted it. That there was nothing wrong with that. Some had it worse, and some made it better, and that was a good thing.* (student F)

These student reflections of multiple stories and future possibilities indicate, in our view, insight into the complexity of reality and reflections regarding the multiple perspectives needed to understand reality.

Figure 1: Six different future scenarios. Student collage presentations.

The interdisciplinarity of future scenario-building

We see the process of future scenario-building as interdisciplinary in that it is an activity characterised by 'integrating, interacting, linking, focusing and blending' (Klein, 2010). As part of the school project 'Build your own future', the students identified and described driving forces in the world's complexity. Lawrence Wilkinson (2009) described such driving forces as things that move the future in a specific direction, the identification of which can help us make better decisions. Driving forces can be understood as external and internal. Internal driving forces include knowledge and attitudes, while external driving forces can be technological, economic or natural (e.g. globalisation, the increasing greenhouse effect or increased life expectancy).

By identifying driving forces and describing changes that have happened and are happening, the students completed a set of research activities. The first task was to interview an elder and compare present society with society in the year 1983 (figure 2). The questions involved patterns of consumption and issues related to energy, technology, media, waste, transport, health and nutrition. The next task was researching these areas in groups, using web resources and statistics. The class then discussed what they had found out and what consequences their findings might have for future societies. In the variety of this work, the students gained different information about and perspectives on the driving forces described, including the variety of scientific fields, personal experience, society changing over time, global statistical information and group reflections. Through the subsequent scenario development, using visual communication and design thinking and methods, the students showed insight into the challenges we face today and tomorrow. Teaching situations that involve future scenario-building give students opportunities to see products in a larger context, which might facilitate a better understanding of such topics as consumption and environmental impact. In the words of one student: 'I didn't think much about it […] Now that I get all this down on paper, I think it's much more important than that' (Student F). We question whether this approach can provide the students an opportunity to see challenges and problems within a holistic context and whether it can prevent the alienation of such issues as sustainability.

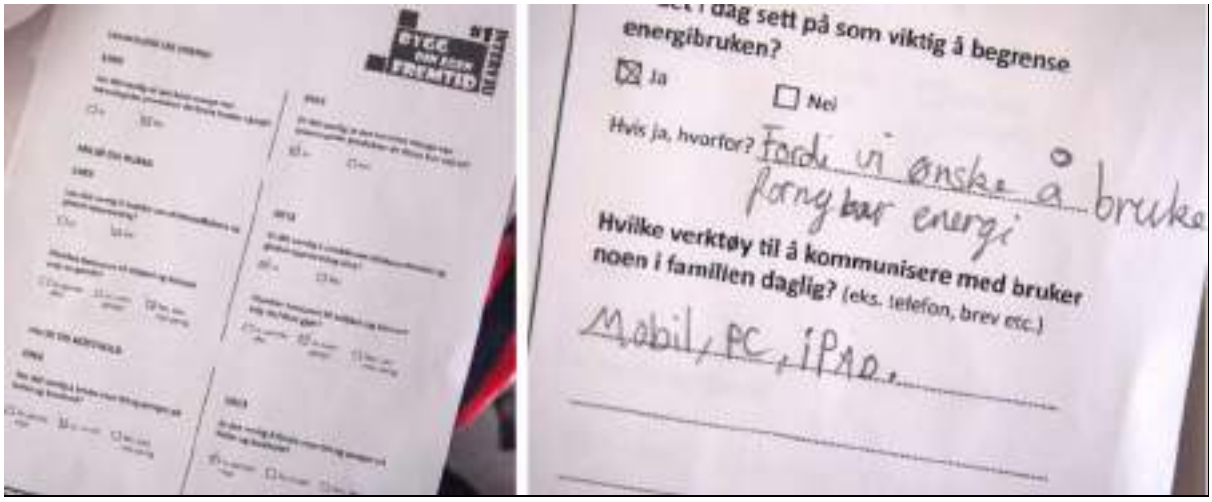

Figure 2: Student work from interviewing an elder.

Design education contributing to reflective and critical thinking

Future scenario-building and design seems to offer the possibility to be an interdisciplinary framework in general education for insight, reflection and critique. The stories provided by the students can engage the students themselves, fellow students and a wider public. It can provide a basis for discussions and reflections concerning ethics, societal and technological developments.

Richard Paul (1993) saw creative and critical thinking as similar. He defined critical thinking as follows:

> *Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.* (Paul, 1993 p. 22)

In light of Paul's (1993) definition, we see the students' project work as an exercise in critical thinking. The students gathered and evaluated information, then analysed and applied the information in their stories and designs, thereby synthesizing it. They accomplished this through reflection, reasoning, communication and conceptualizing.

Early awareness and knowledge of societal challenges might make students more capable citizens in the future. Habits and consumption patterns cannot be changed overnight, and reflection and critique in general education may be key factors in successfully shifting current paradigms. Liv Merete Nielsen and Karen Brænne (2013) argued for design literacy as an important competence for citizens that promotes an understanding of materiality that encourages longer-lasting products and sustainable consumer choices. Stefano Marzano (2005) pointed to studies in brain research showing how consumers are influenced by thoughts of possible futures. We ask whether the insight the students acquired might be considered 'priming memories': an awareness that helps one be observant when meeting the challenges of everyday life and might influence their actions towards making more ethical choices.

Buch-Hansen and Nielsen (2005) have argued that actors do not exist in a structural vacuum, but, rather, can influence and be influenced by the structures around them. Social interaction and collaboration are necessary to change existing structures. One of the aims of education is to give students the tools to interact and collaborate to change existing structures to new ones and mould the future into a more sustainable one. Future scenarios can provide knowledge and serve as interdisciplinary arenas for interaction, collaboration, discussions and reflective thought. As such, they can foster more reflective attitudes towards future actions.

Working with the school project, the students reflected on their learning outcomes. Considering what might be and speculating in their school work was new to some students: 'I have never thought of how it will be in the year 2043. I haven't thought that far ahead before, so I have learned a lot about that and how it can be and such' (student G). In their discussions about the project, it became clear that the students' various stories, dark futures and possible outcomes triggered a diversity of reactions among fellow students*:* 'I don't hope [student name's] version comes true. That's the least I want' (student H). Other students commented: 'He

wanted a third world war' (student G) and 'that cockroaches took over the world' (student H). This dialogue and interchange of reflective thought can be compared to the contributions of speculative design with a focus on more negative and darker futures, according to Dunne and Raby (2013). Specifically, the students' future scenario and speculative design work sparked reactions, thoughts and reflections among their fellow students. Future stories that are negative and scary can help confirm what is positive and what kind of future society students want.

Design processes, tools and ways of thinking can equip youth to 'think outside the box'. However, to accomplish this objective, the students' tasks cannot be fixed or final in form. When the questions youth tackle within these problems are not right or wrong, but deal more with the ethical questions of good or bad solutions or consequences, reflective thoughts will drive the discussions, peer responses and consideration of societal driving forces, while considering how something can be 'good' but have 'bad' overall consequences for the environment or people.

The knowledge formed on basis of the data gathered, experiences and reflections from the school project 'Build your own future' has contributed to transforming the first author's teaching practice. McNiff (2013) emphasized the importance of using action research for transformation, using the knowledge you have earned through action research improving your practice. The first author has in recent teacher practice used the methods of future scenario-building in a wider educational context outside core design subjects. In the school projects 'Media 2046' and 'Media 2047', two newer projects within the Norwegian upper secondary educational programme Media and Communication, students identified media trends of today and tomorrow and created future scenarios through future scenario-building (Ringvold 2019). In this new project the students developed and produced media products and stories that took place within the future scenarios. The stories gave insight into a series of thoughts and reflections about the direction in which our society might move. The projects seemed to provide a framework for critical thinking and reflection. In Figure 3, a student tells a story about a future in which technological developments, robots and automated processes might threaten humanity. In Figure 4, a short film named *twentyfour/seven*, a student tells of a future in which constant pressure causes stress and unhappiness.

Figure 3 Media and communication. School project Media 2046. Student project work.

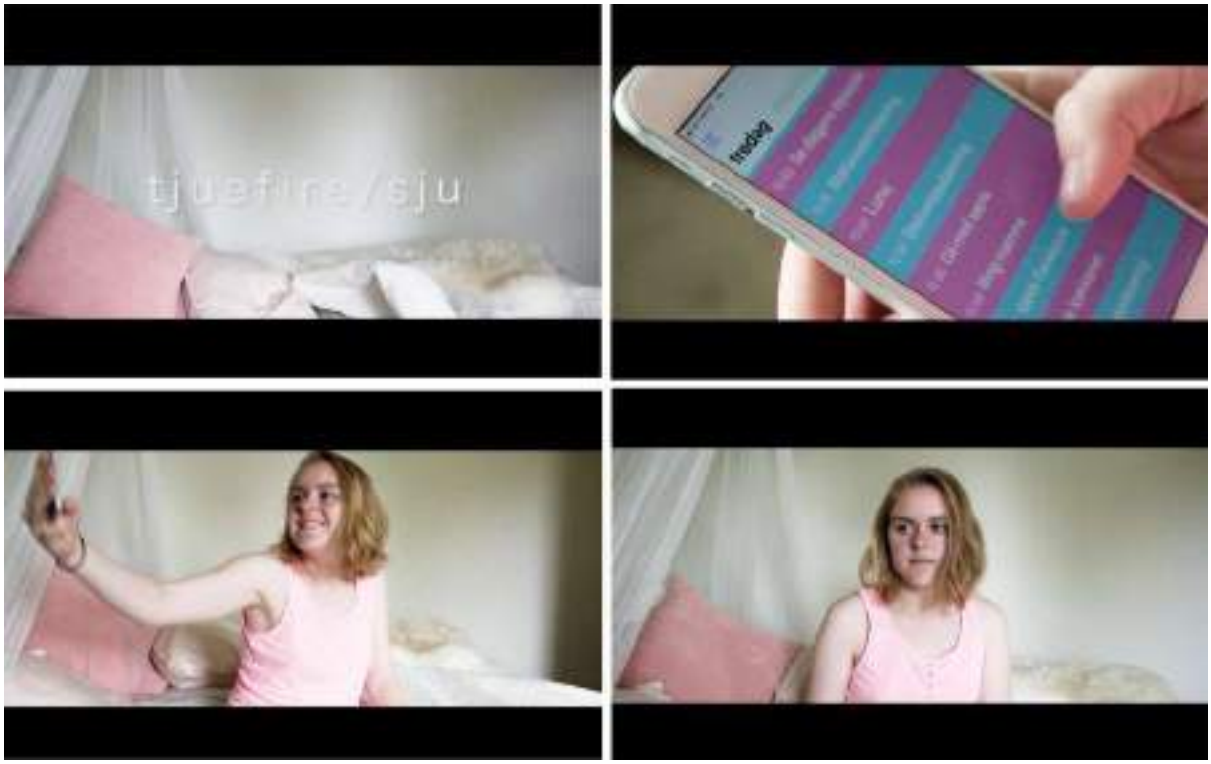

Figure 4 Media and communication. School project Media 2047. Student project work.

Interdisciplinarity, design, creativity and innovation

Interdisciplinary research can discover opportunities that require integrated and collaborative perspectives. Interdisciplinary design thinking can contribute to understanding the complexity or wickedness (Boradkar, 2010) of the problems we face. As Boradkar (2010) argues, '[t]he sheer wickedness and complexity of these issues warrants engagement with other disciplines' (p. 274).

Willis (2005) compared future scenario-building with design, as both are pre-figurative thought exercises. The students' work revealed how this pre-figurative thought process encouraged them to seek new solutions and give shape to something as yet unknown. This ability is seen as a fundamental human capacity and the basis for all design, not just professional design practice (Willis, 2005). Through general design education, this important capacity can be fostered in future generations and can contribute to the development of innovative skills not only among future professional designers, but among all future citizens.

In reflecting on their work with future scenarios, many of the students described a joy of shaping the unknown. They identified problems and described new solutions (Ringvold, 2014). Nigel Cross (2011) argued that good designers have a special way of thinking: 'Rather than solving merely "the problem as given" they apply their intelligence to the wider context and suggest imaginative apposite solutions that resolve conflicts and uncertainties' (p. 136). This description of design thinking is comparable to the students' project work. In their descriptions of the future, they identified problems of today and tomorrow, which they sought to solve with their design solutions. For example, one student designed a *Cloud Bed* (Figure 5), which is not only a hovering bed shaped as a cloud, but also part of photosynthesis. This problem-solving product emerged from the interdisciplinary research phase. The student work shows how interdisciplinarity in general design education can contribute to creative problem-solving. The use of future scenarios and speculative design can help develop human creativity and innovation. Through learning to see the bigger picture and products in a wider interdisciplinary context, students can develop problem-solving skills that support their research capabilities and creativity.

Figure 5. 7th grade student project work: Skyseng (English translation: Cloud Bed).

Obstacles, limitations and challenges

A school project like the one in this study has limitations, and its success is dependent on a series of factors identified during the study. As teaching in schools is not organized in an interdisciplinary manner, but organized in separate subjects, projects like this can be complicated to facilitate and manage. This project was dependent on the goodwill of the school management and teachers. The success of future projects is dependent on general design educators with insight into methods and processes. Ringvold organized and managed this project. Fully understanding the processes and purposes of all the tasks included in the project was considered important to engage the students and tutor them through the different stages and learning processes.

The project success was dependent on providing time for the tasks that needed to be done. In a school day with a tight schedule and minimal available time, projects that are time-consuming might be difficult to organize. On the other hand, by integrating a large set of skills and different subject benchmarks in the same project, an interdisciplinary approach like this can save time by accomplish learning for different subjects within one wider setting.

Summing up

Future scenario-building as part of a design school project can work as an interdisciplinary learning process and framework allowing for perspectives and insights that can contribute to students' ability to better see consequences and grasp the complexity of problems. Through seeing possible futures, be they negative or positive, students can gather and reflect on research and information in a wider context. By playing out the consequences of qualities, trends and changes in today's society, the students raised issues of ethical dilemmas concerning technology and sustainability. This gave them a platform for critical thinking.

The interdisciplinarity of design thinking and general design education projects fosters design literacy including the ability to experience complexity and understand complex problems in a wider context. A design literacy inclusive of design learning can enable students to better understand and reflect upon the challenges of an increasingly complex and rapidly changing society. This kind of design literacy and education for the general public can, in turn, promote sustainable decision-making and critical innovation. The results of these projects are however not generalizable. Time and space influence the outcome. Identifying phenomena and problem-solving through design processes, tools and ways of thinking can be a good interdisciplinarian framework for education because of the nature of the task. To better understand user needs, materials and the environmental consequences of product manufacturing and use, several different disciplines are needed. In light of this, we ask whether general design education can be a natural hub for interdisciplinary education for the general public.

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Networking for strengthening design literacy

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This article focuses on design education for the general public and the ways in which students and teachers can become more design literate through the development of networks, such as professional groups for teachers. The aim of professional groups is to create a structure that focuses on design competency among Design, Art and Crafts teachers as well as design education in Norway's primary and secondary schools. Etienne Wenger's theories of community of practice and Unn Stålsett's theory about the development of networking through professional groups are highlighted in this study through the comparison of two municipalities in conjunction with informant interviews. The emphasis of this study is on how each municipality gives time and space for the development of design competence through professional groups. A well-organized professional group will hopefully contribute to a deeper level of expertise in schools and an increased ability for the general public to recognize design education.

Keywords: design literacy, professional groups, strengthening lay people's competence, school development

Introduction

In order to increase general awareness of which choices one must make for a sustainable future, several researchers have agreed that it is important to strengthen lay people's competence in the fields of design and sustainability (Nielsen & Brænne, 2013; Pacione, 2010; Smith & Iversen, 2018). In Norway's primary and lower secondary schools, where design is a primary focus area in the core curriculum, the subject of Art and Crafts is intended to advance design knowledge amongst students. In Norway, Design, Art and Crafts have been combined into one subject since 1960, first named Forming and from 1997 named Kunst og håndverk whereas in other countries these are most often separate subjects (Nielsen, 2008). Design, architecture, art and visual communication are core aspects of Norwegian curricula in Art and Crafts. This paper focuses on the part of the curriculum that deals with the design area in the subject of Art and Crafts. To make the role of deign within this subject, we choose to translate Kunst og håndverk in Norwegian to Design, Art and Crafts in English. We define design and design education broadly, in line with the journal FormAkademisk – research journal og design and design education, which include "fields such as industrial design, visual communication, interaction design, architecture, landscape architecture, urbanism and design education at all levels from kindergarden to the doctoral level" within their scope (FormAkademisk, 2019).

An example taken from the competence aims, stated in Norway's curriculum Kunnskapsløftet [Knowledge Promotion], indicates that students should be able to "design products based on a specification for form and function, describe the life cycle of a product, and assess implications for sustainable development, environmental impacts and utility" (Kunnskapsdepartementet [Ministry of Education], 2006, our translation

from Norwegian). This policy document communicates that it is desirable that the general public receive design education. Its summary describes what students should learn in the field of design:

> *In design, the design of objects is central. Here, the craft tradition continues in the subject. Design includes both working directly with materials and working with sketches and models. The design of ideas, working drawings, products and forms of use are central. Knowledge of materials, problem solving, and production can form the basis for innovation and entrepreneurship. (Kunnskapsdepartementet [Ministry of Education], 2006, our translation from Norwegian)*

In order for students in Norwegian schools to get the best possible education, they must have teachers with a high level of competence in their subject areas. A teacher of a foreign language, for example, is competent if they have a good command of the language, adequate writing skills and an understanding of the current culture. The teacher should also have a grasp of the language's literature. Similarly, a teacher who teaches design within the subject of Design, Art and Crafts must both must both be a competent practitioner and have the ability to teach the subject.

Teachers in Design, Art and Crafts come from different backgrounds. In our opinion, the aims for improving design competence are extensive and can be interpreted differently. There are several questions to ask within the context of this study:

- Does each primary school teacher have the skills necessary to offer their students a good design education?
- How can teachers strengthen their expertise and design literacy in the subject of Design, Art and Crafts?
- How can teachers develop a common understanding of what is important for their students to learn in order to develop competent decision-making and critical innovation skills?
- How should networking in professional groups be organized and managed in order to promote high-quality professional development for teachers?

These are important questions to reflect on in order for future citizens to become design literate.

Previous research

The study of Design, Art and Crafts is facing a number of challenges. Our current educational system focuses strongly on PISA (Programme for International Student Assessment) results in reading, mathematics and science. The Ministry of Education prioritizes funds for certain subject areas, effectively defining what is more or less important regarding the education of students in Norwegian schools (Brodshaug, 2016).

Issues in the field of Design, Art and Crafts education in Norway

- According to Lagerstrøm , Moafi, & Revold's report *Kompetanseprofil i grunnskolen, hovedresultater* [Profile of Skills in Primary Schools, Main Results], based on Norwegian statistics, only half of all teachers who teach Design, Art and Crafts have a specialization in the subject (Lagerstrøm, Moafi, & Revold, 2014; Kunnikoff, 2015).
- It is difficult to get a job as a specialized teacher in Design, Art and Crafts, and it is beneficial to have additional expertise in other subject areas (Kunnikoff, 2015).
- There are challenges with the current classroom framework, such as poorly functioning workshops or large class sizes (Hansen, 2015).
- There are challenges concerning the assessment of students (Lutnæs, 2011).
- The competency requirements in so-called "basic" subjects are promoted by The Ministry of Education but there are no competency requirements for Design, Art and Crafts at the primary level (Ministry of Education, 2015; Kunnikoff, 2015).
- There are fewer opportunities for teachers in Art and Crafts to pursue further education in their subject than there are for teachers in other subjects, like mathematics (Regjeringen [Government], 2015).
- There are few available textbooks and resources in the subject.
- School leaders perceive the subject of Design, Art and Crafts to be less important than other subjects (Lie, 2013).

- School days offer little relevant development time, and educators need to be able to collaborate with each other across subject areas (Garberg, 2014; Lie & Nielsen, 2016).

Research in the area of Design, Art and Crafts highlights challenges involving a lack of cooperation among teachers of the subject, even though other studies illustrate the advantages of managing professional networks and pursuing collaborations (Brodshaug, 2016). Eva Lutnæs discusses collaboration in her doctoral thesis *Standpunktvurdering i grunnskolefaget kunst og håndverk: Læreres forhandlingsreportoar [Final Evaluation Grades in the Subject of Design, Art and Crafts: the Teacher's Negotiation of Repertoire]* (our translation from Norwegian). In her study, she examines two teams of teachers and focuses on how they collaborate while giving students their final grades. There are no requirements from the educational institutions for collaboration while teachers are grading (Lutnæs, 2011), however, Lutnæs's thesis reveals that teachers who collaborate have a more developed response when it comes to clarifying the reasons behind their final grades. Catrine Lie's 2013 master's thesis, *Skolelederes verdsetting av læreres fagkompetanse i kunst og håndverk [School Leadership's Evaluation of Teachers' Subject Proficiency in Design, Art and Crafts]* (our translation from Norwegian), addresses the issue of school leadership prioritising the hiring of teachers educated in the field of Design, Art and Crafts. Lie touches on the teaching loads of Design, Art and Crafts teachers and, specifically, their number of teaching hours, which is greater than the teaching loads of educators who teach other subjects in Norwegian schools (Lie & Nielsen, 2016). She refers to Design, Art and Crafts teachers as a part of a collegium and describes the effects these teachers associate with collaboration and interdisciplinary work. According to Lie, the interviewees emphasised that having at least two teachers within the field of Design, Art and Crafts per school contributes a great deal to their job satisfaction and professional development (Lie, 2013). In her master's thesis, *Formell fagkompetanse i kunst og håndverk, Betydning, prioritering og konsekvenser [Formal Professional Competence in Design, Art and Crafts—Meaning, Prioritizing and Consequences]* (our translation from Norwegian), June Kunnikoff writes that she consciously chooses to not spend very much time developing her professional network; however, she emphasises that networking is important to the participants of her research (Kunnikoff, 2015). Kunnikoff's study begins with statistics cited from Lagerstrøm et al.'s (2014) research, which shows that half of those teaching Design in Art and Crafts have no formal education in the subject (Lagerstrøm et al., 2014).

> *After having spoken with all five informants, I see in the transcripts that everyone speaks warmly about the professional collegium they have at school, and I get the impression that everyone places value on professional networks in different arenas. To varying degrees, collegiality is mentioned in schools, municipality-based professional network meetings, professional conferences, social media groups and the art and design education journal* FORM *as valuable for professional development and teaching. (Kunnikoff, 2015, p. 56, our translation from Norwegian)*

Marit Garberg sheds light on the progress and development of local curricula in her master's thesis, *Planer—hva og hvorfor? En undersøkelse av innholdet i de lokale læreplanene i kunst og håndverksfaget på barneskolens mellomtrinn [Plans—What and Why? An Examination of the Content of the Local Curricula in the Design, Art and Crafts Subject in Primary Schools]* (our translation from Norwegian). She discusses lacklustre collaboration between schools and the lack of a guarantee that further education in the subject will be offered to Design, Art and Crafts teachers like for teachers in other subjects.

> *From my perspective and with my experience in the field, little collaboration exists among and between primary schools and lower secondary schools when it comes to the subject of Design, Art and Crafts, in contrast to other subjects, such as Norwegian and mathematics, in which established collaboration exists between primary and lower secondary schools. Here, I refer to schools that belong to the same school cluster. (Garberg, 2014, p. 15, our translation from Norwegian)*

The Kjosavik report (2003) emphasises that specialized teachers in Design, Art and Crafts in primary and lower secondary schools collaborate less than classroom teachers in primary schools (Kjosavik, Koch, Skjeggestad, & Aakre, 2003). The reasons for this can be complex. Teachers in Design in Design, Art and Crafts are often the solitary instructor at their school. This may be because the total number of class hours required in the subject is low, there are few classes offered in Design, Art and Crafts or the teachers are more focused on their own subject and find it less useful to work with other teachers and subjects (Brodshaug, 2016).

Current research is based on the question of whether there is a need to collaborate across schools in order to strengthen academic environments and heighten competence, as there are often only one or a few teachers in Design, Art and Crafts at each primary and secondary school.

Research questions

This paper discusses the following research questions: what content can academic networking groups for teachers in Design, Art and Crafts include, how can such groups be organized and what benefits does membership entail? In this research, design is both a core area of curriculum in the subject Design, Art and Crafts and a method for creating professional groups. Herbert Simon's definition of design is essential to our understanding of it; “Everyone designs who devises courses of action aimed at changing existing situations into preferred ones” (Simon, 1969, p. 55).

Method

This study is of an exploratory nature. Therefore, the qualitative method has been chosen to better explore how networking through professional groups can be organized for, as Alvesson and Sköldberg (2009) state, “Qualitative research is a contextual activity that places the viewer in the world. It consists of a set of interpretive, material practices that make the world visible” (p. 17).

Various professionals were interviewed for the study and two different municipalities in Norway were compared. Four informants from each of the participating municipalities were interviewed: an adviser of education in the municipality, the manager of the professional group, and two teachers that were members of a professional group. Their statements were then compared. The questions posed to the informants were designed to gain a deeper perspective on the content, organization and utility of professional groups within the field of Design, Art and Crafts. The questions posed to the informants were about the content, organization and utility value of professional groups. The study examined how the two municipalities, and their respective professionals, developed and manage the professional groups. The research explored—in-depth—field work done in Municipality 1, where the municipality systematizes the management of these groups. The manager of the professional groups in Municipality 2 was also interviewed. The manager, who is a teacher, has taken her own initiative concerning the professional groups and organizes meetings without the structure of a municipal model. Municipality 2 is based on a model where enthusiasts drive the groups without the municipality’s involvement, as is the case in Municipality 1. The research discusses Municipality 1's model for professional development through the professional groups and compares it with that of Municipality 2 (Brodshaug, 2016).

This research is based on a reflexive methodology (Alvesson & Sköldberg, 2009), with a focus on a selection of a few theories, and makes use of Etienne Wenger's theory of communities of practice (Wenger, 1998; Wenger, McDermott, & Snyder, 2002) and the theory for the structure of professional groups as described in the book *Guidance in a Learning Organization* (Stålsett, 2006).

Interpretation perspectives

Etienne Wenger

Etienne Wenger (1998) and his older colleague Jean Lave developed the concept of *communities of practice* in their joint projects. They also developed the concept of *situational learning* (Lave & Wenger, 1991). According to these theories, learning is primarily a social phenomenon. Wenger rejects standard, individualized learning, which he believes makes learning dull and too far removed from the context of the world in which we live.

Professional groups meant to improve the teaching of design practices can employ Etienne Wenger and Jean Lave’s theories about communities of practice, as well as their research on the development of schools (Wenger, 1998), as each embraces the characteristics of mutual engagement, common activities and common repertoire.

Wenger stresses the importance of long-term communities of practice. He writes that these communities are not meant to provide quick solutions to problems. They should not replace a team or other aspects of an organisation; rather, they should contribute value to the organisation and its members. Wenger, McDermott and Snyder (2002) classify short- and long-term communities of practice in their own definitions. Short-term communities of practice serve as venues for problem solving. They provide quick answers to questions; help improve the quality of decisions and provide wider perspectives on problems. In contrast, long-term communities of practice require the ability to execute a strategic plan, form knowledge-based alliances and establish a forum that facilitates the expansion of skills and expertise (Wenger et al., 2002).

Wenger et al. (2002) write that time is important for someone who is the leader of an organized community. The most common cause of failure is that the coordinator of such a community simply does not make time to perform the role, even when they have allocated time for this purpose; they too easily let other things take priority over community work (Wenger et al., 2002, p. 83).

Several researchers in the field of design and teaching practices use Wenger's theories about communities of practice and the ways in which people learn in groups (e.g., Reitan, 2007; Lutnæs, 2011). Wenger co-developed the book entitled *Cultivating Communities of Practice*, which focuses on how people can systematically use communities of practice to develop businesses.

Unn Stålsett

Unn Stålsett is a former Associate Professor at Oslo Metropolitan University, where she worked in classroom teacher education. She describes networking teams in her book, *Veiledning i en lærende organisasjon [Guidance in a Learning Organization]* (Stålsett, 2006, our translation from Norwegian), which serve as a venue which serve as communities where members can share experiences, make use of one another's knowledge and be open about the challenges they experience in their disciplines. Such groups are not meant to serve as courses in which the participants are passive recipients; rather, everyone is expected to contribute his or her own knowledge.

Unn Stålsett (2006) relies on Wenger and Lave's concepts to discuss methods of learning in a practice community in her book. Based on three features (mutual engagement, common activities and common repertoire), the professional groups in each municipality can be defined as communities of practice. The groups consist of teachers who teach the same subject. Every teacher works within the same municipality, which has a common proficiency development program for each of its schools. The teachers use similar terminologies.

Starting and managing professional groups in Design, Art and Crafts

Design, Art and Crafts professional groups were started in Municipality 1 in 2003, as a collaboration between a university and the municipality. The collaboration was managed by Unn Stålsett and an adviser in education for the municipality. Municipality 1 has professional groups for every subject taught in its schools; teachers meet in their groups five times a year for three hours per session (1-4pm). Examples of work done in these professional groups include discussions, relevant political work, workshop activities, excursions, evaluations and visits from external professional speakers. The groups also collaborate with the university to provide guidance for newly educated teachers, as was done at Oslo Metropolitan University's Department of Art, Design and Drama, where new teachers were guided through discussions about innovation and professional development around the theme of assessment practices.

While in Municipality 2, one of the Design, Art and Crafts teachers started a professional group in 2012 on her own initiative, without any support from the municipality. These differences will be further discussed in next section.

Points of view from advisers, managers and teachers in Municipalities 1 and 2

In the interviews, the teachers, advisers of the municipalities and managers of the groups had interesting perspectives on the need for collaboration and professional groups.

The adviser of education in Municipality 1 spent approximately half of her interview discussing the subject group managers—she trusts their expertise in their subjects. She could not comment on the actual quality of the groups' content, but she referred to the evaluations done by the professional groups in which it was made clear that the teachers were largely satisfied. In the conversation, she equated Design, Art and Crafts with other subjects and spoke as though it were a matter of course that there was a professional group in Design, Art and Crafts, in line with the other subjects (Brodshaug, 2016).

The adviser of education in Municipality 1 said, "It would have been absolutely crazy if we were to only have professional groups in other school subjects and not in the Design, Art and Crafts subject. We have had that right from the start" (Brodshaug, 2016). She went on to say, "It is important to have a good group manager then, who knows the subject and who is also interested in the development". The interviewer then inquired if a group manager should be able to pull certain strings. The adviser of education replied, "Yes, it is a key role in

being a good group manager. I think so far that, in Design, Art and Crafts especially, we have had very good group managers" (Brodshaug, 2016).

In Municipality 2, the adviser of education had heard of the professional group that was started through the initiative of individuals. She said it was a shame that political guidelines meant that they could not prioritize the organization of these groups. She said that politicians prioritize only subjects such as mathematics, foreign language and science. The manager of the professional group in Municipality 2 was asked why she started this group and why she believed it was important. She said that she had worked nearly ten years as a teacher in Design, Art and Crafts at a secondary school where she often collaborated with two other teachers in the same field. When she began work in Municipality 2 in 2006, she was the only teacher in Design, Art and Crafts at her school. She had little relevant development time and was alone in her pursuit of the subject. She wanted to work more closely with other teachers in order to assure the quality of her teaching, ensure better academic progression for her students and discuss pertinent challenges with other Design, Art and Crafts teachers. She contacted her principal and asked if she could invite colleagues within the municipality to spend some of their development time on professional groups. The principal in her school took this further during the municipal principals' meetings and the other principals responded favourably to the idea (Brodshaug, 2016).

The manager of the professional group in Municipality 1 has received allocated time for group planning from the adviser of education. The manager in Municipality 2 must use her own spare time for pre- and post-group work. The quality of work done in Municipality 1 may not be better simply because more time is allowed for planning, however, groups in Municipality 2 are more vulnerable because they do not have time set aside for group work and they do not have a budget for lecturers or excursions. Wenger et al. highlight the importance that the group manager or coordinator have a good individual relationship with every member of the practice community (Wenger et al., 2002), which also requires time and good organization.

The focus on prepared, sustainable design proficiency

In recent years, a primary focus of the professional group of Design, Art and Crafts teachers in Municipality 1 has been to continuously develop design and crafts courses. The group worked in cooperation with an upper secondary school on a project called *En ny håndverksvei for barn og unge* [A New Pathway to Crafts children and young people]. Together, they designed and made products, such as a chessboard (Figures 1 and 2), from a variety of wood materials. They focused on developing the design process, quality assurance, knowledge of tools, areas of application and an understanding of the best ways to teach students the importance of sustainable materials and techniques. The high dropout rate of students in upper secondary school in Norway is widely known and only a few students choose to study design and crafts. By collaborating with upper secondary schools and focusing on design and crafts in primary and lower secondary schools, the professional group hopes to increase student interest in design and crafts studies in upper secondary schools. It is therefore important to strengthen teaching effectiveness of Design, Art and Crafts from as early as the first grade. The group also wishes to focus on the use of local materials and promote sustainable development. In future years, the professional group will continue to work on these issues in a systematic way (Brodshaug, 2016).

The professional Design, Art and Crafts groups in Municipalities 1 and 2 are organized differently. Municipality 1 has an adviser who has been collaborating with a university, managing the professional groups and taking primary responsibility for all implementation and decisions regarding group managers. She has also been responsible for coordinating group manager meetings, setting aside meeting times and allocating funds. A substantial system has been built around these professional groups, which serve as the municipality's continuing education program for each individual teacher. The professional group for Design, Art and Crafts is equal to the professional groups of other subjects with regard to time and resources allocated when it comes to external course organizers and excursions. There is no similar system in place for these professional groups in Municipality 2. Nevertheless, much of the group content is the same; the groups work on the issues surrounding their subject areas in a similar manner to Municipality 1 (Brodshaug, 2016).


Figures 1 and 2. Designing the chessboard as a team

In 2017, the Norwegian Minister of Education spoke at the Design, Art and Crafts Conference at Oslo Metropolitan University (Isaksen, 2017). He stated that the academic community should be strengthened and systematised for the betterment of Design, Art and Crafts as a field of study. In an interview, Thomas Nordahl, a foremost Norwegian academic on school development, underscored that systematically working with others to address challenges in schools is the most important factor that affects school development (Amundsen, 2015). Erling Lars Dale, another academic on school development, promotes the establishment of a collegial community as a condition that strengthens the professional quality of schools. Dale writes that if teachers want to experience meaningful cooperation, they should have a collective identity that is in accordance with their frame of reference (Dale, 1993). These ideas can be linked to Stålsett's theories on network building and Wegner's theories on communities of practice. Over time, communities of practice – such as professional groups and networks with strategic plans for the development of teachers in, for example, design literacy in primary and lower secondary schools – will be important in strengthening the field of design in general and ensuring both teacher and student competency.

As Kjosavik et al.'s (2003) report demonstrates, and as many others express in different forms on social media, teachers in Design, Art and Crafts often work independently at their schools. Many miss the opportunity to develop themselves professionally alongside others or to obtain help and advice. This situation is related to the fact that only one-half of Design, Art and Crafts teachers are educated in the subject, although many are educated teachers with backgrounds in other subjects. Facebook groups and other social media forums discuss the subject of Design, Art and Crafts and, through them, it is possible to see a demonstration of Wenger's theories on short-term value communities. These groups become venues for providing quick solutions because group members can easily ask for help and advice. These groups are certainly useful, but teachers should still develop themselves over time and should have a plan for sharing and strengthening their knowledge in the context of a group in order to form strong academic communities.

This study focuses on facilitating collaboration among teachers using professional groups. What does a year of networking through professional groups in the subject Design, Art and Crafts look like for teachers? What should the content of these groups be?

In their employment contracts, teachers in Norwegian schools have time designated both for teaching and for proficiency development. The teachers' total work tasks are performed across 1,687.5 hours per year. Good

communication at all levels and systematic collaboration between teachers is important in order to develop processes that meet the individual school's need to organize work hours according to the agreement between Utdanningsforbundet [the Union of Education] and Kommunenes Sentralforbund (KS) [The Federation of Municipalities]. Teachers in Design, Art and Crafts are responsible for 948 lessons (in a full-time equivalent position) per year (SFS 2013, 2015). During the year, municipalities and schools have control over the ways in which teachers organize their teaching time both during and after work, their continuing education and their meeting times.

In a municipality or area containing different schools, there will be teachers who have different skills in different areas. For example, some will have expertise in design literacy and sustainability, while others will have experience working with textiles or wood. If a system can be created that allows teachers to share and learn from each other, then, in a few years, the overall competence of these teachers will increase through collaborations with colleges and professional designers that facilitate development of new skills and expertise.

This study shows that it is important that municipalities organize their subject groups in a structured way based on theory and research. It is important that the groups do not become simply a collection of people who meet to obtain a new course or that the teachers become passive participants. Instead, participants should share knowledge and create alliances (Wenger et al., 2002). It is also important that these networks be firmly rooted within both the schools and the municipality so that the groups do not become vulnerable for permanent existence of groups, which should not have to depend on enthusiasts (Brodshaug, 2016).

Conclusion and the way forward

In order to construct a good foundation for students early on, teachers need sufficient time to become proficient in their subject areas and to develop their field of study in collaboration with other teachers and institutions. If students are to experience progress at their education, and if the quality of teaching design is to be improved, teachers must have a common understanding of teaching standards. In addition to collaboration between schools, teachers in the field of Design, Art and Crafts should work together with colleges and other institutions in order to acquire relevant research insights into the field. Municipality-based professional groups can help a teacher develop competence and can improve design literacy. This is especially true if the municipalities are able to contribute to the organization and structure of these groups.

The research shows that even though teachers can experience greater freedom and influence on networks or professional groups that they have started themselves, municipality involvement is necessary to structure and organize these networks in order to achieve consistent quality and research-based standards over time. The last part of this article will focus on the ways in which this study can be further developed through work in a third municipality.

The design of professional groups in a third municipality in Norway

In a third municipality in Norway – a big city – political leaders agree that design expertise should be strengthened to improve the teaching of practical Art and Crafts.

The municipality’s Education Agency wishes to start professional groups for Design, Art and Crafts teachers according to the methods and models of Unn Stålsett, Municipality 1’s experiences and the research referred to in this article (Brodshaug, 2016). In this context, it is appropriate to consider Wenger's theories on the value of long-term communities of practice. As stated earlier in this paper, these networks should not simply be a collection of people or courses where one can obtain quick answers. These networks should be a place where teachers develop strategies and knowledge-based alliances and where they help to develop their field more broadly.

The goal of each professional group is to strengthen the study of Design, Art and Crafts throughout their municipality, while also improving the design literacy of their teachers. These teachers should be competent in all aspects of the curriculum in order to properly support the learning of their students. Teachers in the municipality have different backgrounds, skills and experiences. Based on a political order, the Education Agency has established a specialist committee and developed proposals designed to strengthen the teaching of certain school subjects, including the creation of professional groups. This step is justified by the findings from different Education Agency surveys, which state that:

- There are few Design, Art and Crafts teachers at each school, and it is therefore challenging to develop professional communities.
- There is a need to increase the competency of teachers, as determined by a mapping of practical subjects completed in spring 2017. In addition to ordinary courses, specialist committees recommend increasing this competence through the exchanging of experiences, the training of one another and the possible hiring of external course organizers. This would be organized and carried out by professional networks.

Both nationally and locally, government agencies and educational departments have stated that both practical and aesthetic school subjects should be strengthened. In Norway, there is a strong focus on professional development in Fagfornyelsen [The curriculum revision] (Utdanningsdirektoratet, 2018, our translation from Norwegian). The subject renewal states:

> *All employees in the school must take an active part in the professional learning community in order to further develop the school. This means that the community reflects on value choices and development needs and uses research, experience-based knowledge and ethical assessments as the basis for targeted measures. Well-developed structures for collaboration, support and guidance between colleagues and across schools promote a sharing and learning culture. (Utdanningsdirektoratet, 2018, our translation from Norwegian)*

Professional groups can contribute to the systematisation of competence development, the structure of a subject's content and the strengthening of the professions and the students' learning in that subject. In order to succeed, these networks must be based on theory and research and they must be structured and managed in a planned manner. In October 2018, an establishment meeting was held with three teachers from different primary and secondary schools in Municipality 3 to launch professional networks. The three teachers had a high level of expertise in art, crafts and design. Their goal is to be the managers of these professional groups and to use different strategies to increase the competency of teachers and strengthen the study of these subjects in their schools. These potential managers work in different schools throughout the city and intend to coordinate teachers from approximately 25 schools, who will meet to develop their competence. In total, there will be three different professional groups involving approximately 75 teachers.

To strengthen the design literacy of teachers and students in Municipality 3, the region should focus on several things referred to in this article. The managers will collaborate on developing an organizational structure and determining desired content in 2019.

The first gathering of Municipality 3's professional groups took place in March 2019. Their goal was to meet the teachers and discuss the importance of both Design, Art and Crafts and good design education. These groups will focus on design and sustainable development. They will eat together, talk together and map out the competence of the group using Stålsett's model (2006). They will ask the teachers which subject areas they are competent in and how they can share that competency with the group. For example, a teacher with a strong design education could lead initiatives and instruct others in the group on that topic.

In the second session, to be held in June 2019, the three professional groups will gather at a university in Municipality 3 where professionals, designers and professors will contribute to the teachers' education. Afterwards, design education and the development of teacher competence will be discussed. In autumn 2019, another gathering will focus on workshops and knowledge sharing; different teaching methods, crafts, materials and skills will be important topics. The new national curriculum, subject renewal and sustainability development will be highlighted. The overarching goal is to engage professional teachers who are passionate about their subject matter, so that students learn more and develop increased curiosity in these areas. These meetings will also focus on working together to recruit others to the field of education. Finally, professions that emphasize design will be an important topic at these meetings.

The goal is to achieve the best possible community of practice to strengthen the teaching profession so that students can receive better design education and become design literate, a skill that will be ever more valuable as we work toward a sustainable future.

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Developing design literacy through brand-based artefacts

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The brand is a powerful representational and identification-led asset that can be used to engage staff in creative, sustainable and developmental activities. Being a brand the result of, foremost, a design exercise, it is fair to suppose that it can be a relevant resource for the advancement of design literacy within organisational contexts. The main objective of this paper was to test and validate an interaction structure for an informed co-design process on visual brand artefacts. To carry on the empirical study, a university was chosen as case study as these contexts are generally rich in employee diversity. A non-functional prototype was designed, and walkthroughs were performed in five focus groups held with staff. The latter evidenced a need/wish to engage with basic design principles and high willingness to participate in the creation of brand design artefacts, mostly with the purpose of increasing its consistent use and innovate in its representation possibilities, whilst augmenting the brand's socially responsible values.

Keywords: Branding, Participatory Design, Design Literacy, Employees, Higher Education Institutions

Introduction

The brand no longer fits Shannon and Weaver's traditional model of information transmission, mostly because unidirectional branding approaches have been supplanted. This reorientation required from companies a new kind of dominant philosophy, which had to, necessarily, be assimilated by all employees, as individuals. Besides the fact that these must be minimally familiar with the brand identity they represent and with which they commit themselves, they must also realise that their participation in the brand's organic structure means the constant conversion and maintenance of the brand itself. Marty Neumeier states:

> *Unlike the old corporate identity paradigm that prized uniformity and consistency, the new brand paradigm sacrifices those qualities in favour of being alive and dynamic. (…) Brands can afford to be inconsistent — as long as they don't abandon their defining attributes. They're like people. (…) A living brand is a collaborative performance, and every person in the company is an actor (Neumeier, 2006, pp. 133-136).*

The establishment of an institutional philosophy of this nature requires an investment in training collaborative individuals. Employees (being these all the individuals that, as some point, provide institutions with their work and capabilities, either full-time, part-time, no term, casual or voluntary) should, therefore, exploit their own brand knowledge and be confronted with any wrong brand assumptions they potentially have. Neumeier's 'collaborative performance' is only possible when the brand is flexible enough to support the diversity of emerging associations, meanings and artefacts, and as long as these do not turn into instances of infringement

or misappropriation. For employees to experience the brand and collaborate in internal branding activities, brand management efforts must, first of all, be internally-centred, allowing employees to present brand ideas they consider relevant and about which no one has ever thought about (Schultz & Hatch, 2006). Employees that concede themselves to know and align with the brand tend to act in a more consistent way and according to the ideal the company wishes to be perceived by its diverse audiences (Oddie, 2015, Ind, 2017).

This way, the creation of 'brand schools' (Schultz & Hatch, 2006) or 'corporate universities' (Ind, 2007) are interesting benchmarking tactics because they allow the involvement of new groups of individuals, who are expected to be engaged with the brand, whilst enhancing the understanding of what the brand represents (Hatch & Schultz, 2003; Aurand, Gorchels & Bishop, 2005; Schultz, Hatch & Ciccolella, 2006; Ind & Bjerke, 2007; Harris, 2007; Streader & Whitehouse, 2008). However, none of these strategies explore the brand and what it represents from a design perspective, and design literacy (and visual literacy, for that matter) is not part of their curricula. In fact, most of the literature on Branding theorises the brand as a Marketing elaboration and only few consider the design thinking from which a brand should emerge.

Thus, the purpose of this paper is to propose a communication platform for institutions to encourage employees to produce and share their own brand representations and, potentially, select and integrate these artefacts in the brand's identity system, considering the most creative, authentic and appropriate ones – being appropriateness, in this context, understood as a developed sense of design. Such a participatory or co-design approach (Lee, 2008; Fischer, 2012; Oswal, 2014) would contribute to brand equity and to the tangible circulation of intellectual capital but, most of all, to the externalisation of brand knowledge. This research also suggests that computer-mediated communication systems can successfully support this user-generated content logic, whilst increasing inclusion, participation and development. The context of an online community, as defined by Preece (2000) and Preece and Maloney-Krichmar (2003), and the use of Social Web interaction paradigms are considered suitable to support such a participatory internal branding approach. Therefore, the research question that guided this research was '**What participatory design platform can support the development of design literacy by engaging staff in brand artefacts co-creation?'**

Literature review

Brand artefacts are design artefacts

All organisations have a set of rules that allow them to perform their daily activities. These rules are partially codified and, as such, minimally explicit, but not to a lesser extent, they are also hard to articulate as they belong to the realm of *assumptions* – as opposed to the most tangible level, where we would find *artefacts* (Gagliardi, 2017). The study of artefacts takes us back to Schein's work (1984) in which he depicts these levels of organisational culture and their interaction. Several authors followed Schein in exploring nuances of what defines an artefact in an organisational setting: Moingeon and Ramanantsoa (1997) refer to symbolic products (artefacts) as the resources for individuals to understand the governing methods, behaviours and routines that are supposed to be known by the members of an organisation. Masino and Zamarian (2003), state that all artefacts have a set of values:

- *Cognitive*, since they guide the representation of relevant knowledge in the organisation and the identification (or not) with it;
- *Social*, when representing experiences, forms of expression and meanings, shared by individuals who conceive, construct and use them.

Vilnai-Yavetz and Rafaeli (2006) argued on the existence of three dimensions in any organisational artefacts:

- The *Instrumental* dimension refers to the extent to which the artefact contributes to the performance of tasks or to achieving the objectives for which the presence of the artefact was thought for;
- The *Aesthetic* dimension deals with the experience and sensory knowledge that the artefact provides to those who use or contemplate it, enabling the generation of aesthetic judgments that are based on the individual notion of "beautiful";
- The *Symbolic* dimension refers to the meanings or associations – since artefacts, as means of communication, can have symbolic consequences, both desired and unintentional.

These three dimensions seem to be highly relevant in defining satisfaction with imposed artefacts: depending on the adequate functional performance, the aesthetic virtue, and the meanings each individual will read in a specific organisational artefact, an emotional reaction will be determinant as to inform the way individuals will make decisions (Damásio, 1995) and include the artefact in their current and future routines, in a sustainable way. Such value seems to be the one missing in Masino and Zamarian's representation of organisational artefacts and will link to both cognitive and affective constructs – such as identification, belonging and commitment – that historically have been considered essential for values enhancement in internal branding activities (Mahnert & Torres, 2007; Punjaisri, Evanschitzky & Wilson, 2009; Punjaisri & Wilson, 2017), but also behavioural considerations – such as ethics (Dyrud, 2017) – building on awareness of quality, longevity and sustainability (Nielsen, 2017) and that will expectedly increase citizenship at organisational brand level (Burmann & Zeplin, 2005) and beyond.

A brand is a symbolic representation of the organisation's identity, expressed through a diversity of identity-led artefacts (Schultz, Hatch & Ciccolella, 2006):

- *Cultural artefacts*, constructed through the manifestation of perceptions and sensory competences existing in the organisation. Some examples of cultural artefacts can be found in the facilities' decoration style, in the existence or not of more or less rigid dress codes, etc.
- *Strategic artefacts* typically serve to express, communicate, and guide the organisation's purpose through vision, mission and value statements, and consist of the various resources used to make these tangible and operational (such as organisational posters, or enchanted stories filled with metaphors that allow staff to imagine and re-create organisational goals. Logo, signage, slogans and chromatic patterns are used as artefacts that deliberately convey what the organisation stands for and what it aspires to (Balmer & Greyser, 2002).
- *Image artefacts*, functional and aesthetic features that serve to express individuality through the transfer of meanings. Merchandising objects are probably the best example.

Hence, a brand is a whole, made up of symbolic, functional, aesthetic, tangible and intangible elements, grounded on cognitive, social and emotional values, duly articulated and systematised. It is a facilitator in the communication process – thanks to its virtue of stimulating the human ability to retain impressions and linking them to visual or verbal expression (Holsanova, Hedberg & Nilsson, 1998) – and an intellectual capital asset, vehicle of meanings, with which it is possible to establish relationships and create design solutions, through *design artefacts*:

> *"Design can be characterised as an activity where a designing subject shapes the design object by means of some design artefacts. The design object is the artefact formed in design; the outcome that design activity is directed to" (Bertelsen, 2000, p. 17).*

Participatory design and design literacy

Organisational identity and, in this case, the brand as an instrument of identity, are good examples of organisational knowledge made available to all employees within an organisation, and it is true that employees no longer only react: they are interpretive communities and potential sources of innovation. Therefore, some authors argue on the importance of employees to know the brand as much as they should live the brand, participating in its construction, in order to integrate collective knowledge and to make explicit/tangible the abstraction that usually characterises cultural artefacts (Ind, 2007, 2017; Jensen & Beckmann, 2009; Watkiss & Glynn, 2016).

Non-designers' involvement in design processes is a topic under discussion and research since the 1970s (Mambrey, Mark & Pankoke-Babatz, 1998). According to Fischer and Ostwald (2002), participatory design (PD), also known as collaborative design, has been characterised by focusing on the development of systems, more specifically at the design stage, gathering specialists and users in order to better develop new contexts of use and to design, together, the artefacts which the latter shall use. Similarly, co-design helps defining innovative solutions, as much as empowering participants in the solutions that will directly impact their lives (Sanders & Stappers, 2016).

In the PD logic, design is no longer to be practiced in isolation by the designer, but involving a range of other entities in the visualisation of concepts, plans and ideas, and in the production of sketches and models of the design artefact to be achieved. One of the deeper principles of PD is that all individuals can – and should – be designers (Muller, 2003). Some organisations are already involving their audiences (including internal

audiences) in design processes. These entities are aware that supporting and fostering the collective human capital existing in the community they already hold gives them real and creative content. But the strategies of support and development of design literacy are sparse or even non-existent, namely when the contribution of design to the economy is increasingly valued due to the relevance of design skills to the so-called *fourth industrial revolution* (The Design Council, 2018).

From this perspective, a requirement for these contributing audiences would be a minimum sense of design purpose and basic systems of enquiry in the context of design. Hence, as clarified by Pacione (2010), they would have to be design literate, which involves "… basic skills in inquiry, evaluation, ideation, sketching, and prototyping. We are not talking about mastery of more specialised forms of knowledge that a graphic or industrial designer might employ" (p. 9), but also the consideration of production efficiency (time and energy) and efficacy (e.g. sustainability-led artefacts) (Nielsen & Braenne, 2013). Thus, our understanding of design literacy follows Nielsen's (2017, p.2): "a broad concept that encompasses visual literacy, materiality knowledge, ICT literacy, ethics and design education for citizenship. It includes the creation of ideas and technology to create both artefacts and solutions, as well as interpretations and reflections on these designs."

Moreover, brand co-designers can only take part of this if they get to know the brand deeply, and if appropriate infra-structural resources are made available. Currently, much of these communication, skill development-led and co-creation environments have become computer-mediated and follow interaction paradigms common to the Social Web. Cao, Guo, Vogel and Zhang (2016) state that the use of social media in work contexts fosters employees' social capital and, subsequently, furthers knowledge transfer. Hence, the context of an online community, as defined by Preece (2000) and Preece and Maloney-Krichmar (2003), and the use of Social Web interaction paradigms are considered suitable to support the development of design literacy by engaging staff in brand artefacts co-creation.

The proposed system

About a decade ago, the ideals of PD together with the conditions generated by computer-mediated communication (CMC) led to the arousal of user-generated content, defined as interventions on pre-existing content, in a process in which new content is continually being used as the basis for other creations, resulting in constantly under development projects (Bruns, 2008). This is very much aligned with Neumeier's perspective that "A living brand is a collaborative performance, and every person in the company is an actor" (2006: 136) and Schultz, Hatch and Ciccolella's view that the 'perfect artefact' must allow the renewal of perceptions, so as to ensure contemporaneity and the evolution of the entity's interactions (2006).

Lelis and Mealha (2015) developed a supportive procedural model for brand artefacts co-creation which would respond to the needs of employees in service-oriented contexts, to encourage purposeful creativity around the brand. This model proposes three domains of interaction (Figure 1): *Mentoring*, by collaborative brand-related learning experiences, *Co-Design and Transfer*, through opportunities for participation, and *Evaluation* via the creative and sustained brand exploration with the shared responsibility towards both a wealthy and a healthy brand.

Figure 1 — The interaction structure for brand artefacts co-design – adapted from Lelis and Mealha (2015)

Accordingly, a digitally-mediated platform for developing design literacy by engaging staff in brand artefacts co-creation could be governed by these domains of interaction that should be considered in an iterative manner:

- Mentoring towards brand knowledge — staff can interactively experiment the brand's functional visual attributes and applications, exploring and developing basic skills essential for design literacy through, preferably, tangible brand artefacts, as their explicitness and objectified existence facilitate recognition (Watkiss & Glynn, 2016).
- Co-design and transfer of brand artefacts — staff can co-create brand-related ideas (artefacts, associations, meanings) which can be categorised, stored and published, increasing the existing brand knowledge and sense of design.
- Evaluation of brand artefacts — staff can participate in the critical assessment process of these ideas, in an advanced environment where the proposed brand artefacts, subject to open scrutiny, can be further analysed and discussed, considering their design features and functional, aesthetic, symbolic and socially responsible characteristics.

Such an open to participatory design and instructional digital platform, incorporating a three-dimensional approach like the one presented above does not exist. The same authors performed a study covering brand centres' main features (Lelis & Mealha, 2014) which revealed that these include specialised content only, which is previously established or selected by specialists, hence far from the participatory ideology. These researchers also found that critique and evaluation processes are disregarded in most online brand centres. Moreover, this study also states that brand centres tend to be repositories of existing designs and resources, storing standards, guidelines and brand prescriptions and restrictions, not necessarily preoccupied with brand learning, brand tangible experimentation, and design literacy development. With the proposed platform we aim at creating a space where individuals can develop basic design abilities such as ideation, materialisation of ideas and designerly inquiry (Christensen *et al*., 2018).

Methods

This research is grounded on the social constructionist, interpretive paradigm, with greater focus on the way humans interpret their social world in specific contexts. It fits under the 19th century German hermeneutics tradition and symbolic interactionism which, coined in 1969 by Herbert Blumer, is a meta-theory explaining that individuals act before others according to meanings that derive from social interactions, which, in turn, are rooted in shared symbols and language (Putnam & Fairhurt, 2001).

Considering that this research is pertinently supported by employee participation in the design of brand artefacts, only within a real institutional context could a deeper empirical analysis be carried out. A qualitative case study was considered as the most appropriate method, since it allows a holistic view and is more opportune when analysing eclectic and motivational themes, such as participation and identity (Gummesson, 1991). A Higher Education Institution (HEI) seemed to be an appropriate and rich environment, where several domains of knowledge cooperate and cohabit, with high levels of expertise. The University of Aveiro (UA), in Portugal, highly ambidextrous (given it is framed under the new trend of managerialism in HEI), is home to one of the authors and, as an institution not only composed by a great diversity of employees but also holder of a recently redesigned brand, was completely in line with the objective of this research.

In this context, we chose the classic case study that corresponds to the exhaustive analysis of a unique case (Yin, 2014). The objectives of this case study were 1) to illustrate and materialise a communication infra-structure for the design, planning and management of a brand, involving employees (academics and non-academics), offering them opportunities for developing design principles awareness, through creation and co-creation, giving them the shared power and responsibility over the brand they represent, and 2) understand how can a HEI value its brand through the development of their employees' design literacy, grounded on both the creation of new and the appropriation of existing brand design artefacts.

An extensive brand artefacts' audit covering all the existing brand applications was performed, and a set of exploratory semi-structured interviews with 14 specialists (practitioners with academic activity in the fields of branding, design, and communication technologies) was conducted, mostly as means of diagnosis. The information then obtained allowed the identification of:

- the procedural needs that UA's employees face when having to use or appropriate the brand (e.g., via its visual identity) and the difficulties they face;
- the anticipated constraints and advantages of a potential platform for brand artefacts co-design.

Based on the produced insights and results, a prototype for a web-based Participatory Brand Centre (PBC) was designed, considering the definition of a) the essential user interfaces and b) the interaction narratives and main functionalities. The method of prototyping did not resort to any hyperlinks and, for such, it was objectively a non-functional prototype; however, it makes use of careful and detailed visual language features, providing most of the reference system with concrete user narratives.

Finally, five focus groups (FG) were held, with UA's teaching and non-teaching staff (n=32), to whom the PBC prototype was presented for the first time and with whom it was discussed. In order to guarantee impartiality, the invitations for the FGs were sent to a maximum of four employees of different employment categories of each of the 16 departments/schools and six university services.

The sessions had an average duration of 107 minutes. After a brief introduction and review of the topics, the first questions to be discussed were of general character and easy approach, to allow the immediate participation of all (Morgan & Hoffman, 2018). To ease the participants' contextualisation, each one received an *academic chocolate*, a fictitious merchandising brand artefact, composed of a dark chocolate bar and institutional packaging designed on purpose for the research, in which UA's visual identity was clearly adopted. After that, the participants had contact with the prototype via a straightforward walkthrough, using scenarios or recurrent situations, with design and interaction features copied from the institution's website. Hence, a sequence of images representative of the PBC was presented, accompanied by a verbal description of its main functionalities, exemplifying situations of use or representing certain tasks, providing clues of interaction, thus avoiding merely conceptual (sometimes abstract) representations that are, usually, more difficult to share and interpret.

The prototype and its findings

The access to the PBC would have to occur through an initial and public interface, embedded in the internal context of the organisation, and following the current university portal, to ease recognition of major interaction paradigms. It was suggested by some employees that this entry area should include highlights to relevant brand-related ideas and contributions from employees (providing them with public visibility as a means of recognition). This generic and public area, accessible to all audiences, would also make available and explicit what the university brand is, covering all the brand guidelines' topics. Each topic would be described in its own page, with the contents related to it and with links that allow to further expand the information contained therein. As an example, the guidelines for colours are typically described using various colour systems and colour normalisations (CMYK, RGB, Pantone®, etc.). However, as this platform would be incorporating mostly non-specialised people, neither in brands, nor in design jargon, some users may not be able to interpret the technicality underlying this information; still, it was mentioned by several participants that it may be the case that some staff would like to learn what a "Pantone" is. Thus, it should be considered the possibility of broadening the knowledge about the subject through additional resources, e.g. available on the Web.

The access to the staff area would require a staff member login. As a consequence of using the interaction structure for brand artefacts co-design (Lelis & Mealha, 2015), this platform would equally comprise three main areas (Figure 2):

Figure 2 — The overarching structure for a Participatory Brand Centre

Studio

The Studio's main objective (first module in Figure 2) would be the orientation of individuals, providing them with opportunities for experimenting with tangible and visual attributes of the brand's logo, and get an approximate sense of what its standards are, using a context of both simulation and playfulness. In the presented prototype, the Studio area allows the user to click, drag, import, using languages and forms of interaction very close to what they would be accustomed to as regular users of information and communication technologies (Figure 3).

Figure 3 — The Studio area, presenting examples of visual alerts for non-compliance with the brand's standards.

Within the Studio, the user can either create sketches or experiment and exploit the graphic elements of the brand. The free creation and manipulation of own and/or shared sketches, and learning the norms that are inherent to and that govern the brand by trial and error, was very much appreciated by all the participants. This was, in fact, the most popular feature of the entire PBC: the platform would help the user in the process of brand experimentation, allowing the use of basic image editing tools and techniques, managing the constraints associated with the brand's logo, and through a contextual user comprehensible traffic-light metaphor, issuing visual and written explanatory alerts should mistakes be detected (e.g. modified image ratio, lack of readability/contrast, unaccepted typography, etc.). Simultaneously, the user would be presented with the visualisation of correct uses and the options of decision to be made: 'Amend as Suggested', or 'Ignore and Proceed'. Guidelines would, therefore, be provided where any visual elements of the brand logo/symbol were somehow misrepresented. However, the user would be free to follow on and continue their brand artefacts creation process, but already aware (hence, with developed brand design literacy) that their experience is not in compliance.

Community

Community (second module in Figure 2) is an internal and contextual *social network*, through which employees manage and share their contributions, and where they can also see, evaluate, comment and create links to their peers' ideas (Figure 4). In this section, users have access to all artefacts that are published in the Community, by the community. They can filter these by using the PBC predefined categories used to name artefact galleries (such as 'merchandise', 'learning & teaching resources', 'entertainment', 'end-of-year showcase'), or any other labels associated to occasional activities, launched by the institution to promote, for example, participation.

In these circumstances, the PBC would cumulatively be the repository of all unofficial brand artefacts of greater or lesser applicability. The FG participants found it interesting but were intrigued with the purpose of storing "not-in-compliance" cases. It was then clarified that, in this prototype, one of the predefined categories was titled *Pirate*, intended to bring together all the brand artefacts designed by employees and which, deliberately, did not follow the brand standards or brand values. It was further explained to the participants that, depending on the organisation and its culture, it might be interesting to save and retrieve such records, which may, in certain moments, turn out to be great ideas, grounded on the perspective that current standards are not, necessarily, the ones of tomorrow. Users can also participate in the artefact's evaluation process using assessing languages common to Social Media, such as *Like*, *Emoticons*, *Favourites*, five-star rankings, insertion of comments, among others. Interestingly, one of the participants mentioned she would like to have a *Dislike* option available, to allow "a more rigorous evaluation".

Figure 4 —The Community area, presenting the user's published artefacts and the upload of a new artefact to the PBC

Explorer

Finally, the Explorer (third module of Figure 2), allows activity monitoring and analysis according to interest criteria, such as the number of users participating in one's design and evaluation process, the links/interactions established between contributors, the authors involved in a creation, the most recurrent categories, the validation status of their artefacts, among others (Figure 5).

Figure 5 — The Explorer area, presenting analytics and the monitoring interface of artefacts under evaluation

The FGs confirmed that the university brand is highly cherished among staff but there is an apparent inability to understand and relate with the brand guidelines that were made available after its redesign: all participants had experienced compelling situations when using the brand's logo, for not understanding basic design principles. Therefore, participants were very positive mostly regarding the Studio feature that they considered "extremely innovative" and "really helpful". Its perceived playfulness linked to the development of design skills were seen as the most relevant aspects of the entire platform. However, such a system is useless without proper recognition and incentive actions — through which a culture of knowledge development and sharing would be awarded and promoted — as much as a reasonable amount of time dedicated to activities that could easily fall within staff development plans, including, in this case, the development of design literacy.

Discussion

The ultimate intention of this research was to propose a participatory design platform that would integrate, in a multi-directional way, internal branding activities, conceptualised in accordance with participatory design assumptions, providing a context in which design literacy could be developed and where the creation of brand-related and design-informed artefacts could be carried out with the participation of any employee.

A pedagogical dimension is needed to raise employees' brand awareness, which does not happen if investments are limited to unidirectional and imposing communicational approaches, such as through the provision of prescriptive templates. Thus, this instructional informal learning domain should promote and clarify what the brand is – because a brand is, foremost, the result of a design exercise – and the employee would be given the opportunity to embark into an actual design process as an insider.

When employees are invited to assess brand-related ideas provided by other members of their community, these processes must be as transparent as possible, for staff to have a very concrete idea of the value of their own contribution (not only in the design of potentially valuable artefacts, but also in the scrutiny of artefacts designed by others), allowing the community to a) know more and better its brand and how it should be applied in its various contexts of use, and to b) understand the immense design possibilities every brand entails. And, although described in a linear fashion, the interaction structure is always iterative (as depicted in Figure 2).

There is some preliminary evidence of the supporting model's potential, but not enough to completely validate it as a structure to support design literacy. The process of participation, which is, by its very nature, a social and communicational process, enhances, from a cognitive perspective, the flow and use of brand-related information existing in the organisation, hence constantly creating new knowledge, potentially contributing to more design literate individuals: those able to code and decode functional, aesthetic, symbolic and socially responsible artefacts.

It should be noted that a technological resource based on participatory design would demand a) tactics to reduce the perceived effort associated with participation in such a resource, aimed at avoiding frustrations and irreversible withdrawals, and b) a moderator, able to ignore the entropy and noise that will escort some of the contributions, making use of his/her own brand and design -related experience to systematise, (re)categorise and, eventually, validate ideas. A designer would be in the best possible position to assume such job, which would be very much aligned with some of the actions listed on the Report and Recommendations of the European Design Leadership Board (European Commission, 2012), namely:

- *Strategic Design Action 2*, "Positioning design within the European innovation system", namely through "the public procurement of innovative solutions through the recognition, inclusion and implementation of design as a driver of user-centred innovation" (recommendation 9),
- *Strategic Design Action 3*, "Design for innovative and competitive enterprises" by recognising "training for generating world-class specialist and skilled crafts-people in traditional and emerging sectors with an increased awareness of design, as a driver of growth and job creation" (recommendation 15),
- *Strategic Design Action 4*, "Design for an innovative public sector", considering the HE context, by increasing "the use of design/designers in public sector innovation" (recommendation 16) and

- *Strategic Design Action 6*, "Design competencies for the 21st century", by increasing the level of design literacy for all the citizens of Europe by fostering a culture of design learning for all at every level of the education system" (recommendation 20).

Undoubtedly there is a societal challenge involved in this project: as publicly funded institutions, many European Universities do not rely on their low or inexistent fees to keep themselves active. For this reason, one may say that it is ethically correct to conceptualise systems that allow the received public money to be spent more with research and social services and less with outsourced agencies, especially when, sustainability-wise, a design school is one of the institution's faculties. There is also a dilemma, which was addressed by some of the FG participants: freedom to create and to have a voice vs. intellectual property and authorship. The public area and the Community space were thought to, in a way, mitigate this, by providing contributors with full visibility, especially when their ideas were to advance to production stages. Finally, it is a complex problem as it involves multiple stakeholders with different views, potentially leading to conflicts concerning the nature of the platform and its solutions: on one hand, the employees, happy to engage with the suggested activities, on the other, the outsourced agency and designers that may feel their role is being minimised and taken from them.

As major limitation, this research used a single case study approach within the very specific sector of academia, in one country only. Nevertheless, the findings were presented to and discussed with eight communication directors and human resources managers from commercial companies (three of them among the biggest in Portugal and at least five fairly well internationalised). Out of the eight, seven found the approach very relevant for their own staff development context and one wanted to implement it straight away. In addition to this, the Studio area was designed to explore the experimentation of design principles based on interactions with the brand's logo only, which, although permitting a considerable array of applications involving other design specialisms, is in fact only one of the several design resources a brand encompasses, hence, much more can be investigated within the same context and loyal to the same brand-based rationale. A functional prototype and a longitudinal, multi-institutional context study would gauge the implications and possible reciprocity between the development of brand knowledge and design literacy and the proposed platform.

Conclusion

Most of the existing work on internal branding is conceptual and based on small-scale studies grounded on managers' views, rarely shedding light on design as a pivotal activity for brand success. Staff development activities that involve and motivate them to participate in the construction of brand artefacts are not design-led and tend to be individualistic, centred on the result achieved by each individual, without systematically contemplating the possibility of collective creation, nor of sharing. In addition to this, research in PD covering the design process of brands is reduced, if not non-existent.

The number of studies on the introduction of CMC resources to support brand awareness is also limited; online brand centres are typically unidirectional, only allowing the download of brand-associated features, and the completion of forms as means to request further information. Some research has been done on the contextual analysis of online platforms that have been used by big corporations to promote both the collection of brand strategy-led ideas from employees and the appropriate usage of the brand's visual system, but no holistic ecologies were found supporting a combination of these activities. Finally, no studies were found where an explicit combination between a brand's design artefacts and the development of design literacy is established whatsoever.

This research contributed to a better understanding of the potential that brand artefacts may have in the development of design literacy among staff, enhanced by the strong ties these develop with the brand they represent. Moreover, predictably, systems such as the presented can bring 1) a change in participation patterns and shared opportunities to express opinions and make decisions and 2) the democratisation of innovation, capitalising individual or collective brand-related and design-informed user-generated content, which can, potentially, be applied in the official brands' product/service development, communication and marketing throughout, in a sustainable way.

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Track 6.c Introduction: Entrepreneurship in Design Education

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Over that last few decades there has been a significant rise in interest for design-led entrepreneurship and innovation. This has brought about the need to expand on the principles and methods of human-centred design by incorporating knowledge from multiple disciplines, such as management, business, and entrepreneurship studies. This expansion aids designers, engineers, and marketing practitioners who strive to create innovative, meaningful and relevant services, business models and experiences.

More often than not, ventures operate under very limited resources, and practitioners are often required to fulfil several roles. The concept of 'multidisciplinary teams' widely spread in this sphere often bears little resonance in these contexts. Designers possess valuable competencies that can have a significant impact on the venture, especially driving user and context-centred strategy and processes for the introduction, legitimization and scaling-up stages. However, engaging with these areas of practice requires skills and capacities that overlap traditional disciplinary roles. In doing so, the boundaries between design and engineering, branding and communications, cultural and behavioural insight, marketing and management strategy are blurred.

As educators in design innovation, how do we explore, define and balance interdisciplinary relationships between design, engineering, management, business and entrepreneurship theories, methods, language and models of education? The purpose of the entrepreneurship in design education track is to discuss methods, models, case studies, research, insights and unexpected knowledge in benefits and limitations of design entrepreneurship education. In particular, the three papers presented in this track demonstrate different approaches to entrepreneurship and design education.

The paper, *Design Thinking & Entrepreneurial Opportunities: Visual Case Studies of Chilean Designer/Non-Designer Founders* by Potocnjak-Oxman, Kriz and Nailer explores the rise in both number and diversity of roles played by designers in the global entrepreneurship ecosystem. Be it as consultants, contractors, educators, founders or funding decision-makers, design skills seem to be increasingly attractive to entrepreneurial teams, accelerator programs and venture capital. The study asks whether the practices, cognitive processes and mindsets prevalent in formal design thinking training helps in the formation of entrepreneurial opportunities. The paper highlights the parallels between design thinking traits with established entrepreneurial competencies and points out that while there are significant alignments, there are also gaps, which when identified, could help determine entrepreneurial actions and success. It also explores how "abductive reasoning" which has been said to sit at the core of design thinking could be a potent tool to enable the successful formation of entrepreneurial activities. The study compares the processes of 14 Chilean founders from both design and non-design backgrounds, with the purpose of identifying how design thinking contributes to, or hinders, those processes. Preliminary findings suggest that successful entrepreneurs from

design backgrounds extend the human-centred view to include organisations, industries and societies, use continuous observation and learning-by-doing to develop their ventures, rely on interdisciplinary collaboration and are tolerant of failure. Design thinking does not, however, seem to provide a clear understanding of the importance of value creation and resource leveraging in the formation of entrepreneurial opportunities.

The paper, *Contamination Lab of Turin (CLabTo): how to teach entrepreneurship education to all kinds of university students* by Fiore, Sansone, Remondino, and Tamborrini presents the impact of combining design and entrepreneurial methods to teach entrepreneurship to a variety of university students in three different formats. As demand for entrepreneurship courses increase, new methods of teaching entrepreneurship will be required. This paper explains how instructors at the University of Turin are exploring this. Their study addresses how students from different fields of study and different educational levels can have a positive entrepreneurial experience. The teaching experience combines design and entrepreneurial education methods to create a practical, multi-disciplinary team-based course that addresses real-life projects through a learning-by-doing approach. The courses enlist instructors from multiple disciplines to mentor students. The study relies on programme assessment data, including pre and post-surveys to evaluate educational impact. Overall, they found a positive effect on the students' entrepreneurial skills. However, when the data was broken down according to the students' fields of study and education levels, mixed results emerged.

The paper, *Entrepreneurial Mindset: a longitudinal study of three different teaching approaches to developing it* by Fain, Rod and Bohemia explores the influence of three teaching approaches on entrepreneurial mindset of commerce, design and engineering students across three universities. They measured the entrepreneurial mindset of students at the start of a course and then again at the end. During the course, three different teaching methods were employed; lecture and case based, blended online and class based, and project-based course. They found that the engineering students mindsets grew the most, followed by the commerce students, while the design students grew the least.

Attendance and conversation during this session was strong and focused. A number of participants shared insights and experiences that enriched the conversation beyond the paper topics. Near the end of the session, a sincere interest was shared that session participants should get together more often and discuss opportunities and practices. Clearly, exploring entrepreneurship and design education is of growing interest while a challenge remains on how we develop effective education methods in multi-disciplinary entrepreneurship courses.

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Forming Opportunities through Design Thinking: Comparing Visual Narratives of Chilean Designer/Non-Designer Founders

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An interesting development in the entrepreneurial economy is the rise in both number and diversity of roles played by designers. Be it as consultants, contractors, educators, founders or funding decision-makers, design skills seem to be increasingly attractive to entrepreneurial teams, accelerator programs and venture capital. This exploratory study asks whether the practices, cognitive processes and mindsets prevalent in a formal design education help in the formation of entrepreneurial opportunities. Using a visual narrative approach, it compares the processes through which entrepreneurial opportunities were formed by 14 Chilean founders from design and non-design backgrounds, with the purpose of identifying how design thinking contributes to, hinders, or fails to support those processes. Findings suggest that collaborative work styles, thinking by doing and reflective reframing have the greatest positive impacts on opportunity formation, regardless of the disciplinary background of founders. Design thinking does not seem to provide a clear understanding of value creation and resource leveraging. The study finds parallels between design thinking and opportunity formation that can be drawn upon to improve development of entrepreneurial competencies among designers.

Keywords: Entrepreneurship, Entrepreneurial Opportunities, Design Thinking, Entrepreneurial Competencies, Design Entrepreneurship

Introduction

Entrepreneurship has become an important part of the global economy, with close to fifty percent of companies on the Fortune 500 list having been founded in the previous fifteen years (Sarasvathy, 2001, p.44). Early-stage firms have been shown to contribute more to job creation than their larger, older counterparts (Haltiwanger, Jarmin & Miranda, 2013, p. 355-356; Haltiwanger, Jarmin, Kulick & Miranda, 2016, p.29). These early-stage “start-ups” grew by 75.6% in 2016, five percent faster than they did in 2015 (Morelix & Russel-Fritch, 2017, p.6). Increasing access to technology and the emergence of new industries such as artificial intelligence and robotics are also opening new pathways for entrepreneurial activity (Ortmans, 2016). In the United States, participation of women and members of ethnic minorities in entrepreneurial activity is also increasing (Buchanan, 2016).

An interesting development in the entrepreneurial landscape is the growing number of designers who are engaging with entrepreneurship (Grayson, Lee & Dillon, 2016, p.10; Maeda, 2016, p.10; Startup Muster, 2017, p.11; Startup Muster, 2018, p.16). Be it as contractors, consultants, educators, decision-makers, founders or

funding parties, the skillsets present in the design discipline seem to have become attractive to the global entrepreneurship ecosystem.

Entrepreneurship as a field of research is itself evolving, with a growing emphasis not on the creation of firms, but rather the entrepreneurial opportunity and the processes through which these are formed (Suddaby, Bruton and Si, 2015, p.2). A recent theory of "opportunity creation" highlights the importance of creative imagination, social skill, iteration, reflective learning, and interactions with the environment in the process of conceiving a venture (Alvarez & Barney, 2007, p.11-12; Steyaert, 2007, p.453;472; Suddaby et al, 2015, p.3).

This theory of opportunity creation presents numerous parallels with the collection of practices, cognitive processes, and mindsets of the design-driven approach to innovation that the management discourse refers to as "design thinking" (Dunne & Martin, 2006; Hassi & Laakso, 2011; Hehn, Uebernickel & Herterich, 2018).

This exploratory paper seeks to recognise the parallels that may exist between the process of forming an entrepreneurial opportunity and the traits that make up the design thinking toolkit. It aims to gain a better understanding of how design thinking may or may not impact on the formation of opportunities, with the purpose of recognising which of its tools could be most efficacious in enabling entrepreneurial behaviour. Conversely, it also seeks to identify how design thinking is lacking in its ability to support or foster entrepreneurial behaviour. The goal is to contribute to the fields of design thinking and entrepreneurship research by identifying relationships between the two, and exploring whether design thinking can provide frameworks to enable entrepreneurial learning.

RQ1: *How do the practices, cognitive styles and mindsets of design thinking contribute, hinder, or fail to support the formation of entrepreneurial opportunities?*

RQ2: *How could design thinking support development of entrepreneurial competencies among designers?*

The present study took place in Santiago, Chile. The questions were approached by gathering and comparing the entrepreneurial experiences of fourteen founders from the Chilean context. Nine of these had received a formal education in design, whereas five had not. Twelve of the founders perceived themselves to have achieved success with their ventures, while two felt that they were yet to be successful.

Founders' experiences were captured through use of a "visual narrative" approach that combines rich picture diagrams (Avison, Golder & Shah, 1992, p.398; Sutrisna & Barret, 2007, p.168) with Lawson's (2006, p.26-27; 266) concept of "Design by drawing". Participants were asked to visually describe the process through which they formed the entrepreneurial opportunities that led to the conception of their ventures. Individual visual narratives were analysed through flexible pattern matching (Sinkovics, 2018), comparing them with existing frameworks in the design thinking and entrepreneurial competencies literature. The results from all visual narratives were then analysed collectively to identify themes and derive implications for theory and educational purposes.

The paper is structured in three parts. The first provides the research background, describing the lenses and frameworks that provide the theoretical foundation for the study, as well as an overview of the context in which the study took place. The second explains the methodology, briefly describing some of the visual narratives, and includes preliminary data coding and analysis. The third section covers findings, implications and limitations of the study, finishing off with further research that could stem from this work.

Research Background

The Evolving Field of Entrepreneurship Research

Entrepreneurship, as a field of research, is in the process of defining its "core puzzle". Although not thoroughly established, one approach suggests that the discipline should focus not on the entrepreneurial firm, but on the concept of the entrepreneurial opportunity. These are defined as those that "bring into existence new goods, services, raw materials and organising methods that allow outputs to be sold at more than their cost of production" (Shane, 2000, p.451). Special emphasis is placed on the processes and conditions that lead to the formation of these opportunities (Suddaby et al, 2015, p.2).

There are currently two prevailing theories that seek to explain how opportunities are formed. Although these two theories stem from different epistemological, ontological and teleological perspectives, they both focus on the same dependent variable: the actions undertaken by entrepreneurs to form and exploit opportunities

(Alvarez & Barney, 2007, p.12). This focus on a bias for action is present in key definitions of entrepreneurship. These include "[…] the pursuit of opportunity beyond resources controlled" (Professor Howard Stevenson, cited in Eisenmann, 2013), and the way that entrepreneurs' attitudes towards opportunities are described by Steve Blank, one of the pioneers of the "lean start-up", an experimental, feedback-driven and iterative method for innovation that became popular in the mid-2010s (Blank, 2013):

> *[…] everybody has an idea. [...] number one is: do you have curiosity? Number two is: does it translate to imagination? But number three is: did it translate to action? That's the difference between someone with an idea and someone who is an entrepreneur. Are you willing to actually take that action? (Steve Blank, cited in Nickisch, 2017)*

One current theory around the formation of entrepreneurial states that "opportunities are objective realities that exist in the environment and are discovered due to the unique characteristics of individual entrepreneurs", a product of market inefficiencies and only exploitable by individuals who are specifically suited to perceive them (Shane, 2000, p.467; Suddaby et al, 2015, p.3; Venkataraman, 1997, p.121). This is

Another, more recent, theory is that "opportunities are ultimately determined, not in an exogenous fashion by the external environment, but rather in an endogenous way, through the creative imagination and social skill of the entrepreneur (Suddaby et al, 2015, p.3). In other words, rather than being discovered, opportunities are created by entrepreneurs who engage in an iterative learning process based on interactions with the environment (Alvarez & Barney, 2007, p.11-12). This process has also been referred to as 'effectuation', where entrepreneurs "take a set of means as given and focus on selecting between possible effects that can be created with [those] means" (Sarasvathy, 2001, p.245); 'entrepreneuring', where entrepreneurship is described as a verb, a creative social process and "one of the most inventive human activities" (Steyaert, 2007, p.453;472); and 'reflexivity', where "opportunities are generated by reflection on the possibility of new and creative social realities" (Suddaby et al, 2015, p.6).

Table 1: Comparing Two Theories of Entrepreneurial Opportunity, adapted from Suddaby et al, 2015, p.7-8.

	Imprinting Construct - Discovery Thesis	*Reflexivity Construct - Creation Thesis*
Environment	*"The discovery thesis of entrepreneurial opportunity contains an inherent assumption that the external environment is both distinct from and more agentic than the entrepreneur"* (p. 7)	*"In the creation thesis, the boundary between entrepreneur and environment is less distinct and the degree of agency between entrepreneur and environment is more evenly distributed"* (p.7)
Time	*"an isolated episodic influence"* (pp. 7-8)	*"an iterative […]ongoing interaction"* (p. 8)
Epistemological Emphasis	*"Concrete practices and objective experiences"* (p. 8)	*"Subjective and interpretive inner world"* (p.8)
Level of Analysis	*"Individual or group focus"* (p. 8)	*"Industry or organisational field"* (p. 8)

This second, less-developed, "opportunity creation theory" is of specific interest when attempting to identify the possible links and intersections between design and entrepreneurship. In particular due to the strong parallels that exist between its defining characteristics: creative imagination, social skill, iteration, reflective learning, and interactions with the environment; and the defining characteristics of what the management discourse refers to as "design thinking" (Hassi & Laakso, 2011).

Design Promotion and the Rise of Design Thinking

An interesting development in the field of design, specifically design education, is the emergence of schools providing design-related programs beyond the scope of traditional design students (Glen, Suciu, Baughn & Anson, 2015, p.182; Hasso Platner Institute, 2017; Lehtonen, Schilli & Berg, 2018; Melles, Howard & Thompson-Whiteside, 2012, p.163-164; Stanford d.school, 2017). This may stem from a changing perspective on the role of design, which pushes the discipline from the cosmetic, through the tactical, towards its participation in strategic decision-making, including the development of new experiences and design-driven innovation (Montana-Hoyos & Potocnjak-Oxman, 2017; Ramlau & Melander, 2004, p.49; Verganti, 2009). This changing paradigm would require design professionals to take part in clearly articulating the value of design to

business. This activity became known as “design promotion”, and has focused on demonstrating design’s contribution to national competitiveness, increasing demand for the discipline among small businesses, incorporating design in the innovation processes of established firms, and government support for, and acquisition of, design services (Raulik-Murphy, 2010, p.48-49).

Design promotion is not new, and began in earnest during the post-World War II period (Raulik-Murphy, 2010, p.18;101-102). One example is the development of the design discipline at the HfG Ulm (Bonsiepe & Cullars, 1995, p.15), which “championed the insertion of design into the industrial process, and discarded all artistic or decorative speculations about design activity” (Fernandez, 2006, p.4). Another example is the revised definition of industrial design put forward by the World Design Organisation, formerly International Council of Societies of Industrial Design (ICSID) and one of the world’s leading design promotion organisations, which states that:

> *Industrial Design is a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences. Industrial Design bridges the gap between what is and what’s possible. It is a trans-disciplinary profession that harnesses creativity to resolve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, [design] provides a more optimistic way of looking at the future by reframing problems as opportunities. It links innovation, technology, research, business, and customers to provide new value and competitive advantage across economic, social, and environmental spheres. (WDO, 2019).*

From the above definition, it seems that the design discipline has made concerted efforts to move beyond the object into the realm of systems and organisations. It seeks to transition from a problem-oriented view to an opportunity-seeking perspective motivated by the desire to create value.

Arguably one of the most successful design promotion initiatives has been the proliferation of design thinking. This suite of methods has recently gained popularity as a way to facilitate adoption of design processes among non-designers. Although this concept was first described fifty years ago (Simon, 1969), it rose to prominence as an approach to innovation during the mid-2000s (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013, p.123). The concept itself currently holds many definitions, ranging from the generic ‘what designers do’ (Carr, Halliday, King, Liedtka and Lockwood, 2010, p.62); through the strategic ‘approaching management problems as designers approach design problems’ (Dunne and Martin, 2006, p. 512); to the transdisciplinary:

> *Design practice [...] used beyond the design context, for and with people without a scholarly background in design, particularly in management’ (Johansson-Sköldberg et al, 2013, p.123)*

This definition, which does not describe the traits of design thinking, highlights the intended impact of bringing managers and people from the business world into the design process as active participants. Given the growth and contribution of entrepreneurial activity to the global economy, design promotion that inserts design practitioners into the entrepreneurship ecosystem could provide an interesting new horizon for the discipline.

Design Thinking and Entrepreneurial Competencies

A clearer approach to understanding design thinking and the role it can play in entrepreneurship and entrepreneurial opportunities may be to categorise its characteristics. One such categorisation, stemming from the management discourse (Hassi & Laakso, 2011, p.5-10), states that design thinking includes:

- **Practices** closely related to concrete activities and ways of working;
- **Thinking Styles** and methods of processing information cognitive processes; and
- **Mentalities** in individuals and as part of an organisational culture.

For the purposes of this study, Thinking Styles and Mentalities will be referred to as “Cognitive Processes” and “Mindsets” respectively. Collectively, they will be referred to as “traits”. These traits have been described through various lenses (Hassi & Laakso, 2011; Hehn, Uebernickel & Herterich, 2018; Micheli, Wilner, Bhatti, Mura & Beverland, 2018; Razzouk & Shute, 2012; Sanders & Stappers, 2008; Tschimmel, 2012; among others), leading to extensive lists of methods to be used at different stages of an innovation process. Recently, Micheli et al (2018) have synthesised these lists into ten core components. Their synthesis presents traits not explicitly included in Hassi & Laakso (2011). These traits have been integrated with Hassi & Laakso’s (2011) categorisation to develop a list that, although not definitive, provides an overview of the elements of design

thinking that may be present in the formation of entrepreneurial opportunities. The final list of practices (p), cognitive processes (c) and mindsets (m) of design thinking used for this study, with a brief definition and corresponding code for data analysis, is provided below (see Table 2).

Table 2: List of Practices, Cognitive Processes and Mindsets of Design Thinking (adapted from Hassi & Laakso, 2011 and Micheli et al, 2018).

Code	*Component*	*Simplified Definition*
p1	Human-centred Approach	Putting people first, achieving a deep and empathetic understanding of the customer and other key stakeholders.
p2	Thinking by Doing	Creating and developing knowledge iteratively, through practical, rapid and continuous prototyping.
p3	Visualising	Using concrete representations of abstract concepts, models and ideas to make sense of and communicate them.
p4	Divergence/Convergence	Undergoing cycles that broaden and refine scope to explore diverse alternatives and synthesise preferred solutions.
p5	Collaborative Work Style	Interacting with a wide range of stakeholders to include a diversity of perspectives when tackling complex problems.
p6	Innovation	Successfully implementing novel and useful ideas in organisational or social contexts.
c1	Abductive Reasoning	The logical process of moving from what is known to what could be.
c2	Reflective Reframing	Identifying, framing and reframing the problem to be solved.
c3	Holistic View	Perceiving problems as a system of interdependent structures, patterns and events with functional, emotional, social and cultural elements.
c4	Integrative Thinking	Achieving balance between conflicting requirements, such as the technical, commercial and human dimensions of a problem.
c5	Problem-solving	Defining and tackling systemic social issues.
c6	Blend Analysis & Intuition	Combining perceived patterns with rational evaluation.
m1	Experimental/Explorative	Posing questions and exploring constraints in creative ways that push current boundaries and proceed in unexpected directions.
m2	Ambiguity Tolerance	Maintaining an openness to uncertainty and accepting it as a natural part of an emerging design process.
m3	Optimistic	Assuming that the results of the process will be in some way better than the current situation.
m4	Future-Oriented	Anticipating and visualising new scenarios and situations.
m5	Tolerance of Failure	Perceiving failure as a necessary element in the process of learning about the problem that is being addressed.

These traits of design thinking provide an overview of the competencies used in solving design problems. Of note is their parallel with the traits described in the opportunity creation theory and their similarity with entrepreneurial competencies, or those that are used by entrepreneurs "to begin or transform organisations, [adding] value through their organising of resources and opportunities" (Mitchelmore & Rowley, 2009, p.96). These competencies are said to be distinct from those required for business administration or management (Morris, Webb, Fu & Singhal, 2013, p.355). A list of 13 entrepreneurial competencies, developed through a multi-round Delphi study with both academic experts and successful entrepreneurs (Morris et al, 2013), is

provided below (see Table 3). As with the traits of design thinking, these have been given simple codes for later use in data analysis.

Table 3: 13 Entrepreneurial Competencies, adapted from Morris et al, 2013, p.358

Code	*Competency*	*Simplified Definition*
e1	Opportunity Recognition	Perceiving changed conditions or overlooked possibilities in the environment.
e2	Opportunity Assessment	Evaluating opportunities to accurately determine their relative attractiveness.
e3	Risk Management and Mitigation	Taking actions that reduce the probability or impact of a risk.
e4	Conveying a Compelling Vision	Conceiving and articulating an image of the future that empowers followers.
e5	Tenacity/Perseverance	Sustaining goal-directed action in the face of difficulties and obstacles.
e6	Creative Problem-solving	Relating previously unrelated variables to produce novel and useful outcomes.
e7	Resource Leveraging	Accessing resources not owned or controlled to achieve personal goals.
e8	Guerrilla Skills	Employing low-cost tactics not recognised by others to do more with less.
e9	Value Creation	Developing new solutions that generate revenue exceeding their costs.
e10	Maintain Focus yet Adapt	Balancing strategic direction with actions that improve fit with environment.
e11	Resilience	Coping with stresses or disturbances to thrive in the face of adversity.
e12	Self-Efficacy	Maintaining self-confidence regarding one's ability to accomplish a task
e13	Building/Using Networks	Establishing, developing and maintaining relationships with supporters.

It would seem that these entrepreneurial competencies present interesting parallels with the traits of design thinking described in Table 2. Some of these possible parallels are highlighted below (see Table 4).

Table 4: Parallels between Design Thinking Traits and Entrepreneurial Competencies

Design Thinking Traits	*Entrepreneurial Competencies*
Abductive Reasoning; Innovation; Problem-solving	Creative Problem-solving
Thinking by Doing; Experimental/Explorative	Maintain Focus yet Adapt
Collaborative Work Style	Building/Using Networks
Visualising; Future-Oriented	Conveying a Compelling Vision
Ambiguity Tolerance; Tolerance of Failure	Tenacity/Perseverance; Resilience; Self-Efficacy

It is important to note that design thinking does not completely parallel entrepreneurial competencies. This can help in determining where it may be lacking in terms of enabling entrepreneurial action and success.

Design Thinking Impacts on Entrepreneurship

In its attempts to transition from the cosmetic to the strategic, the design discipline and design thinking have had well-established positive impacts on the performance of private enterprise (e.g. Dunne & Martin, 2006, p.512; Hertenstein, Platt & Veryzer, 2005, p.12-17; Kotler & Rath, 1984, p.17; Maeda, 2016, p.8; Sheppard, Kouyoumjian, Sarrazin & Dore, 2018). Similar positive impacts have also been perceived in the public sector (e.g. Laboratorio de Gobierno, 2018; OECD, 2017, p.30-33; Sanders & Stappers, 2008, p.3; The Australian Centre for Social Innovation, 2018). Although these impacts focus on established organisations, the effects of design on the processes associated with entrepreneurship are only recently being explored. There is currently little research into how design thinking may come into play during the process of forming an entrepreneurial opportunity.

This is of interest due to the increasing participation that design and designers have had in the entrepreneurial economy. In 2016, 21% of "unicorn ventures", defined as "entrepreneurial ventures with a valuation of a billion dollars or more" (Fan, 2016), had designers on the founding team (Maeda, 2016, p.10). An example of this is AirBnB, founded in August, 2008 by two designers and a computer scientist. In March of 2017, the company secured over USD1 billion of investment based on a valuation of USD31 billion (Thomas, 2017). To put this in perspective, Marriott International Inc., one of the world's largest hotel chains, founded in 1927 and owning over 4200 hotels, has a market capitalisation of approximately USD35 billion (New York Stock Exchange, 2017), only USD4 billion greater than that of AirBnB. In 2016, a report on the role of designers in the global technology entrepreneurship industry found that 31% of 400+ companies surveyed had a founder with a design background (Grayson, Lee & Dillon, 2016, p.10). In Australia, a study into the state of the local entrepreneurship ecosystem found that 15% of ventures surveyed had graphic design skills present on the founding team, with 20.4% having user experience design skills (Startup Muster, 2017, p.11). A year later, these numbers had increased to 17% and 21.4% respectively (Startup Muster, 2018, p.10).

Designers are not only taking part in the entrepreneurship economy as founders. They are also increasingly sought after as contractors, ranking second only to accounting (Startup Muster, 2018, p.16). They have also been recruited to take on roles in venture capital firms (Maeda, 2016, p.11), and established funds that invest only in entrepreneurial ventures with designers on the founding team, such as The Designer Fund, founded in 2011 by a "guild" of successful design entrepreneurs (Designer Fund, 2016).

Design Thinking and the Formation of Entrepreneurial Opportunities

Why is the design discipline, traditionally associated with product development and visual communication, having such a sizable impact on the entrepreneurial economy? One possible explanation may be that the aforementioned practices, cognitive processes and mindsets that comprise design thinking provide a set of tools that can help in the formation of entrepreneurial opportunities.

One example is "abductive reasoning", which has been said to sit at the core of design thinking (Dorst, 2011, p.522-524). This cognitive style is defined as "the process of forming an explanatory hypothesis […] the only logical operation which introduces any new idea" (Peirce, 1960). People trained in design use complex forms of abduction that has been said to be particularly useful when tackling open-ended or 'wicked' problems (Dorst, 2011, p.523-524), defined as:

> *[…] a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing' (Rittel, cited in Buchanan, 1992, p.15).*

Wicked problems present similar characteristics to the "opportunities as objective phenomena" described in the entrepreneurial opportunity discovery theory (Suddaby et al, 2015, p.3). Additionally, designers' ability to use abductive reasoning and 'framing', or 'the creation of a novel standpoint from which a problematic situation can be tackled' (Dorst, 2011, p.525; Schön, 1984, p.132), among other tools, present similarities to the processes through which entrepreneurial opportunities are formed in the opportunity creation theory, including the use of creative imagination, social skill, iterative interactions with and learning from the external environment (Alvarez & Barney, 2007, p.11-12; Suddaby et al 2015, p.3)

This study aims to explore the possible relationship between design thinking and entrepreneurship, determining how these practices, cognitive styles and mindsets are used by designers and non-designers in the process of forming entrepreneurial opportunities. It also looks at the visual narratives of successful and

unsuccessful founders to gain an insight into which of these tools are beneficial, which have no impact, and which can prove a hindrance to the early stages of an entrepreneurial project. It also seeks to find if there are gaps in the design thinking toolkit, or areas where it is unable to provide support for entrepreneurial action.

Additionally, the project seeks to inform entrepreneurship education with a set of guidelines as to how to better use design thinking frameworks in supporting the formation and development of an entrepreneurial project.

Research Context

The study took place in Chile, which in 2015 had a Total Entrepreneurship Activity (TEA) indicator of 25.9%, putting them in 6th place of countries that participate in the Global Entrepreneurship Monitor (GEM) study (Kelley, Singer & Herrington, 2016, p.65). In 2018, this number fell slightly to 25.1%, but the country rose in ranking to 3rd place (Bosma & Kelley, 2018, p.72). Entrepreneurial Intentions, defined as "the effort that a person will make to carry out entrepreneurial behaviour" (Liñán & Chen, 2009, p.596) are also high, with 50% of Chilean GEM respondents expressing that they believe the conditions to start a business are favourable, placing the country in 3rd place overall. Entrepreneurs in Chile also state that their products are new to their market or to that of their competitors, and Chile ranks 1st in terms of innovation (Kelley et al, 2016). Design however, has a similar situation to Australia, with between 62% and 70% of recent graduates finding employment in the field, and at fourth year of practice are receiving average wages between CLP4.8m and CLP17.7m per annum (Ministerio de Educación, 2018), roughly equivalent to EUR6.4k and EUR23.7k respectively. In 2018, entrepreneurship was seen as an attractive career path by 76.1% of respondents (Bosma & Kelley, 2018, p.72).

This context is of interest as it combines high TEA with low remuneration for design professionals. Given the right mechanisms for designers to access capital, Chile could present a fertile context for opportunity-driven design entrepreneurship to flourish.

Methodology

In seeking to recognise how design thinking may contribute to, hinder, or fail to support the formation of entrepreneurial opportunities, a "visual narrative" approach was taken. This approach aimed to capture descriptions of the sequence of events and activities that took place in the process of forming an entrepreneurial opportunity. The goal of these visual narratives was to allow for the mapping of procedures, methods and specific tasks undertaken by the entrepreneur in the conception of their venture, identifying whether these included any design thinking traits. Based on the nature of the experiences described in the narrative, a qualitative assessment was made to determine whether specific traits had a positive or negative impact on the formation of the opportunity. To determine where design thinking may fail to support this process of forming an entrepreneurial opportunity, the presence or absence of entrepreneurial competencies was also mapped.

Due to the complex and unique nature of each opportunity formation process, this exploratory visual narrative approach drew upon Sutrisna and Barrett's (2007) use of rich picture diagrams to gather case studies in the field of construction projects. Rich picture diagrams are a pictorial representation that surfaces processes, relationships, people, tasks, environmental factors, interests and other aspects of a situation (Avison et al, 1992, p.298). Based on Lawson's (2006, p.26-27; 266) concept of "Design by drawing", which highlights designers' use of visualisation techniques as part of a thinking process, it was assumed that this visual narrative approach would enable entrepreneurs with design backgrounds to effectively describe their experience of conceiving a venture.

Participant Selection

In order to be eligible for the study, participants must have been part of the founding team of a venture that has had at least 2 years of history. For the purpose of this study, ventures are defined as:

> *'a daring undertaking in the public, private or academic context, using resources beyond the immediate control of the founding team, to create value for a range of stakeholders'*
> *(adapted from Oxford Dictionary, n.d.; Shane, 2000; and Stevenson, cited in Eisenmann, 2013).*

Fourteen participants were recruited through the researcher's personal networks. Participants were divided into four categories based on two criteria:

1. *Successful (S) / Unsuccessful (U)*
   This criterion divided participants into those whose ventures were functioning sustainably or had achieved significant growth two or more years after their launch, and those whose ventures had not achieved significant growth or had been discontinued before their third year of activity.
2. *Designer (D) / Non-Designer (N)*
   This criterion divided participants into those with a traditional education in a design discipline – graphic, industrial, product, fashion, game, interior – and those without said education.

In total, eight Successful Designer Founders (coded SD01-SD08), one Unsuccessful Designer Founder (coded UD01), four Successful Non-designer Founders (coded SN01-SN04), and one Unsuccessful Non-designer Founder (coded UN01) participated in the study.

Data Capture

Data collection took place between the 7th and 17th of January, 2019. Data was collected through sixty- to ninety-minute semi-structured interviews. During these, participants were provided with one blank sheet of 110x77cm paper, pencils, pens, markers and highlighters. They were asked to visually describe the process they went through to form the opportunity that led to the venture. The audio component of these interviews was recorded for cross-referencing purposes and to assist in analysis of the visual narratives.

Data Analysis

Data analysis took place over several successive stages. The first stage aimed to identify which design thinking traits were present in each founder's visual narrative. Due to the exploratory nature of the study, these were analysed using flexible pattern matching (Sinkovics, 2018), comparing them to the design thinking traits derived from the literature (see Table 2). This analysis was complemented through review of audio recordings to reduce the risk of misinterpreting the visual narrative.

The second stage sought to discern which design thinking traits may have produced an impact on opportunity formation. In particular, an attempt was made to qualify whether these had a high or low impact, and whether said impact was perceived to be positive or had the potential to be negative. Each of the Design Thinking Practices (p1-p6), Cognitive Processes (c1-c6) Mindsets (m1-m5), and Entrepreneurial Competencies (e1-e13) identified in a participant's visual narrative was assessed based on the events described by the participant. Where these traits were present and perceived to make a minor contribution to the formation of entrepreneurial opportunities, they have been coded as 1. When their contribution is perceived to be significant, they are coded as 2. When the component is absent or does not seem to have supported opportunity formation, they have been coded as 0. Where its absence is perceived to have had a negative impact, it has been coded as -1. Where its use is perceived to have hindered or had an adverse effect on opportunity formation, they have been coded as -2.

The third stage focused on the overall results of the study. A comparison of visual narratives was undertaken to identify which traits of design thinking seem to produce a consistent positive impact across ventures. Traits were given a score between -4 and 28. This score was based on their presence in the narratives of successful and unsuccessful ventures and their code from the previous stage. These were reviewed in relation to entrepreneurial competencies to determine whether there were any clear gaps in design thinking's ability to support opportunity formation.

This third stage of analysis was used to synthesise findings and detect patterns from which themes and implications for theory, education and further research could be derived.

Sample Visual Narratives

Fourteen visual narratives were captured during this study. The following section includes a brief overview of four of these ventures, including one from each participant category. Examples of visual narratives are also provided to give insight into the methodology used. Preliminary observations and the presence of design thinking traits and entrepreneurial competencies are included in the description of the narrative. They are later summarised in the Results section of this paper.

Founder DS02 – Adding Value to Industrial Processes through Design

The narrative begins with emphasis on the role of design in the creation of value *(e9)*. The participant, while working in a manufacturing industry, realised that they could improve upon the processes present in their workplace *(c2)*, and offer a service to their employer that would provide improved returns to both *(e1)*. They describe their entrepreneurial process as "basically the design process", which includes stages of divergent interaction with the external environment and convergent implementation to improve industrial processes *(p4; p6)*. They perceive the client firm as "an individual with needs" *(p1)* and a system *(c3)*. One of the main drivers for entrepreneurial behaviour was the idea of freedom *(e12)*, and being able to control one's own destiny, even if it is a more strenuous career path *(e11)*. Although the venture managed to earn upwards of USD1m per year, it has ceased to operate due to external market conditions. The founder, however, has already started a new venture *(m5; e5)*, and states that their opportunity formation process is both structured and replicable.

Founder DS03 – Recovering Industries through Social Enterprise (Figure 1)

The narrative begins with a discussion of the entrepreneur's own career path, which began with the intention to provide "strategic design" which could deliver value to people, companies and communities *(e9)*. While working with microbusinesses in regional Chile, they realise that improved packaging is not enough to help their clients, and that it is possible to offer design "that solves meaningful problems" *(c2; e10)*. They undertake further studies, and find "lost industries" which could be recovered to improve the quality of life of local communities *(e1)*. Drawing upon the resources of their university *(e7)*, they interact with the community *(p1)* to develop a small-scale experiment *(p2; p3)* to help connect microbusinesses with design capabilities *(c4).* From this experiment they then develop a model that continues to operate and grow, has produced communication material *(e4)* and is expanding into other regions. They highlight the importance of collaboration with other disciplines *(p5)* and the use of learning loops *(p2)* of varying scope *(p4)*.

Founder DU01 – Integrating Traditional Crafts with Digital Technologies

This founder commences by explaining that towards the end of their design degree, they attempted to keep multiple options open, including academic work, employment and entrepreneurship as possible career paths *(m1)*. After careful consideration, they choose entrepreneurship *(c2)*, and begin by tackling an opportunity that takes advantage of burgeoning digital manufacturing technologies *(e1)*. This venture does not achieve a sustainable client base *(-e2)*. This does not deter them from pursuing an entrepreneurial journey *(m5)*. The second venture aims to combine traditional crafts with advanced manufacturing *(c4)*. Their main goal is to "recover appreciation for crafts", and approach the project from an intuitive, explorative mindset *(p2; c6)*, with heavy use of prototyping *(p3)*. The main obstacle they express is a lack of commercial motivation, and it is implied that they have not engaged with other disciplines to facilitate administrative tasks *(-p5)*. They do not pursue capital *(-e7)*, and the venture maintains an informal status. They express that they are yet to experience success or perceive a path forward *(-m3; -m4)*, as they have been unable to dedicate themselves fully to the venture *(-e5)*.

Founder NS04 – Improving User Experience of Environmental Accounting (Figure 2)

The founder, an academic and a practitioner, begins their journey with an interest to participate in the changing industrial landscape that results from increased awareness of sustainability *(e1; m4)*. This did not initially have a commercial incentive, but rather a desire to experiment and "play business" *(p2)*. From initial development of a prototype that could improve user experiences when measuring environmental impact *(p1; p3; e9)*, collaboration with a close tie *(p5)* and their network of clients *(e7)* led them to start a company. During development of the company, a conflict arises within the founding team *(-e13)*, which is promptly overcome *(e5)* and leads to a reframing of both the venture's value proposition and structure *(c2)*. The product is developed continuously *(p2)* and intuitively *(c6)*. The venture has obtained significant funding in the form of government grants, and now represents an opportunity for the founder to extend the reach and impact of their teaching *(c4; e8)*.

Founder NU01 – Rescuing Heritage through Collected Artefacts

This founder's journey begins with a personal family experience that involves the loss of all belongings. This leads them to seek to fill a personal void through collections of historical objects. They then pursue a fine arts degree, and through their creativity *(c1)*, personal vision *(e4; p3)* and a work ethic *(e12)*, are invited to become part of the local film industry. They perceive an opportunity to provide a service to said industry *(e1)*, but have

a difficult time separating the initial need for collecting with the possibility of creating a valuable service *(-c3; -e2; -e9)*. The business becomes reliant on their other sources of income. Although there is a strong desire to make the venture a success, the main struggle is overcoming the need to use it as a vehicle to "construct a personal identity through artefacts" *(-p1; -e5)*.

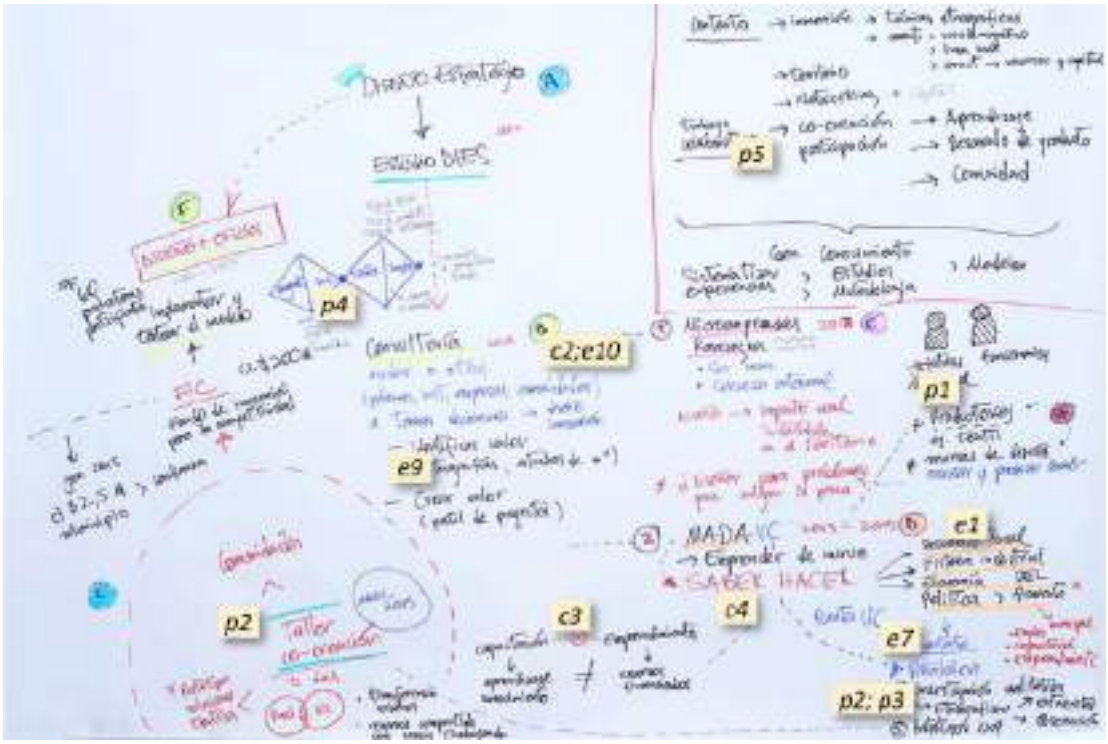

Figure 1: Founder SD03 Visual Narrative with Identified Design Thinking Traits and Entrepreneurial Competencies.

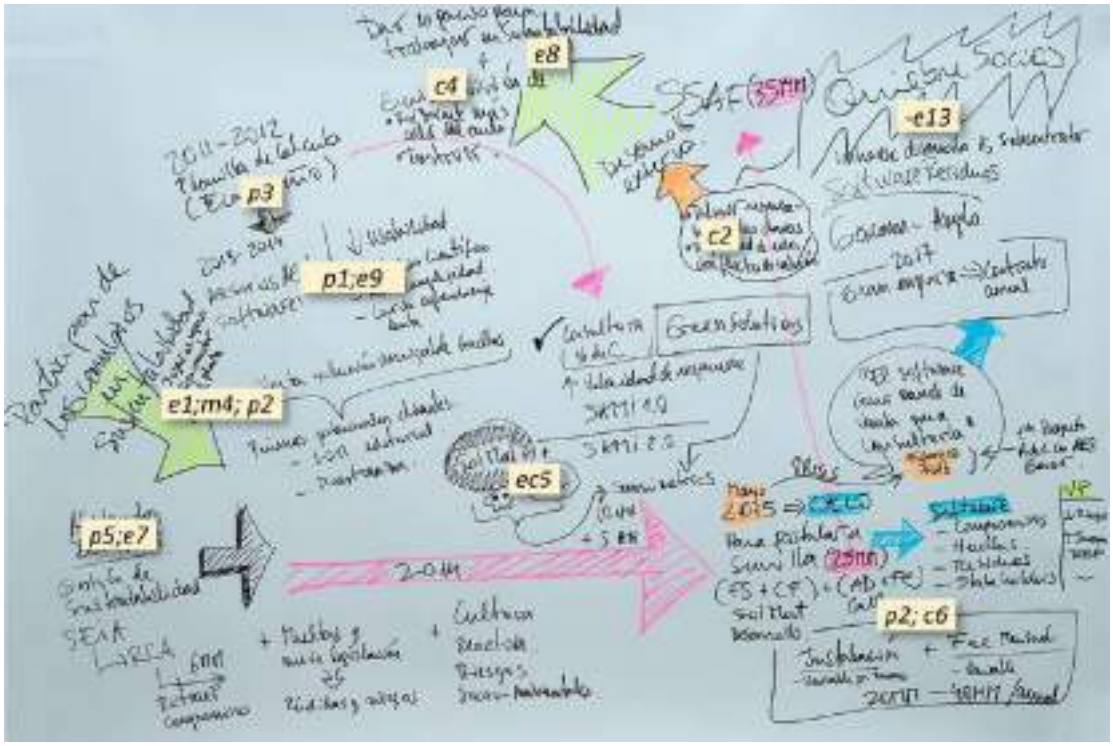

Figure 2: Founder SN04 Visual Narrative with Identified Design Thinking Traits and Entrepreneurial Competencies.

Results

The following section contains findings and observations based on the visual narratives, audio recordings and interview notes. Appendix i provides a summary of the design thinking traits present in participants' visual narratives. The presence of entrepreneurial competencies y available in Appendix ii.

General Findings

Each design thinking trait has been given an indicative score and ranked according to its presence in the narratives of successful founders. Based on this ranking, traits have been attributed a level of impact: high, moderate, low or potentially negative. Traits that were not present in four or more narratives, or whose impact seems negligible, have been omitted. It is important to note that these rankings should not be interpreted as quantitative or predictive. A synthesis of these observations is provided in Table 5.

Table 5: Design Thinking Traits: Presence, Score, Perceived Impact and Observations (S = Successful; U = Unsuccessful; D = Designer Founder; N = Non-designer Founder)

Trait	*S*	*U*	*D*	*N*	*Score*	*Impact*	*Observations*
Collaborative Work Style *(p5)*	11	0	7	4	19	High	Absence hindered success
Thinking by Doing *(p2)*	10	1	7	4	18	High	Overwhelmingly positive
Human-centred Approach *(p1)*	8	0	6	3	16	High	Positive when related to c3
Reflective Reframing *(c2)*	10	1	6	4	14	High	Absence hindered success
Integrative Thinking *(c4)*	8	1	5	4	12	Moderate	Present in S and U
Future-Oriented *(m4)*	8	1	6	3	11	Moderate	Absence hindered success
Holistic View *(c3)*	6	0	5	1	10	Moderate	Absence hindered success
Visualising *(p3)*	6	2	5	3	9	Low	Present in S and U
Divergence/Convergence *(p4)*	5	0	3	2	9	Low	Positive yet rare
Innovation *(p6)*	5	1	3	3	8	Low	Present in S and U

Some interesting outliers include: Tolerance of Failure (m5), which is predominantly represented in designer founders' narratives; and Blending Analysis and Intuition (c6), which has greater representation in the narratives of Non-designer founders.

To identify areas where the traits of design thinking failed to support the formation of opportunities, a similar process was undertaken with the thirteen entrepreneurial competencies. In this case, competencies were highlighted when having a high presence or a low presence. Synthesis of observations is provided in Table 6.

Table 6: Entrepreneurial Competencies, Absence, Score and Observations (S = Successful; U = Unsuccessful; D = Designer Founder; N = Non-designer Founder)

Competency	*S*	*U*	*D*	*N*	*Score*	*Observations*
Value Creation *(e9)*	8	0	5	3	19	Presence increased success
Resource Leveraging *(e7)*	7	0	5	2	14	Absence hindered or delayed success
Guerrilla Skills *(e8)*	6	0	3	3	12	Equal presence among SD and SN
Tenacity/Perseverance *(e5)*	4	1	2	4	8	Potential negative impact without e2
Opportunity Assessment *(e2)*	2	0	1	1	1	Lacking across all categories

Some additional observations include: Building/Using Networks *(e13)* was less present than the presence of Collaborative Work Style (p5) would suggest; Risk Management/Mitigation *(e3)* was also rarely mentioned.

Emerging Themes

From analysis of the visual narratives, it is possible to detect themes and patterns that emerge from the data. These are described below.

1. Interdisciplinary Collaboration is Critical (p5; e13)

Successful entrepreneurs recognise their skill gaps and seek to form collaborative arrangements with people from other disciplinary backgrounds. This occurs early in the opportunity formation process. This seems to contribute to a venture's longevity, as collaborators extend the founder's networks and impact of the project. Unsuccessful founders were either unaware of the possibility of collaboration, unfamiliar with the mechanisms of collaboration, or did not seem willing to engage with the expertise of people from other backgrounds.

2. Opportunities are formed by Doing and Reflecting (p2)

Consistent with the bias for action present in definitions of entrepreneurship, successful entrepreneurs from both categories show high degrees of learning through practice. They highlight successive stages of venture development that are characterised by low cost trials and use of prototypes to refine the venture concept. Sometimes these trials take several years and occur over several distinct entrepreneurial opportunities, with the learnings from each providing the necessary reflection and reframing of the problem for the next.

3. Human-centred Approaches are better when Holistic (p1; c3)

Successful founders from both design and non-design backgrounds highlight their use of continuous observation of the context in which they are executing the venture. This is particularly effective when coupled with a holistic view, including individuals, organisations, industries and regions in their identification of "user groups". Participants whose motivations were centred on personal development tended to have a harder time forming or evaluating opportunities. In these cases, there was little mention of a client, customer or consumer, and the project focused on developing a product or using a particular technology.

4. Tenacity can be a drawback if Opportunity Assessment is lacking (e5; e2)

Data analysis suggests that opportunity assessment is not as common as opportunity recognition. This leads to opportunities being pursued beyond the possibility for them to provide value. Successful entrepreneurs mention failure as part of their process, moving on to other opportunities over time. Unsuccessful entrepreneurs do not seem to have the ability to perceive the point at which a venture should not be continued.

5. Value Creation, when explicitly stated as a goal, is a factor for success (e9)

One of the most consistent aspects of successful founders from both backgrounds was a clear articulation that the purpose of their ventures was to create value, either for themselves, a customer, an industry, or society more generally. Unsuccessful founders did not mention the concept of value, regardless of the depth of their understanding of the concepts and frameworks of design thinking. It would seem that value, although a core component of innovation that is present in definitions of the design discipline, it is not an obvious concept.

6. Guerrilla Skills are widespread; Resource Leveraging is limited (ec8; ec7)

Although guerrilla skills and working in a clandestine manner to access low-cost resources were present in the narratives of entrepreneurs from both design and non-design backgrounds, it seems that designers are less aware of how to leverage resources. Successful design entrepreneurs understand mechanisms to access capital, such as government grants or debt, but the majority were not aware of concepts such as equity or fundraising. There seems to be a negative connotation to the concept of commercialisation, and having an initial profit motive is rarely described.

Discussion, Implications and Limitations

This exploratory study set out to answer the question of how the traits of design thinking may contribute to, hinder, or fail to support the formation of entrepreneurial opportunities, with a specific interest in how design thinking can be used to support development of entrepreneurial competencies among designers. Although the limited sample size and geographic scope of the study prevent a definitive statement on the ability of these traits to predict success, data analysis suggests that some traits have the potential to produce a greater

positive impact than others. This provides an interesting set of directions for further exploration and testing of these finding in other contexts.

Implications for Theory

The study did not find any design thinking traits to have a consistent hindering effect on opportunity formation. On the other hand, Collaborative Work Styles, Thinking by Doing and Reflective Reframing seem to have the greatest positive contribution to the formation of an opportunity. These traits parallel concepts from the entrepreneurial literature, such as bricolage (Fisher, 2012, p.1026-1028) the lean startup (Blank, 2013) and hypothesis-driven entrepreneurship (Eisenmann, Ries & Dillard, 2012).

An empathetic Human-centred Approach, commonly associated with design thinking (e.g. Brown, 2008), is not enough to ensure success. It is when this approach is combined with a Holistic View, perceiving organisations, industries and societies as "human", that it leads to greater outcomes. This is complemented when an Integrative view is present, considering technological and economic requirements alongside human needs. As above, this is also consistent with entrepreneurial literature. In particular, the dynamic systems perspective of an entrepreneurial firm, such as the concept of the business model (Zott, Amit & Massa, 2011; Osterwalder, 2004), and its recognition of customers, partners, activities and revenue streams as interconnected components of a venture's logic-flow (Frow & Payne, 2011; Osterwalder & Pigneur, 2010).

With regards to the shortcomings in design thinking's ability to support opportunity formation, there were several entrepreneurial competencies that were underrepresented, such as Resilience and Opportunity Assessment. Others, such as Value Creation and Resource Leveraging, were not widely present but showed an important contribution to venture success. It may be that Value Creation, abstractly embedded in the Human-centred approach and Innovation, needs to be more concrete and explicit in definitions of design thinking traits. One possible approach, drawing on the field of innovation, is to make the concepts of customer jobs (Bettencourt & Ulwick, 2008), jobs-to-be-done (Christensen, Hall, Dillon & Duncan, 2016), or the value proposition (Kambil, Ginsberg & Bloch, 1996; Osterwalder, Pigneur, Bernarda & Smith, 2014) into the design thinking lexicon.

The parallels between design thinking traits and entrepreneurial competencies are numerous, making it difficult to discern which of the two was present in individual narratives and the overall data set. Examples of this are: Tolerance of Failure (m5) vs Resilience (e11); Abductive Reasoning (c1) and Problem-solving (c5) vs Creative Problem-solving (e6); Future-Oriented (m4) vs Conveying a Compelling Vision (e4).

This leads to perhaps the most meaningful implication from this study: surfacing the overlap between design thinking and opportunity formation. This seems to signal a convergence in theory between the broader disciplines of design and entrepreneurship. This convergence is echoed in practice through the increasing participation of designers in the global entrepreneurship ecosystem.

Could this lead to a further evolution in the field of entrepreneurship, towards an interdisciplinary field of "design entrepreneurship"? Rather than focusing on the entrepreneurial opportunity, perhaps this field could assist in addressing the need for frameworks that enable the transition from opportunity to project (Klein, 2008, p.181). From this, possible avenues for further inquiry could be to explore and define the boundaries of design entrepreneurship as a field of research, and how the traits of successful design entrepreneurs could assist in the development of methods for entrepreneurial action.

Implications for Education

The previously described overlaps between design thinking and the formation of entrepreneurial opportunities provide valuable encouragement for the development of entrepreneurship programs in design education.

There are a several existing conceptual approaches, such as Laukkanen's (2000) Business Generation Model, and practical programs that have done this to achieve positive outcomes, such as Aalto University's IDBM Challenge (Lehtonen et al, 2018). Building on their work, and drawing from the findings and themes that emerged from this study, here are a few basic propositions that focus specifically on using design thinking to develop entrepreneurial competencies:

1. **Foster Interdisciplinary Collaboration:** create contexts that enable designers to begin engaging with representatives of other disciplines or industries early in their studies or careers;
2. **Make Entrepreneurship Continuous:** incorporate the concept of the entrepreneurial opportunity in every project. Include assessment of those opportunities at each stage, ending those with low

chances of success. Celebrate the end of each project as an important chance to reflect on and integrate learnings into the pursuit of a subsequent opportunity.;

3. **From Individuals to Social Systems:** ensure that designers perceive whole systems as their end users. Encourage them to visualise the connections and flow-on effects of designing for each component of those systems;
4. **Value Creation should be a Persistent Message:** coupled with the systems view, designers should be constantly reminded to describe their work not as a collection of features, but as a collection of benefits delivered to a wide range of stakeholders. Designers should be encouraged to measure those benefits in terms that are relevant to said stakeholders.
5. **Pitching for Funding should be part of the Design Process:** incorporate activities that involve acquiring resources from third parties from early on in their training. This could start small, such as B2C sales, but should build up to understanding a range of different funding sources, including crowdfunding, grants and venture capital. As with all design, this will be best learnt by doing.

Limitations & Further Research

Although exploratory in nature, this study possesses many limitations.

The major limitation of the present study is its reduced sample and limited geographic scope. The disparity in the number of successful and unsuccessful founders interviewed is due to both a limited timeframe for data collection and the difficulty in *ex-post* identification of unsuccessful ventures. Additionally, unsuccessful founders who had not initiated a subsequent venture were excluded for ethical reasons. Further research should aim to increase this scope, both geographically and in the number of unsuccessful opportunities whose visual narratives are captured. Of interest would be exploration of different cultural or industrial contexts to identify whether these have an effect on the opportunity formation process. Additionally, it would be of value to look at how design thinking is present in the processes of other specific disciplines, such as engineering, social sciences, art, etc.

The data collected suggests that success is not a binary variable, but rather a spectrum of achievement. Successful entrepreneurs, in particular those that had obtained government funding or revenue through their ventures, did not consider said achievements as measures of success. They were described as means to an end. Failure was similarly described. Success may not be a fixed state, with “successful” entrepreneurs perceiving themselves as being in a constant cycle of achievement and disappointment, with each experience providing insights and lessons to be implemented in the next iteration of the venture. This would require a new categorisation of research participants and a different data analysis technique. One possibility would be to develop a simple survey that could help to characterise the subjective level of success of a venture, complemented with quantitative metrics such as revenue, staff and third party use of intellectual property created by the venture. This could help with comparison and situating participants along the “success spectrum”.

A third limitation is the “visual narrative” and accuracy of data collection and analysis it affords. An unexpected outcome was that no participant, regardless of background, was discouraged by the prospect of visualising their entrepreneurial journey. The overlapping of concepts and interpretive nature of the flexible pattern matching both made it difficult to ensure that design thinking traits were comprehensively identified with an adequate assessment of their positive or negative impacts. Three possible improvements could be made for future studies. The first is further synthesising the design thinking and entrepreneurial competencies, avoiding redundancies that could lead to coding errors. Examples include the nuanced distinctions between Problem-solving (c5) and Innovation (p6) or Optimistic (m3) and Tolerance of Failure (m5). The second would be to structure the interviews in stages from the design thinking literature. For example, Inspiration, Ideation and Implementation (Brown, 2008, p.5). This would help to clarify which design thinking tools are best suited to each of these stages. Finally, limiting the diversity of visualisation materials to improve legibility, and embedding coding tasks in the interview itself through use of colour by the participant would reduce researcher bias in determining positive and negative effects of tools in the study.

Conclusions

The present study set out to contribute to an understanding of the role that design thinking plays in the formation of entrepreneurial opportunities. Through a visual narrative method, it was possible to capture rich picture diagrams about the experiences of fourteen founders from a range of backgrounds and industries.

From this study, it is possible to say that most of the practices, cognitive processes and mindsets of design thinking have the potential to facilitate the formation of entrepreneurial opportunities. The most important impacts were produced through collaborative workstyles, thinking by doing and reflective reframing. The human-centred approach also produced a positive impact when combined with a holistic view of social and industrial systems. A key aspect that could be further emphasised in design thinking is the importance of value creation for stakeholders, including the founders themselves. Designer founders seemed to lose focus of potential returns and as such may be inadvertently limited in the scope of the opportunities they form. This could be addressed by also highlighting the importance of resource leveraging, specifically accessing capital markets, as this could increase the ambition and impact of opportunities formed. The study also finds interesting parallels between the fields of design and entrepreneurship that could lead to interesting interdisciplinary research opportunities.

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Appendices

Appendix i: Design Thinking Practices, Cognitive Processes and Mindsets present in visual narratives of Successful (S), Unsuccessful (U), Designer (D) and Non-Designer (N) founders.

	SD01	*SD02*	*SD03*	*SD04*	*SD05*	*SD06*	*SD07*	*SD08*	*UD01*	*SN01*	*SN02*	*SN03*	*SN04*	*UN01*
dt_P1	0	2	2	2	2	2	2	0	0	1	0	1	2	-1
dt_P2	2	0	2	2	0	2	2	2	2	2	2	2	2	0
dt_P3	2	0	1	2	0	0	2	0	2	0	2	0	2	2
dt_P4	0	2	1	0	0	0	0	2	0	0	2	2	0	0
dt_P5	2	0	2	2	1	2	1	2	-1	1	2	1	2	0
dt_P6	0	1	0	0	1	0	0	2	0	0	1	1	0	2
dt_C1	0	1	0	1	0	0	2	2	0	0	0	0	0	0
dt_C2	0	1	1	1	0	2	2	2	1	2	1	2	1	0
dt_C3	0	1	1	0	2	2	2	0	0	1	0	0	0	-1
dt_C4	0	0	2	0	1	1	2	2	2	2	2	0	2	0
dt_C5	0	0	0	0	0	2	2	0	0	0	1	0	0	0
dt_C6	0	0	0	0	0	0	0	1	1	1	0	2	1	0
dt_M1	0	0	0	1	0	0	1	2	1	0	1	2	0	0
dt_M2	1	0	0	0	0	0	0	0	0	0	0	2	0	0
dt_M3	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
dt_M4	0	0	0	2	2	2	2	2	-2	0	2	2	1	0
dt_M5	1	2	2	1	0	1	0	0	1	0	0	0	0	0

Appendix ii: Entrepreneurial Competencies present in visual narratives of Successful (S), Unsuccessful (U), Designer (D) and Non-Designer (N) founders.

	SD01	*SD02*	*SD03*	*SD04*	*SD05*	*SD06*	*SD07*	*SD08*	*UD01*	*SN01*	*SN02*	*SN03*	*SN04*	*UN01*
ec1	1	1	1	1	2	1	2	2	1	0	0	1	1	2
ec2	0	0	0	-1	0	2	0	0	-1	0	2	0	0	-1
ec3	0	0	0	0	0	2	0	0	0	0	2	0	0	0
ec4	0	0	0	0	2	0	1	2	0	2	0	2	0	0
ec5	0	1	0	0	0	0	0	0	-1	2	0	1	1	-2
ec6	0	0	0	0	1	0	0	0	0	0	1	0	0	0
ec7	0	0	2	1	0	2	2	2	-1	0	2	0	2	0
ec8	2	0	0	0	0	0	2	2	0	2	0	2	2	0
ec9	0	2	2	0	2	0	2	2	0	2	0	2	2	-1
ec10	0	0	1	0	0	2	0	1	0	0	1	2	0	0
ec11	0	1	0	0	0	0	0	0	0	0	0	0	0	0
ec12	0	2	0	0	0	0	1	0	0	0	1	1	0	2
ec13	-1	0	0	0	0	0	1	2	0	1	2	1	-1	0

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Contamination Lab of Turin (CLabTo): how to teach entrepreneurship education to all kinds of university students

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Interest in offering Entrepreneurship Education (EE) to all kinds of university students is increasing. Therefore, universities are increasing the number of entrepreneurship courses intended for students from different fields of study and with different education levels. Through a single case study of the Contamination Lab of Turin (CLabTo), we suggest how EE may be taught to all kinds of university students. We have combined design methods with EE to create a practical-oriented entrepreneurship course which allows students to work in transdisciplinary teams through a learning-by-doing approach on real-life projects. Professors from different departments have been included to create a multidisciplinary environment. We have drawn on programme assessment data, including pre- and post-surveys. Overall, we have found a positive effect of the programme on the students' entrepreneurial skills. However, when the data was broken down according to the students' fields of study and education levels, mixed results emerged.

Keywords: Entrepreneurship education, design thinking, entrepreneurship, design education

Introduction

The European Commission defined a sense of initiative and entrepreneurship as "key competences [..] which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment" (EC, 2006, pp. 4). Therefore, local, national and international actors (universities, business incubators, foundations, corporations, policy makers) are working together to promote Entrepreneurship Education (EE) for all kinds of university students (Katz, 2008; do Paço et al., 2011; Duval-Couetil, 2013). This is probably due to the fact that EE increases the students' entrepreneurial competencies (e.g., Man and Lau, 2005; Phan and Siegel, 2006; Pittaway and Edwards, 2012; Duval-Couetil, 2013; Shahab et al., 2019), entrepreneurial intention (e.g., Kolvereid & Moen, 1997; Peterman and Kennedy, 2003; Fayolle, 2005; Shahab et al., 2019) and entrepreneurial activities (e.g., Kolvereid & Moen, 1997; Mueller & Goic, 2003; Florin et al., 2007). Moreover, entrepreneurial competencies can be valuable, not only to create start-ups, but also to work in innovate corporations, since they require entrepreneurial mind-sets and pro-active employees. In addition, universities have increased attention towards EE as part of their 'third-mission' (Siegel and Wright, 2015; Birtchnell et al., 2017) in order to foster the entrepreneurial culture of their students and to develop the local entrepreneurial ecosystem. Therefore, there has been a remarkable expansion in the number of programmes devoted to EE (e.g., Katz, 2008; Fretschner and Weber, 2013), in part because students have expressed a desire to participate in EE programmes (Peterman and Kennedy, 2003).

However, despite its popularity, the vagueness of the EE teaching goals (Hoppe, 2016) and its pedagogical approaches (Thursby et al., 2009; Piperopoulos & Dimov 2015; Nabi et al., 2017), there are still some important weaknesses that future research should try to face. For instance, there is a need to create more practical-oriented entrepreneurship courses (Cooper et al., 2004), and the introduction of design thinking into EE may be a solution to this need (Glen et al., 2014). Moreover, the impact of the entrepreneurial abilities of EE students might vary considerably, according to the students' characteristics (Piperopoulos & Dimov, 2015; Maresch et al., 2016) and the content and pedagogy of the entrepreneurship course (Piperopoulos & Dimov, 2015). Most studies on EE (see Nabi et al., 2017 for a recent literature review) have analysed an EE course offered to a specific field of study (e.g., management) and a specific educational level. Therefore, it is not clear how to teach entrepreneurship to students from different backgrounds and with different levels of education (e.g. bachelor and master), since most of the EE literature refers to a single field of study, which is mainly related to business curricula. However, it is important to teach entrepreneurship to students from different backgrounds in order to create multidisciplinary teams, thus fostering an innovative and entrepreneurial mind-set. Colombo and Grilli (2005), for instance, using the human capital theory, suggested that entrepreneurial teams composed of team members from different backgrounds perform better than others. Moreover, if a student works for an innovative company, he/she will probably work in a multidisciplinary team. This suggests that EE in a multidisciplinary environment is also important for students interested in innovation. In fact, several companies make employees from different backgrounds work together as a strategy to deliver innovative products/services. In addition, companies are increasing their open innovation strategies through the creation of different activities, such as corporation incubation programmes (Becker and Gassmann, 2006; Kohler, 2016). For all these reasons, it is important for students to learn how to work in multidisciplinary teams.

This paper, in order to overcome these drawbacks, is aimed at explaining how it is possible to combine design thinking with EE in order to develop a practical-oriented entrepreneurship course. Moreover, we suggest how entrepreneurship may be taught to students from different fields of study and with different educational levels and help them to work in multidisciplinary teams. In order to do so, we have investigated the entrepreneurship activities developed by the Contamination Lab of Turin (CLabTo) in Italy. We decided to analyse CLabTo because it is a recent programme that was funded by the Ministry of Education, University and Research (MIUR) in Italy in 2016, that is aimed at fostering the entrepreneurial and innovative abilities of all kinds of university students. The aim of CLabTo is to enhance the students' specialised expertise and integrate it with new capabilities to face new, uncertain and complex situations in the real world (e.g. solving real-life/entrepreneurial/societal problems) through learning-by-doing. In CLabTo, we combine EE with design thinking, design methods, cognitive processes, techniques and sensibility for solving problems (Glen et al., 2014).

Following the structure of Thursby et al. 2009, we have drawn on programme assessment data. We administered pre- and post-surveys to the participants to assess the barriers and the obstacles to teaching entrepreneurship in a multidisciplinary environment. Out of 62 participants, 56 participants answered both the pre- and post-surveys, thus yielding an effective response rate of 90.3%. In general, we found a positive effect of the programme on the students' entrepreneurial skills. However, when the data were analysed after breaking them down into the students' fields of study and their education level, mixed impacts emerged for the course on students' entrepreneurial skills. Moreover, on the basis of their answers, it emerged that students liked the multidisciplinary environment of CLabTo and the fact that it is based on real cases and a learning-by-doing approach. However, since our sample was only composed of 56 students and a control sample was not available, our analyses can only be considering qualitative.

We contribute to the theory of literature on entrepreneurship by adding our case study to the structure of Thursby et al. (2009) and by explaining how entrepreneurship may be taught to different levels of university students. Moreover, as suggested by Glen et al., (2014), we suggest how design thinking and EE may be merged in order to develop a practical-oriented entrepreneurship programme, thus contributing to the discussion started by Nielsen and Stovang (2015) by creating knowledge about the cross-over of design thinking and EE. Lastly, this study has a practical implication for scholars, teachers and policymakers interested in how to teach entrepreneurship in a multidisciplinary environment.

This section is intended to frame and introduce the relevance of the topic. The next section will focus on the literature review in order to articulate where this new research is located and how it could add new knowledge. The CLabTO programme is introduced in section 3 as a key study to explain how to integrate EE and design thinking. We show the results obtained on the basis of the Clab teaching model in section 4 and the

answers received from the pre- and post-surveys, including the overall degree of satisfaction with the programme. A discussion on the results is presented in the fifth section, together with the limits and implications for future research.

Literature review

According to Rae & Carswell (2000), a learning-by-doing programme enhances the development of student's entrepreneurial competencies. In fact, Cope and Watts (2000) explained that individuals learn from experiences and failures. Therefore, it is important for students to test and try their hypotheses through real project-work in order to develop their skills. Moreover, such an activity allows students to work in a real-case project on their own ideas, which can help them and teachers to create a more innovative and experimental environment, in part because students are more enthusiastic about working on their own ideas. In addition, the recent social and technological changes that have taken place blur organisational boundaries and emphasise collaboration (Browder et al., 2019). Therefore, it is important for students to know how to collaborate in a multidisciplinary environment. However, collaborating with people from different backgrounds can be complex, and it requires some experience. It is possible to understand, from the literature, that technical students (from engineering and natural science) lack skills in management, communication and team-based problem solving, all of which are critical for decision making in innovation-related careers (Thursby et al., 2009). Moreover, Thursby et al. (2009) suggested that there is a growing need to address this gap without sacrificing specialised and in-depth technical training. In fact, many critiques of Business school education emphasise the need to overcome the rational analytic approach of such curricula, which have been proved to address the complexity of real-life and entrepreneurial problems in an unsatisfactory manner (Glen et al., 2014; Nielsen and Stovang, 2015; Taatila, 2010; Huber et al., 2016). Furthermore, they suggest introducing practical approaches, such as design thinking, to unlock the potential of entrepreneurial and innovative students to deal with practical cases and active learning, in order to help business students develop design skills and mind-sets. On the other hand, another strand of literature points out the need to introduce EE into the curricula of design schools to increase the ability of design candidates to turn product ideas (concepts) into actions and to develop managerial, economic and strategic thinking skills (Gunes, 2012). In fact, EE is expected to allow designers to develop entrepreneurial skills and mind-sets, in order to create new jobs in the future and to become major drivers of economic growth through creativity and innovation (Gunes, 2012).

In this work, we seek to demonstrate that design thinking should play a fundamental role in EE that is complementary with business education (Glen et al., 2014, Nielsen and Stovang, 2015) for any field of study. The two disciplines should coexist in a practice-base new course that is able to encourage students to participate with a learning-by-doing approach centred on action (Joannisson et al., 1998). Several studies have proved that EE, in order to be efficient, must be practical (e.g., Cooper et al., 2004). Thus, we have used design pedagogy to provide the practical approach and stimulate thinking outside the box for any field of study, that is, not just the managerial or design fields.

The CLabTo programme

Introduction to the Contamination Lab (CLab) programme and to CLabTO

The CLab programme is a nationally funded programme that now counts 22 CLabs in Italy. Each of these CLabs is recognised at a ministerial level (Directorial Decree no. 315 of 29 November 2016). This entrepreneurship programme involves two universities in Turin – the Politecnico di Torino and the University of Turin – in which both technical and humanistic disciplines are taught. The CLabTo programme has the aim of developing the students' skills in running their own businesses, as well as in working in highly innovative contexts, by training them through EE and design methods with entrepreneurial and real-life challenges. The goal of CLabTo is twofold. On the one hand, it has the aim of creating the entrepreneurial intention of students to become entrepreneurs or innovators. On the other hand, it seeks to help students to develop skills (such as problem solving, team working, etc.) that are increasingly being requested by companies that operate in innovation fields by introducing design thinking into EE.

Programmes

CLabTo is a sprint-like challenge-based programme that is directed towards innovation. It combines EE and design thinking by allowing students from various backgrounds to apply them to real challenges in the industrial or academic worlds. It includes three different programmes which have three different intents, durations and expected outcomes.

The intention of Type 1 (CLab Workshop) is to generate new ideas in the form of feasible concepts and it lasts 1 or 2 weeks. Type 2 (CLab Sprint) includes prototyping and it lasts from 2 to 4 weeks. Type 3 (CLab Master) has the goal of validating technical, business performances and IP studies to forward the ideas and the prototypes to a more advanced stage, and it lasts from 3 to 6 months. Each of these 3 programmes is divided into courses (training) and team experience (team working). In other words, the first part involves a discussion between students and professors from different research fields. This first part is aimed at filling the theoretical-methodological and entrepreneurial gaps of the students with diverse curricula and from different backgrounds. The professors teach the students the skills necessary to address specific real-life problems and propose coherent and innovative solutions. Professors from different departments and research fields also increase the multidisciplinary aspect of delivering pedagogy. The second part mostly involves team-based work where the students have to face a complex and unpredictable situation within a multidisciplinary environment within which they have to consider several variables. In the second part, professors, experts from industry and entrepreneurs help students by giving feedback on their team-work as mentors/tutors. This second part is aimed at representing a real case as much as possible. CLabTo engages students in tasks, activities and projects that should enable them to acquire key entrepreneurial skills and competences in a real-life situation (Nielsen and Stovang, 2015).

Structure of the challenges

In this paper, we have analysed two types of challenge since, until now, we have organised only three challenges: two type 1 challenges (CLab Workshop) and one type 2 challenge (CLab Sprint). However, the overall duration of both types was limited to two weeks. The structure of these challenges is described hereafter.

The type 1 programme focuses on generating new ideas and exploring alternative solutions in order to allow the students to think beyond technological push solutions, by considering the centrality of the user they are designing for and thus reframing the needs to which they have to respond with different solutions. This type of challenge leads students to develop concepts that are characterised by a certain degree of technical and economic feasibility. Moreover, the solutions are usually iterated with the relevant stakeholders from the local ecosystem during revisions, meetings and intermediate presentations. The type 2 programme, instead, introduces the production of working prototypes, which are developed in a suitable environment for prototyping activities, the Fablab Torino. The students have the chance to experiment with shape and materials through different technologies (Browder et al., 2019), such as 3D Printing, CNC machining, programming on Arduino and Raspberry Pi shields, and are supported by mentors (Figure 1). During these challenges, the focus is more on the process than on the outcome.

Figure 1: Fablab tutoring

As far as the overall structure of the challenge (both type 1 and 2) is concerned, during the first days, the students are required to build their multidisciplinary teams, an activity that is facilitated by team-building exercises. We relied on a team of researchers from the Department of Psychology of the University of Turin, led by professor Cristina Mosso, to perform this activity, settle disputes and balance skills and competencies.

During the first week, we provided the students with short teachings (1-2 hours) on sustainability, entrepreneurship, design thinking, digital innovation and communication, that is, the mandatory modules of our programme, which were delivered by professors from different departments. In the same week, they were also taught challenge-specific contents by university faculty members (both professors and researchers) and industry mentors (entrepreneurs and experts). The organisation of these classes is dealt with in detail in the result section and the students' feedback is commented on. The second week, in the type 1 programme, the students worked in teams to develop their ideas with the support of tutors and mentors, while in the type 2 programme, they worked in teams to develop both their ideas and a working prototype in the FabLab Torino, and on this occasion they were supported by makers, computer engineers and other tutors. On the last day of the challenges, they performed a 10-minute pitch in which they presented their ideas to an audience that included CLab programme members, university faculty members, industry mentors and members of the university incubators.

The first challenge was a type 1 challenge on the specific topic of electric mobility, in cooperation with Iren S.p.A.[1], and it took place in July 2018. The second was a type 2 challenge on the topic of sustainable food conservation, which took place in November 2018, and the third one (type 1) on the potential impact of new technologies (such as AI) on our future life and jobs, which also involved the Visionary association[2], took place in December 2018.

These specific challenges gave the students the opportunity to test their theoretical knowledge in a practical case in multidisciplinary teams and then learn from the others and through mistakes and feedback from the mentors. Each participant provided his/her knowledge and expertise to a programme where there was room to make mistakes, to test and to experiment. In fact, since there was no exam, the students felt free to make errors and to try. They learned more about the specific topics from the tutors, mentors and professors from both industry and academia. CLabTo in fact collects students who are interested in a topic, whatever background they have, provided they have been enrolled in university. The followed teaching model gives rise to the cognitive difference theorised by Reynolds and Lewis (2017). It includes an enhancement of the difference in perspectives and how students elaborate and process information (knowledge processing), as well as how they think about and engage with new and complex situations (Reynolds and Lewis, 2017).

Opportunities

Although multidisciplinary, collaborative learning projects that inspire entrepreneurship are not unusual, the CLabTo programme is extracurricular and it is intended for students from all fields of study and from different university educational levels who are willing to take on a challenge pertaining to a specific topic. Therefore,

CLabTo allows an entrepreneurship programme to be developed for all the enrolled students, albeit outside the university environment, but closely related to it. This is in line with what Thursby et al. (2009) expressed:

> *Introducing entrepreneurship education to graduate programs is challenging because they are typically highly structured and allow little room for courses outside the primary discipline.*

CLabTo was created to solve certain problems (such as credits for different students from different departments, different professors involved in a course), with the intent of being a neutral place where they could conduct experiments. In this way, different types of teaching that could be relevant for EE are now accessible to the various students in a single place. CLabTo adopts teaching methods and space layouts for teaching and team work which stimulate cooperation among the students who work in teams. We witnessed an active role of the participants and a revised the role of the teachers as tutors and facilitators, who were willing to learn from the students and to build the programme with them (Celaschi, 2008). Although this type of approach was originally theorised for design curricula, it should be noted that it is somewhat novel for other types of students who are not used to receiving design pedagogy. On the other hand, students in design schools often discuss and negotiate their ideas with other stakeholders from different fields, but it is not as common for designers to work effectively in transdisciplinary[1] teams, mainly with non-designer students. Combining EE and design thinking, in addition to the previously mentioned characteristics, makes the CLabTo programme different from those that have already been analysed in the literature. This programme includes business and design pedagogies, but it is not intended specifically for business or design students.

According to Yee et al., (2017), the importance of the design process can be summarised as:

1. a cultural catalyst, which promotes both openness and pragmatism;
2. a framework maker, which provides and organises the whole project system (information, spaces, partners, etc.);
3. a humaniser, which encourages empathy in the creative process;
4. a power broker, which tries to break down prejudices and maintain the human-centric focus;
5. a friendly challenger, which encourages an environment of openness and trust and spurs a constructive critique of each-others' work;
6. a technology enabler, which ensures the as fluid as possible transition between physical to digital and the other way around;
7. a community builder, which attracts people (students, mentors, specialists, etc.) with the final goal of enlarging the network of participants to create important impacts.

In addition, another important factor of CLabTo is its focus on sustainability (social, economic and environmental) for all the CLabTo challenges, since there is growing attention on this topic (UN SDGs (2015).

Teaching environment

Since the classroom layouts and University spaces usually dedicated to teaching are unsuitable for these kinds of activities (Nielsen and Stovang, 2015), we provided a physical environment for learning and team work that allows a complete reconfiguration, according to the type of activity that has to be performed. We avoided fixed furniture and opted for wheeled furniture that could be arranged to best satisfy the needs of the students' activities. In this environment, the professors chose the best layout according to the type of lesson, and preferred to sit among the students in circles, or they divided the students into groups for group exercises. Moreover, as mentors, they gave them feedback on their work. In addition, each table was individually cabled and this allowed projection onto a canvas and audio play from any part of the room. This allowed the students and professors to work in a more informal and open environment.

Description of the study population

In this paper, we refer to the study population by reporting data pertaining to all of the participants in the 3 challenges described in the previous section (e-mobility, food conservation and visionary). Overall, from July to

[1] Herein, we refer to transdisciplinary team work, since students from different backgrounds created outputs that are completely new and different from the outputs achieved by means of multidisciplinary cooperation. They integrated their perspectives with a holistic approach that falls outside any disciplinary boundaries.

December 2018, 62 students took part in these 3 challenges and they therefore represent the study population.

The study population was composed of 61% men and 39% women. Of these, 75% were MSc, 25,5% BSc and the remaining students were PhD candidates. It can be noticed, from Figure 2, that 16 students came from humanities, 13 students were engineers, 12 came from management or management engineering, 11 were designers or architects and 10 came from natural sciences. Some of these categories were identified by Thursby et al. (2009) i.e. Engineering, Management and Natural Science, and we added two extra categories, that is, Design&Architecture and Humanities.

This varied and extremely multidisciplinary sample was a good starting point for the creation of 16 heterogeneous teams.

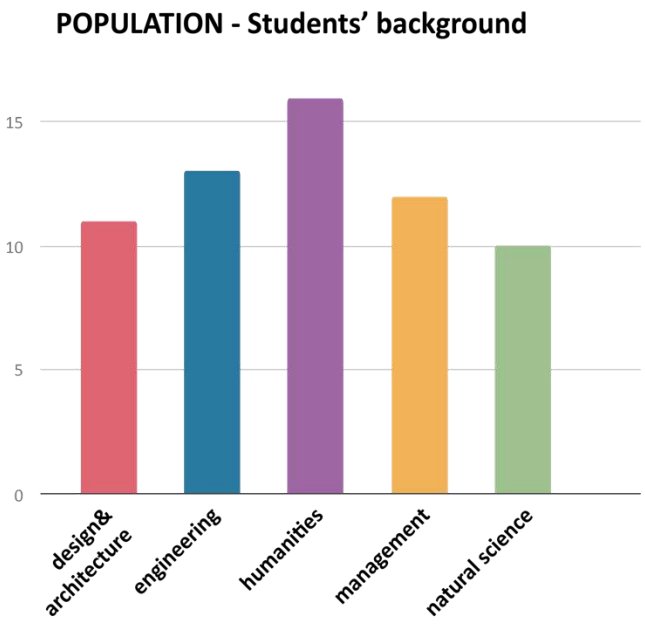

Figure 2: Students' backgrounds divided into categories

The study population of the challenges was generally aged between 20 and 34 years, with an average age of 25 years. The age distribution of the study population showed a peak between 25 and 26 years.

We developed and administered pre- and post-surveys to assess the students' perceptions of their skills or multidisciplinary competencies on entry and exit (Thursby et al., 2009). Data from these surveys allowed us to evaluate the effects of student learning across degree programmes. The assessment goals were both formative and summative, so that the students' feedback and performances could be used to improve the programme (Thursby et al., 2009).

Results

Combining EE with design thinking

As working in innovative sectors and entrepreneurship is increasingly heading towards transdisciplinary collaboration, students will find themselves collaborating with people who have different mind-sets. This EE type of path seems suitable to provide skills that would otherwise not be provided by traditional training. The ability to change their mind-sets in order to communicate effectively and to co-design with people with different curricula will be an essential skill for workers in the coming decades, as indicated by the EU commission (EC, 2006, pp. 4) and by Colombo and Grilli (2005), whether the students decide to start an entrepreneurial path or decide to be employed in stimulating and innovative environments. In fact, even within start-ups when the team is particularly homogeneous, in terms of background and *forma mentis* (in the way to engage with and think about change), this slight cognitive diversity and multidisciplinary reduce their versatility in how to approach a task and their ability to accomplish it (Reynolds and Lewis, 2017). It has been

proved that colleagues usually gravitate towards people who think and express themselves in a similar way (like-minded teams) and have limited ability to see things differently (Reynolds and Lewis, 2017).

For this reason, we tracked the composition of the teams during the proposed challenges in order to make sure a certain degree of cognitive diversity and multidisciplinarity was satisfied. Introducing team building in the first two days of the challenge was appropriate to prompt the students to get to know and compare a small number of people before the onset of friendship or bias among the classmates.

The teams so far have been composed of 3 or 4 people with at least 3 different skills. The winning teams of the three challenges were in fact constituted by four students from three different fields of study, which implies that two students for each team were from the same field of study, as is shown below:

1. E-mobility: two students from Humanities, one from Design&Architecture and one from Engineering;
2. Food conservation: two students from Design&Architecture, one from Management and one from Natural Science;
3. Visionary: two students from Natural Science, one from Engineering and one from Management.

However, it should be noted that the students from the same field of study belonged to different courses and had different levels of education.

Challenge-specific results

During the type 1 challenge on e-mobility, the students were asked to provide a feasible solution to multimodal transport that included all-electric vehicles, that is, from car sharing to scooters and bicycles. The students provided 8 interesting possible solutions, and the winning team focused on a solution that benefited from the historic and well-distributed tram network in the city of Turin, suggesting the provision of multifunctional power stations near the existing junctions.

During the type 2 challenge on food conservation, the students hypothesised alternative food preservation methods. In the prototyping phase, they experimented machine learning, voice recognition and shape recognition of food (Figure 3), as well as temperature/humidity recording and automatic correction measures (Figure 4). The winning team demonstrated, with humidity and temperature sensors, the effectiveness of the pot-in-pot system[2], which consists of two clay containers with wet sand in the cavity, which is able to maintain low humidity and to lower the inner temperature below the environment one. This solution does not require the use of energy and it is suitable for preserving fruit and vegetables. They developed a system of containers that can be integrated in any European domestic environment.

Figure 3: Machine learning, voice recognition and shape recognition of food

[2] Pot-in-pot is a traditional African system that is used to cool the temperature of foodstuffs, which is achieved through direct evaporation generated by exposing the container to the sun.

Figure 4: Temperature and humidity monitoring prototypes

A gaming-based education system which benefited from augmented reality and learning systems won the third challenge (type 1) on Visionary solutions. The students were supported by computer scientists, natural scientists and researchers in the field of Information and Communication Technologies.

Survey results

The results of the two surveys distributed to the CLabTo participants, which resulted in a high response rate of 90.3% (56 students out of 62) were used to form the survey sample. The surveys were given to the participants before and after the challenge, and they are here referred to as the pre-challenge and post-challenge surveys.

To assess the extent to which the CLabTo classes and team experience contributed to fostering the professional development of the students, they were asked. in both the pre- and post-surveys, to provide a self-assessment of their capabilities and perceived expertise in each of the six skills listed in Table 1. These entrepreneurial skills were taken from GUESSS[3].

Table 1: Six skills on which the students were asked to give a self-assessment

Skills					
Creating new products and services	Managing innovation within a firm	Commercialising a new idea or development	Building up a professional network	Identifying new business opportunities	Successfully managing a business

The first three items refer explicitly to the innovation and development of new ideas/products/services. The fourth one is about belonging to a professional network, while the last two refer to vision and management business aspects.

The students' self-declared capabilities were ranked on a 5-point Likert scale, where 1 refers to very low competence, 2 refers to minimally capable, 3 to adequate, 4 expresses good competence and 5 refers to very high competence. The results are shown in Figure 5.

[3] GUESSS is a large, global research project on student entrepreneurship. More information is available on: http://www.guesssurvey.org/.

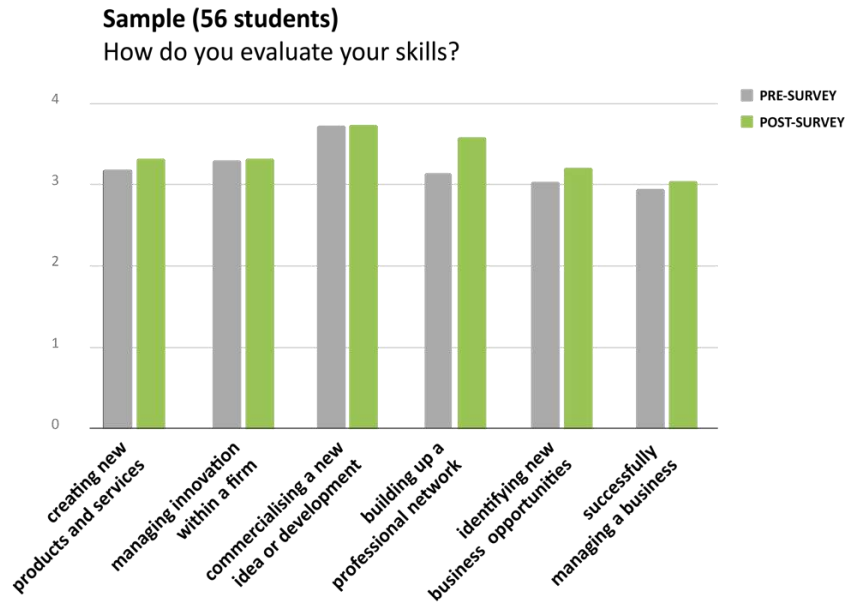

Figure 5: The overall perception of students' pre- and post-challenge skills

At a first glance, it seems that the students' perception of their skills (pre- and post-challenge) increase slightly, which is a good result, considering the limited duration of the programme. However, if the data are analysed by breaking them down into the students' fields of study and their education level, it can be observed that some students benefited more than others from this type of education. The remaining part of this section is dedicated to discussing the obtained data by exploring what happened according to the different education levels of the students (graduate and undergraduate) and the different fields of study (Design&Architecture, Engineering, Humanities, Management, Natural Science).

Differences in results for the BSc and MSc students

On entry to the programme, the BSc students differed from the MSc students for all the capabilities; the results indicate that the MSc students (39 individuals) perceived higher capabilities than the BSc students (16 individuals) (Figure 6). However, at the end of the programme, the situation was completely reversed, with the MSc students feeling they had little or no gains, while the BSc students perceived a greater gain, as shown in Figure 7.

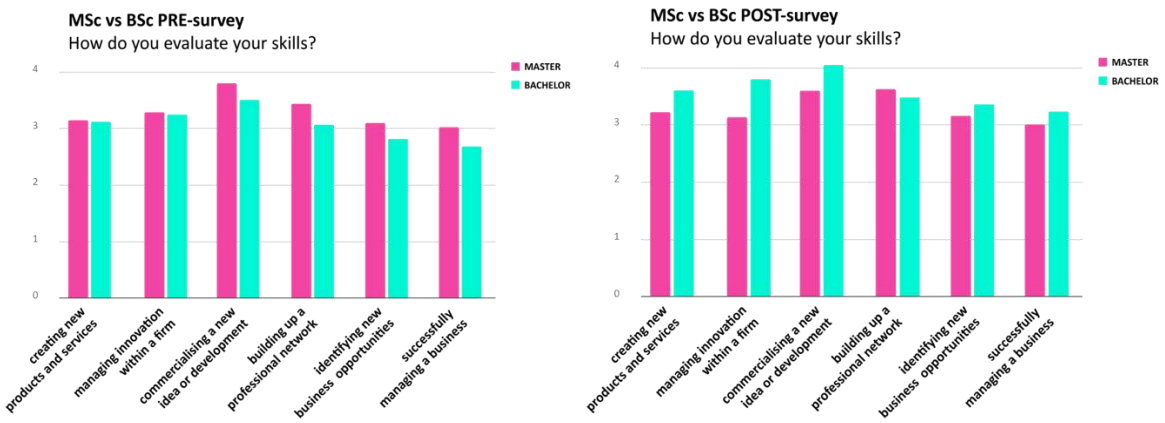

Figure 6: The perception of the MSc and BSc students on entry to the programme and at the end of the programme

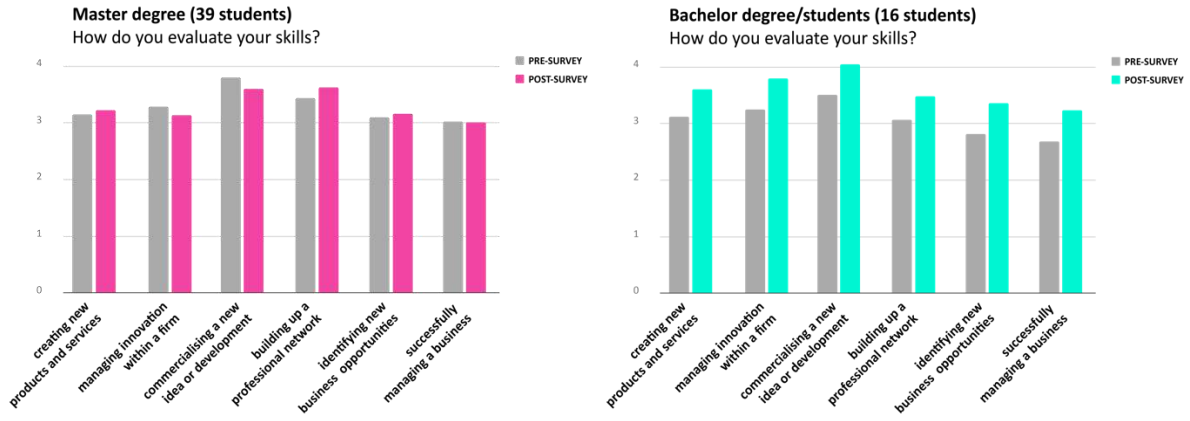

Figure 7: The perception of the MSc and BSc students about their skills (pre- and post-challenge)

Comparing the pre- and the post-challenge perceptions, it emerges that the Bachelor students showed the greatest gain in perceived skills during the course. It also emerges that the MSc students, in some cases, perceived a decline of their skills, such as "managing innovation" and "commercialising a new idea or development". However, since our sample is only composed of 56 students (even though they answered on both the pre- and post-challenge) and no control sample was available, our results can only be considered qualitative.

The results according to the students' backgrounds

In addition to the difference between the MSc and BSc students, the perceived skills of the students are presented in this section, divided according to the fields of study (Figure 8).

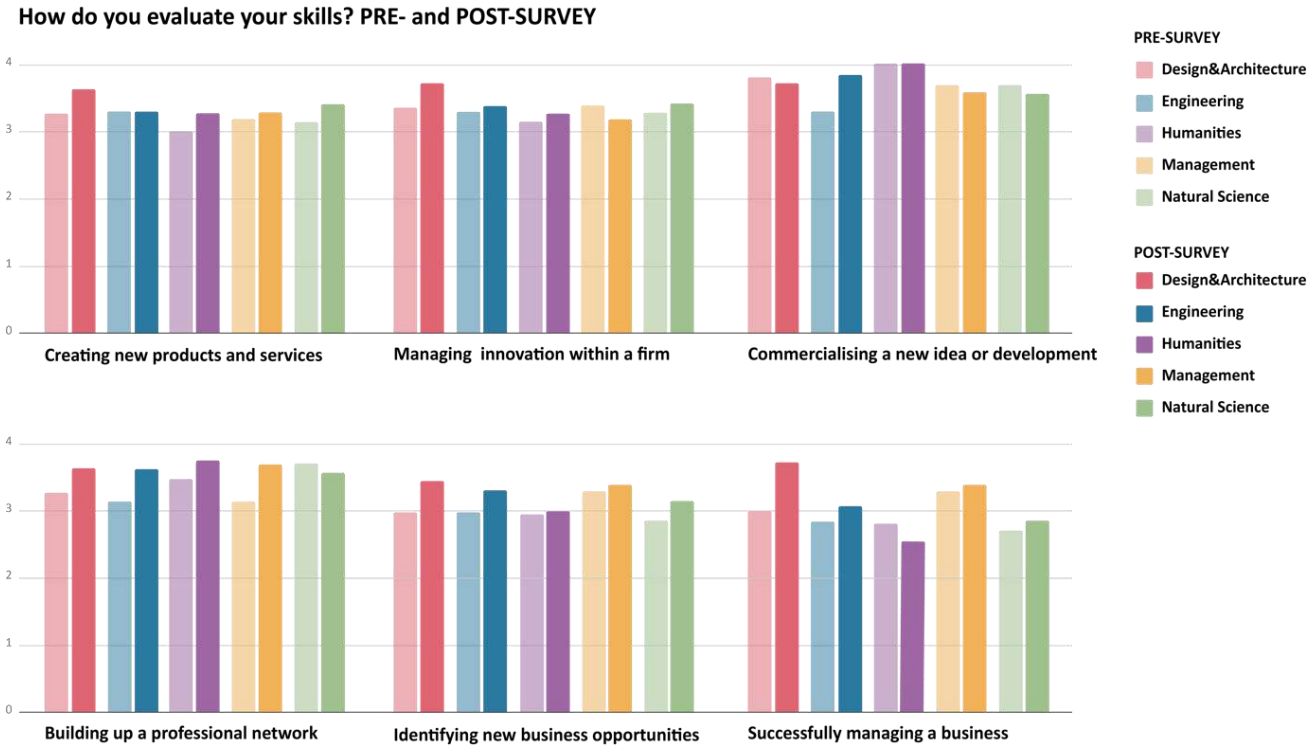

Figure 8: The students' perception of their entrepreneurial skills according to GUESSS.

As far as the two innovation-related aspects, i.e. "Creating new product/services" and "Managing innovation within a firm" are concerned, an increase was observed from the entry to exit levels for all the student categories, except for the management students who declared a decrease in "Managing innovation within a

firm" from the pre- to the post-surveys. Designer students experienced the greatest gain, and they were followed by the natural scientists. This may indicate that this entrepreneurial course and the CLabTo's environment are able to foster these two innovation-related aspects of students from design and natural science. As far as the third innovation-related aspect (Commercialising new ideas or development) is concerned, this entrepreneurial skill decreased for all the students, except for the engineers. We have hypothesised that this is due to the fact that all the students had over-evaluated their capabilities on entry and found themselves facing difficulties during the programme on this topic. The "Building up a professional network" skill increased significantly for all the categories, except for the natural scientists. A satisfying sense of belonging developed during the programme for all the other students. The two entrepreneurial aspects (Identifying new business opportunities and Successfully managing a business) showed a general improvement from the pre- to the post-survey, except for the students of humanities, whose skills remained almost unchanged or were even lower at the end of the programme. This may be a common problem of this category of student, but there was no evidence of it in their comments. The designers, engineers and natural scientists perceived the greatest gain in "Identifying new business opportunities", and the designers also perceived the greatest gain in "Successfully managing a business", and this was followed by the engineers. Those who were more skilled at the beginning of the programme, i.e. the management students, found the programme moderately useful for improving this skill.

Finally, we observed the results for each student category pertaining to each skill (Figure 9).

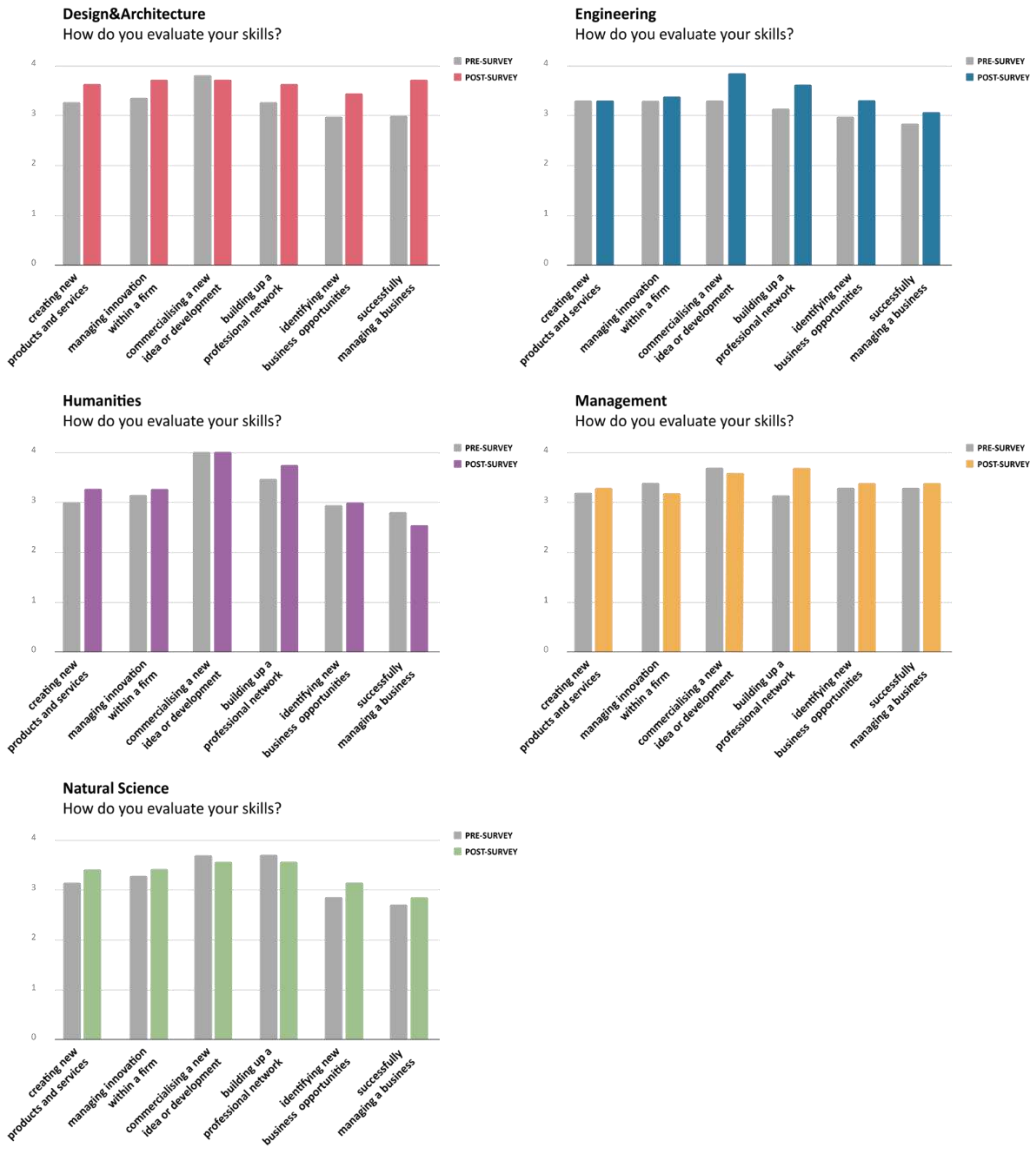

Figure 9: Students' skills divided according to the category of student (pre- and post-survey comparison)

Although our results are qualitative, they show mixed results according to the students' fields of study.

Thus, it can be noted that:

- The Design&Architecture students perceived an increase in 5 items out of 6
- The Engineering students perceived an increase in 5 items out of 6 and one remained unchanged
- The Humanity students perceived an increase in 4 items out of 6 and one remained unchanged
- The Management students perceived an increase in 4 items out of 6
- The Natural science students perceived an increase in 4 items out of 6.

These mixed results indicate how a complex environment with students from different fields of study and different levels of education can have a different impact on the participants.

Results on the degree of satisfaction of the programme

We asked the students if they perceived the programme as being more theoretical (1) or practical (5), and to evaluate this feature over a range of 1 to 5. An average mark of 3.55 was achieved, which means that the programme was perceived as being slightly more practical than theoretical.

Moreover, we also asked the students how they considered the time dedicated to the following topics on a 1 to 5 scale (1=insufficient, 3=adequate, 5=too much):

- Teamwork: 2.77
- Presentations (Pitches): 2.91
- Support received: 2.66
- Classes: 3.11

It emerges that the students' perception about the classes is that the duration is slightly overestimated, while the time spent on team work, presentations and support received should be increased.

Moreover, as far as the overall duration of the challenges (1=insufficient, 3=adequate, 5=too much) is concerned, an average of 2.68 was obtained, which indicates a perception of the programme being slightly shorter than expected. From these results, it can be concluded that the time spent on classes was perceived as a little excessive compared to what the students expected as support for their specific projects.

The students found the material provided satisfactory as a support to develop their ideas. It was evaluated from 1 to 5 (1=insufficient, 3=adequate, 5=too much) in answer to the question "Were the available materials sufficient for the realisation of your idea?" with an average of 3.57/5. Moreover, they were asked to what extent they felt the interdisciplinary experience was useful for their team. Their answers show it was the most appreciated aspect, thus confirming that the multidisciplinary promoted by the CLabTo has been extremely enriching. In this regard, it should be noted that the provided training was also multidisciplinary, as it involved professors and experts from disparate fields. The students indicated they were satisfied with this aspect, and reported it in the free text boxes. Moreover, on the basis of the three categories of teacher presented by Béchard and Grégoire (2005), the students' perception of the teachers was mainly "as tutor and facilitator".

The teachers in the CLabTo programme are in fact encouraged to facilitate debates, share learning, interact and brainstorm. Dziuban et al., (2004 p.3) and Nielsen and Stovang (2015 p 985) suggested a shift from lecture- to students-centred instruction in which the students become active learners, and an increase in interaction between students and teacher is encouraged. One of the questions in the post-survey was related to this aspect, and the perception of the students about their role was mainly that of "active participant with a close interaction with the teachers" (Fiore et al., 2019)

Finally, we asked the students if they thought this programme had overall increased their interest in innovation (evaluated from 1 to 5), and we received positive feedback, with an average mark of 4,45/5.

Discussion and conclusions

In recent years, the focus on the innovative value of design thinking in businesses and business education has increased (Nielsen and Stovang, 2015). In this paper, we provide new insights into how to develop EE through design thinking, teaching methods, teacher-user relations, teaching and team working environment. CLabTo

offers a unique programme for EE as it provides EE for all the different types of university students in the form of a practice-oriented design-led programme. The students faced real-life challenges as well as entrepreneurial ones, and the programme helped the students to acquire communication and networking skills, while working in transdisciplinary teams to develop entrepreneurial tasks (Ball, 2003).

Design is seen as a valuable route to accomplish business goals and new entrepreneurial opportunities (Nielsen and Stovang, 2015; Clark and Smith, 2008; Boland and Collopy 2004). CLabTo has thus allowed design and business pedagogy to be merged for their mutual enrichment, by identifying new business opportunities, and anticipating and creating an unknown future (Nielsen and Stovang, 2015).

We tested our model on students with different educational levels and from different fields of study, and introduced teaching, tutoring and mentoring in which a variety of professors, researchers and experts from different fields were involved. We created a learning environment in which the students and their creativity in delivering innovative solutions were stimulated, with the help of prototyping, visualisation techniques and idea generating support.

As previously noted, a multidisciplinary team approach is a key element of such a programme (Thursby et al., 2009) and it was the aspect that was most appreciated by the students, as shown in some comments to the question "What worked best during the programme?" (Fiore et al., 2019) in which they recognised the role of the Psychologists in the team building phase.

- *"The advice of the group of psychologists for the creation of groups"*
- *"Working in a group with different skills"*
- *"Multidisciplinary allowed us to develop a real project"*
- *"Interacting with different people from different universities. This meant that each of us put his/her own expertise into the project"*
- *"Interdisciplinary groups"*
- *"Being all immersed in something new and unexpected. Regardless of the background, perceiving yourself as similar to others and being able to create in an environment without prejudices and that is only aimed at your growth"*

Teamwork is the students' most commonly mentioned benefit of the programme. For example, in the exit surveys the students were asked "What worked best during the programme?" Of the 56 respondents, 67% of them listed "team" or "teamwork" as one of the most important aspects of the programme. Moreover, the programme has been perceived as being more practical than theoretical, which is in line with our goal. Another relevant result is that the students found that the programme increased their interest in innovation.

As far as teaching is concerned, achieving a pedagogical delivery that simultaneously engaged all the student groups was challenging. We decided to create our own courses and use our own material instead of resorting to those of the two involved universities. The first reason why the programme could not benefit from the teaching of ongoing courses is that they are difficult to access. We in fact needed to cover specific topics on specific days and at specific times, because of the restricted duration of the challenge. The second reason is that the module had to balance the differences in students' background, that is, by trying to keep some parts generic and easily understandable with examples and case studies, while providing some more technical contributions for the students who had the necessary knowledge to understand it and use it during the team work. The key for the class structure is delivery to inform those with limited backgrounds, while avoiding boring those with in-depth knowledge (Thursby et al., 2009). Thus, our classes tended to focus on content for an hour or two, with practical implications on the projects that the students were working on. The teachers became aware of the heterogeneity of the audience and changed their way of explaining to a more interactive and engaging way; this was facilitated by the limited number of participants in each challenge (from 32 to 15). The approach we have undertaken appears to have been successful, as shown by the following comments to the question "What worked best?"

- *"Expert interventions. They have been very useful to approach a new way of assessing the challenge"*
- *"The initial lessons of the various professors allowed us to focus on and study the theme in question in more depth"*

- *"The insights given by the lessons and the mixed groups were good incentives to look for new ideas"*
- *"The multidisciplinary nature of the lessons and the teams"*

The evaluation, by means of pitching instead of written or oral examinations, was also appreciated by the students, as may be seen from two comments to the question "What worked best?"

- *"The final pitch with the jury was a great stimulus"*
- *"Time schedule, pitches, multidisciplinary lessons and teams"*

As already highlighted by Thursby et al., 2009 with another EE programme, although our data are self-reported perceptions, it is clear from our empirical analysis that the described programme had some effects on the students' perceptions of their ability. Both on entry and exit from the programme, we found some differences, according to the fields of study and MSc/BSc background, in the perceived capabilities. Moreover, the greatest gains were shown for the BSc students and designers, followed by the engineers. However, there was an overall increase in each skill, which is a good result, considering the limited duration of the programme (2 weeks).

A better management of time, an extension of the duration of the programme and the need to increase the presence of tutors are some of the aspects that still need to be improved. Moreover, it was noted that some students did not to attend 100% of the classes, probably as a result of a lack of credits. Each aspect of the challenge of developing such an integrative programme is significant, that is, from recruiting students, to planning the teaching activities and the team work, to managing the time of each activity. As far as pedagogy is concerned, the most challenging aspects were finding suitable professors to satisfy the CLabTo approach and the specific teaching delivery required for the challenge. Each challenge in fact required *ad hoc* teaching planning. The CLabTo programme, with its focus on idea generation and transdisciplinarity (pertaining to both the fields of study and the education level), makes an important contribution to EE, as it offers the possibility of working across disciplines. The model may lead students to acquire all the capabilities needed for their future careers in innovation (Thursby et al., 2009). Echoing the hope of Nielsen and Stovang (2015), we hope to have contributed to the discussion by creating knowledge about the cross-over of design thinking and EE.

Limits and future research

In our study, the survey data were based on a limited number of students and no control sample was available, therefore, our analyses can only be considered qualitative. Moreover, we considered a single case study (CLabTo) in Italy and it is therefore not possible to generalise. However, the sample is representative of the population of students who took part in the CLab Torino programmes. Moreover, our results may be different from those of other countries, since different cultures can lead to different results. For example, Mueller and Thomas, (2001) and Giacomin et al., (2011) suggested some variables that should be taken into account in order to study EE in different countries. Therefore, it could be interesting to include students with different cultures and to study the differences in addition to the multidisciplinary nature of their backgrounds, thus creating not only multidisciplinary teams with different educational levels, but also bringing different cultures together.

In addition, since corporations seem interested in employees with entrepreneurial competencies, it could be interesting to analyse whether employees who have taken part in EE classes are more innovative than those who have not participated in EE classes; this could be achieved by introducing control samples.

Given these assumptions and the results of the survey, we believe that the process of creating an entrepreneurial programme for all types of university students, and which would be suitable to fit all the different circumstances, will take from 3 to 5 years of continuous tests and iterations. Thanks to the students' feedback, in the next challenges, we will test new forms of teaching and tutoring during the team work in order to improve the programme and to make it useful for both those students who decide to create their own businesses and those who want to work in multidisciplinary teams in innovative contexts. We believe that this entrepreneurial programme could lead to cooperation with universities outside Italy, but this would require a non-trivial effort to convince different professors and Universities to collaborate in a common project.

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Research Perspectives IN THE ERA OF Transformations

Entrepreneurial Mindset: a longitudinal study of three different teaching approaches to developing it

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This paper explores the influence of teaching approaches on entrepreneurial mindset of commerce, design and engineering students across 3 universities. The research presented in this paper is an initial study within a larger project looking into building 'entrepreneurial mindsets' of students, and how this might be influenced by their disciplinary studies. The longitudinal survey will measure the entrepreneurial mindset of students at the start of a course and at the end. Three different approaches to teaching the courses were employed – lecture and case based, blended online and class based and fully project-based course. The entrepreneurial mindset growth was surprisingly strongest within the engineering cohort, but was closely followed by the commerce students, whereas the design students were slightly more conservative in their assessments. Future study will focus on establishing what other influencing factors beyond the teaching approaches may relate to the observed change.

Keywords: entrepreneurial mind-set, teaching approaches, longitudinal study

Introduction

The purpose of this paper is to explore the assumption, or essentially 'test' the hypothesis that different approaches to teaching within specific disciplinary fields influence the entrepreneurial mind-set of students and their willingness to pursue their own business ventures after they graduate. We subscribe to the notion that what is foundational in entrepreneurship education is that the disposition, skills and competences of the creators of enterprises are key to enterprise development but that these skills, dispositions and competences can be influenced/shaped by education (Maresch et al., 2016). What we *don't* assume though, is: a) that this entrepreneurial education has the same impact in all contexts, and b) that students in different educational/disciplinary programs view entrepreneurship the same way and that they perceive the importance of and assign the same meaning to the various traits of an entrepreneurial mindset. Although this could introduce some level of 'noise' into the analysis of results, we would simply note that many schools are offering entrepreneurship courses to students as certificates or minors and attract students from across different disciplines (Bilén, Kisenwether, Rzasa and Wise, 2005) and the literature on entrepreneurship does not appear to dig deeply into any possible disciplinary biases that might cause students from different disciplines to view entrepreneurship differently (Levenburg, Lane and Schwarz, 2006).

Entrepreneurship has become one of the driving forces of economies across the world and a variety of disciplines have adopted courses within their curricula to build entrepreneurial skills of students, ranging from commerce programs to design and engineering specializations.

Although much research is currently focusing on exploring different approaches to teaching within and across disciplines, there is no agreed-upon approach to teaching entrepreneurship to students across disciplines and there is also no real evidence of how effective the approaches taken are in building the entrepreneurial mindset of the students – although there would probably be little debate as to the importance of teaching entrepreneurship where it "goes beyond understanding, knowing, and talking and requires using, applying, and acting" (Neck and Greene, 2011).

Changes in the environment through technology advances are driving the students to adapt their approaches to engaging both with school material as well as their interactions in life outside of the University environment. We are trying to assess, if the Universities actually address the environmental changes in preparing students for the workplace, particularly in the face of the new technological trends influencing the way people work and communicate with one another. It seems the new transitions within the socio-cultural, technological and digital environments are requiring the workforce to develop entrepreneurial skills not only for the purposes of launching new ventures, but also for the purposes of better engaging with the new era, to which we are transitioning (Le Merle & Davis, 2017). The students need to develop entrepreneurial skills to be more creative, more tolerant to risk and to make sense of the new content-centric, connected workplaces in which they are entering (Farny, Frederiksen, Hannibal, & Jones, 2016).

It seems that universities are responding by taking a more individualist approaches to student learning, acting as coaches and mentors rather than as the providers of knowledge (Lahn & Erikson, 2016). This shift is particularly evident in business schools, where entrepreneurship has found its home in the past decade. It is however unclear, if this approach brings any further benefits than other, more traditional academic approaches to learning.

To explore this, a study, looking at the influences that teaching approaches have on entrepreneurial mind-sets of students was conducted at 3 different universities, within 3 different educational programs – commerce, design and engineering. This study is the initial component of a much wider research project looking into the effectiveness of teaching entrepreneurship across disciplines.

The study is based on a survey, administered to the students at the start and end of an entrepreneurship course taught at their university. The entrepreneurial mindset traits are taken from well-established and validated measures and include assessments of commitment and determination, courage, tolerance to risk, creativity and ability to adapt, motivation to excel and leadership (Spinelli Jr. & Adams Jr., 2016).

The paper will first look into the theoretical background relevant for the study. The entrepreneurial mindset and different approaches to teaching and delivering content to students will be explored within this section to present the overarching reasoning behind the study. This will be followed by a detailed methodology section to illustrate how the research protocol was developed and administered. The sample and the key variables will be discussed, and key reliability verifications presented. The results will be presented separately for all three universities and conclusions drawn based on the findings presented. The paper will conclude with a brief overview of the future work within the discussed domain.

Theoretical Background

Entrepreneurship has gained increased momentum both in the professional world as well as in education. As Aulet, et al. (2017) point out, a good entrepreneur needs to have the "spirit of a pirate and skills of a navy seal". This clearly indicates, that the skillset the students need to be developing relates on the one hand to creativity, tolerance to risk and opportunity obsession and on the other hand to commitment, determination, motivation to excel and specific leadership skills (Aulet, et al., 2017; Spinelli Jr. & Adams Jr., 2016). All of these skills can often be developed through reflection, learning by doing and continuous drive to develop one-self and the world around us.

At the same time, the changes in the environment, particularly in terms of advances in technology are increasingly changing the way organizations and the business world in general operate. The disruptions that digitalization brings in terms of technological shifts are particularly evident for the so-called generation C – the connected, content-oriented and always clicking population born after 1990. They were born into the digital,

technologically advanced and connected world and have no real understanding of how a world, organization or social environment operated without this connectivity (Le Merle & Davis, 2017). This is the new workforce, entering the job markets currently and in the near future and the way they engage, work, network and behave, is largely connected to the digital world. This means their perceptions of success, development and growth is often very different from established work practices currently employed in organizations. Even the successful entrepreneurs of today are often connected to the advances of the previous era, where different approaches to doing business are still present – they connect traditional way of doing business (structure, governance, process), with the new, connected ways (creativity, drive and interconnectedness). Thus, those entering or already in the workplace need to learn these skills and at the same time foster the ones brought to them innately by the world of connectivity.

All these changes in essence, mean that education is playing catch up in adapting to the new trends within the business environment, no matter whether corporate or venture based (Lahn & Erikson, 2016). New pedagogies, linking to the generation C need to be considered and implemented to develop skills of the students that will enable them to engage on the one hand with the established practices, and on the other to develop their connectivity that comes natural to them to a level that will drive their future growth.

Often, project-based learning has been considered as an approach that bridges the gap between academic knowledge and real-world business skills, but even so, Universities are still not engaging enough to bring the changes to the curricula as they develop in the business world. Academic evidence suggests that project-based learning encourages and supports collaborative work (Christophersen, Coupe, Lenschow, & Townson, 1994); it also improves retention and enhances design thinking (Dym, Agogino, Eris, Frey, & Leifer, 2005) and bridges the gap between theory and practice (Du, De Graaff, & Kolmos, 2009). As the work of de Graaf and Kolmos, (2003; 2007) suggests, project-based learning helps develop collaborative, cognitive and content-related skills, which would in turn mean that the students learn how to collaborate within a particular environment, they understand the key theoretical principles of a particular discipline and they are also able to translate that into practice. Often engineering disciplines are the ones, where project-based approaches are used within the curriculum to advance the skills of the students in a structured, practice-based manner. They solve a particular problem for an industrial partner and learn the processes related to it. This gives them the opportunity to gain an understanding of the processes and practices in the work environment, but at the same time include the safety of the University base, where failure does not have the same magnitude of negative consequences it might have in the work place.

On the opposite end of the spectrum of the learning curve are soft disciplines, like the majority of business studies. As defined by Shulman (2005), the main characteristic of teaching and learning in business would be the absence of routine in the discipline as such – it is an ever-changing practice, jumping from structured to creative approaches of doing things in extremely short periods of time, based predominantly on a critical review and analysis of what is happening in the business and social environment. This is particularly true for the previously mentioned generation C, where their continuous link to technology is speeding up the processes of change, growth and understanding of how things need to be done in that particular timeframe and work framework.

Different approaches in practice and an ever-changing environment therefore demand different approaches in pedagogy. What the students need to learn, understand and acquire is not only the concepts relevant to the practice of business, but also the skills relevant to dealing with constant change in their social, political, technical and economic environments. The business, and in particular entrepreneurship discipline “values insights generated from the variety of different paradigmatic positions to be found in the discipline” (Shankar, 2009), and therefore students need to embrace and understand these positions to be able to become part of the communities of practice in their professional lives. At the same time, they are actively changing the discipline through their engagement with the digital world, where influencers are often the drivers of change and needs that generation C now exhibits.

As Midendorf and Pace (2004) propose, learning to think and work as a business professional is more complex than generally appears to be the case to professionals, and students therefore, need a chance to perfect the skills in order to succeed. This is achieved through active, collaborative and inquiry-based learning. The engagement between students and teachers is significant throughout their time at the University and most of the interaction is case-based, giving the students insight into modern practices and professional approaches towards conducting and managing business. In that sense, the discipline can be classified as pedagogy of uncertainty (Shulman, 2005). The continuous shift in business that the disruptive organizations such as

Amazon, Apple and Facebook (Le Merle & Davis, 2017) have brought to the workplace has however, put the business student at the forefront to develop understanding of this change, and it is uncertain if Universities have adapted fully to the new pace.

This is the reason behind the current study. As the world shifts rapidly, we wanted to explore, if the paradigms and teaching approaches with which students are currently ensconced have the structure and detail to prepare them for the new employment arena.

We are working on the presumption that the skills of an entrepreneur are the ones required to navigate the changing environment (Aulet, et al., 2017; Spinelli Jr. & Adams Jr., 2016) and thus we wanted to test, how different approaches to teaching across various disciplines influences the entrepreneurial mindset of students over the duration of a particular course. The main research question is: will the perceived entrepreneurial mindset of students improve through a particular educational approach?

To test this, three different courses were assessed, and the mindset change measured for the cohort within these courses. The methodological approach employed is presented in the next section.

Research Methodology

As outlined above, the key objective of this initial project was to establish whether and how the entrepreneurial mindset of the students changes throughout their studies and if entrepreneurship courses offered to them actually support the development of the soft skills needed in today's changing environment.

Due to current environmental trends increasingly driving the need for an entrepreneurial mindset in the new workforce, Universities have embraced entrepreneurial courses not only within business schools, but also within engineering and design disciplines, with the key purpose of preparing the students for the new workplace requirements.

From a theoretical perspective, the key traits of an entrepreneurial mindset include the following traits, as outlined by Spinelli Jr. & Adams Jr. (2016):

- Commitment and determination in terms of mission orientation, discipline, decisiveness, tenacity and persistence in solving problems;
- Courage in terms of moral strength, fearless experimentation, tolerance of conflicts and failure and intense curiosity in the face of risk;
- Opportunity obsession in terms of leadership in shaping the opportunity, knowledge of customer needs, market drive and value creation;
- Tolerance to risk, ambiguity and uncertainty in terms of calculated risk, risk minimization and sharing, tolerance to lack of structure, stress and conflict and ability to integrate solutions;
- Creativity, self-reliance and adaptability in terms of open-mindedness, restlessness with status quo, ability to adapt and no fear of failure;
- Motivation to excel in terms of goal orientation, drive to achieve that is self-imposed, ability of support to others and a perspective and sense of humour;
- Leadership in terms of being a self-starter, having internal locus of control, integrity and responsibility and being a team builder/hero maker, with patience.

These key traits of an entrepreneurial mindset were translated into a survey, where each of the mentioned traits was assessed on a 5-point Likert scale, where 1 indicates this trait was perceived as weak by the students and 5 was perceived as strong. The survey also asked the students to qualitatively discuss their key strengths and weaknesses in relation to the entrepreneurial mindset traits to give further depth to understanding where improvements can be made.

Commitment and determination were measured by assessing 6 mindset items, giving a total of 30 possible points for this trait. Courage was measured through 4 items, totalling 20 points. Opportunity obsession was also measured with 4 items, giving a total score of 20. Tolerance of risk, ambiguity and uncertainty consisted of 6 items, giving possible scores of 30, followed by a 5-item measure of creativity, self-reliance and ability to adapt, which gave a total possible score of 25. A final two measures were motivation to excel, measured with 6-items and leadership measured with 5 items. Overall, a full mindset score can be summed to 180 points, indicating a 100% skillset relevant for an entrepreneurial mindset. The full survey is presented in the appendix of this paper.

We tested the mindset of students in three courses that ran in the fall semester of the academic year (all the programmes were located in the Northern hemisphere). The pool of students came from design (N=85), engineering (N=57) and commerce (N=106). The chosen courses were focusing on the soft skills that those entering workforce will require in the changing work environment. The delivery was predominantly lecture-based, with some components occurring online and case studies or projects being the core of the student assignments and assessment.

The design students that participated in this study were Design Innovation students and the course where the mindset was assessed had to do with Communication in an international context. Key theoretical concepts in the course were introduced in lectures and seminars and directed reading and related activities were organized online to support these concepts. There were structured online activities targeted towards supporting the final assessment related to observing and reflecting on communication of peers within an international context.

For the commerce students, the introductory entrepreneurship course followed an application based approach, where student teams were expected to learn how to build high performance entrepreneurial teams, assess the feasibility of innovative opportunities they have originated, develop competitive business models, build a minimum viable product, and test their value propositions with potential customers. This was done through experiential learning, lectures, simulations, videos and interactions with successful entrepreneurs. The format of the course consisted of one 170-minute class meeting per week. The primary role of the course instructor was to lead discussion and experiential learning in practical applications of course concepts. Class sessions entailed a mixture of lecture, videos, problem analysis, guest speakers and class discussion. The content of any lecture presumed and expected that students had carefully studied the assigned reading. Lectures emphasized major topics and readings, yet students were responsible for all assigned materials. This required active learning, where the student was expected to take responsibility for their learning and to ask questions and to stimulate discussion on topics that were of interest to the class.

Engineering students that participated in the survey assessed their entrepreneurial mindset within the New Venture Launch class. The course guides the students through the disciplined entrepreneurship approach towards developing their own idea into a workable business plan with a go-to market strategy. They learn the key entrepreneurial traits by actually engaging with the development of their own venture.

The proportion of design students that completed the survey both times was 44, so all results are based on this sample, although some insight can also be drawn from the larger sample that completed the first survey (N=85) and that which completed the last survey (N=58). 77 Commerce and 27 Engineering students completed both surveys, giving an effective response rate of 72% and 47% respectively.

Preliminary findings

The first survey was administered at the start of the course for each group of students. Figure 1 shows the distribution of perceived mindset traits for all of the students that completed the survey.

Figure 1: entrepreneurial mindset traits of design, engineering and commerce students as perceived at the beginning of the semester

As the figure indicates, the key traits that are perceived as strong by the commerce students have to do with leadership, motivation to excel and opportunity obsession. They seem to perceive themselves as relatively tolerant to risk, which is the trait that is the weakest for design students. The design students assess themselves strongly in terms of courage and creativity. Interestingly, the engineering students assess their entrepreneurial mindset as relatively strong across all of the investigated traits and seem to be strongest at commitment and determination and courage.

Table 1 further dissects the relevant items for each of the entrepreneurship traits, illustrating the average responses for each of the items scored for all 3 groups of students at the start of the semester.

It is interesting to note that the commerce and engineering students seem to perceive themselves as more opportunity obsessed and tolerant to ambiguity than the design students. Similarly, they seem to consider their leadership skills and motivation to excel as stronger entrepreneurial traits than the design students. Overall, the assessment seems to be stronger for commerce and engineering students than for the designers.

BEFORE	*Design*		*Commerce*		*Engineering*	
	Average score	*Standard deviation*	*Average score*	*Standard deviation*	*Average score*	*Standard deviation*
Commitment and Determination						
Decisiveness	*3.3*	*0.9*	*3.3*	*0.9*	*3.4*	*0.9*
Tenacity	*3.3*	*0.8*	*3.7*	*0.8*	*3.9*	*0.7*
Discipline	*3.7*	*0.8*	*3.8*	*0.9*	*3.9*	*0.7*
Persistence in solving problems	*4.0*	*0.7*	*4.0*	*0.9*	*4.1*	*0.8*
Willingness to sacrifice	*3.6*	*0.9*	*3.4*	*1.0*	*3.7*	*0.9*
Total immersion in the mission	*3.8*	*0.8*	*3.8*	*0.9*	*3.9*	*0.7*
	21.5	*3.2*	*21.9*	*3.1*	*22.8*	*2.7*
Courage						
Moral strength	*4.1*	*0.8*	*4.1*	*0.8*	*4.2*	*0.7*
Fearless experimentation	*3.4*	*0.8*	*3.3*	*1.1*	*3.7*	*0.9*

Unafraid of conflicts, failure	*3.4*	*1.0*	*3.1*	*1.1*	*3.4*	*1.0*
Intense curiosity in the face of risk	*3.6*	*0.8*	*3.4*	*1.0*	*3.5*	*0.9*
	14.5	*2.4*	*13.9*	*3.1*	*14.8*	*2.7*
Opportunity obsession						
Leadership in shaping the opportunity	*3.4*	*0.9*	*3.9*	*0.8*	*3.6*	*0.9*
Having knowledge of customer needs	*3.7*	*0.8*	*3.9*	*0.8*	*3.8*	*1.0*
Being market driven	*3.2*	*0.9*	*3.6*	*0.9*	*3.6*	*1.0*
Obsession with value creation and enhancement	*3.7*	*0.9*	*3.6*	*1.0*	*3.9*	*1.0*
	13.9	*2.8*	*15.0*	*2.3*	*14.9*	*3.0*
Tolerance of risk, Ambiguity, and Uncertainty						
Calculated risk taker	*3.3*	*0.9*	*3.8*	*1.0*	*3.8*	*0.8*
Risk minimizer	*3.3*	*0.7*	*3.7*	*1.0*	*3.7*	*1.0*
Risk sharer	*3.2*	*0.7*	*3.4*	*1.0*	*3.4*	*0.8*
Tolerance of uncertainty and lack of structure	*3.1*	*0.9*	*2.9*	*1.1*	*3.2*	*1.0*
Tolerance of stress and conflict	*3.3*	*1.0*	*3.5*	*1.1*	*3.5*	*0.9*
Ability to resolve problems and integrate solutions	*3.7*	*0.8*	*4.1*	*0.8*	*4.1*	*0.8*
	19.6	*3.0*	*21.3*	*3.3*	*21.8*	*3.1*
Creativity, self-reliance and ability to adapt						
Nonconventional, open-minded, lateral thinker	*4.0*	*0.8*	*3.9*	*0.9*	*3.9*	*0.9*
Restlessness with status-quo	*3.3*	*0.9*	*3.3*	*0.9*	*3.6*	*0.9*
Ability to adapt	*3.9*	*0.8*	*4.2*	*0.8*	*4.2*	*0.8*
Lack of fear of failure	*3.3*	*1.0*	*3.0*	*1.2*	*3.1*	*1.0*
Ability to conceptualize and "sweat details"	*3.7*	*0.8*	*3.5*	*0.9*	*3.6*	*0.9*
	18.2	*2.7*	*17.6*	*3.7*	*18.4*	*3.2*
Motivation to excel						
Goal and results orientation	*4.0*	*0.6*	*4.3*	*0.8*	*4.2*	*0.8*
Self-imposed drive to achieve and grow	*3.7*	*0.7*	*4.3*	*0.8*	*4.2*	*0.8*
Low need for status and power	*3.0*	*0.8*	*3.2*	*1.2*	*3.4*	*1.0*
Ability to be inter-personally supporting (vs. competitive)	*3.7*	*0.6*	*3.9*	*0.9*	*3.8*	*0.9*
Awareness of weaknesses (and strengths)	*3.7*	*0.8*	*4.1*	*0.7*	*3.8*	*0.9*
Having perspective and sense of humor	*3.8*	*1.0*	*4.4*	*0.7*	*4.2*	*0.8*
	21.9	*2.1*	*23.9*	*3.4*	*23.5*	*2.8*
Leadership						

Being a self-starter	*3.4*	*0.9*	*3.6*	*1.1*	*3.7*	*1.0*
Having internal locus of control	*3.4*	*0.8*	*3.7*	*1.0*	*3.8*	*0.7*
Having integrity and reliability	*3.7*	*1.0*	*4.3*	*0.6*	*4.2*	*0.8*
Having patience	*3.8*	*1.0*	*3.8*	*1.0*	*3.8*	*0.9*
Being a team builder and hero maker	*3.3*	*1.0*	*3.9*	*0.8*	*3.7*	*0.8*
	17.7	*3.2*	*19.4*	*2.9*	*19.1*	*3.0*
Total	*127.3*	*14.5*	*133.0*	*14.8*	*132.7*	*14.5*

Table 1: Average score per entrepreneurial mindset trait as defined by students at the start of the semester

One of the assessed skills where commerce students scored relatively low, was fear of failure, whereas both design and engineering students scored slightly better. They were 1 assessment point stronger on the courage trait than the commerce students. This may be related to the lack of experimentation within business education, where failure is often still considered increasingly bad, whereas within engineering and design domains experimentation is part of the learning process, particularly in project-based environments. This observation goes hand in hand with tolerance of uncertainty and structure, where commerce students were conservative in their assessments, unlike design and engineering students, who seem to be relatively strong in this trait.

It is further observed that the design students don't consider leadership as one of their stronger skills, whereas the engineering and commerce students seem to be more comfortable with these traits. Although statistically significant (t-test;$P<0.05$), differences between the assessed traits of the different disciplines seem to be relatively small, giving an interesting starting point for further study.

Further to the differences between student perceptions across disciplines, we also wanted to assess, if the teaching approach influences the mindset change at all. As a starting point into this exploration, the students completed the same survey again at the end of the course. The assessed mindset at the end of the course is presented in figure 2 for all of the disciplines.

The average mindset has been assessed by the design students at 127/180 points at the start of the course, putting their mindset at about 71% development at the point in time. It rose to 132.6/180, which would bring it to 74%. The key change that the communication course brought, as indicated in Figure 2 has to do with tolerance to risk and opportunity obsession. This would indicate that the approach to teaching within this course, which included both in-class work as well as online work had a positive influence on their mindset. Overall, however, the mindset score is still rather low, particularly in terms of tolerance to risk, ambiguity and uncertainty. This further aligns with the key weaknesses that the students reported within the qualitative part of the survey, where the most cited weaknesses were tolerance to uncertainty (47%) and fearless experimentation (27%). This may have to do with the discipline on the one hand and the cultural background of students on the other. Creativity is one of the key traits of designers; it is overall however, a structured discipline, with processes and best-practices in place. Furthermore, the majority of the students participating in the survey were international (87%), originating form learning cultures with high dependency on their tutors' input (Zhang, Bohemia, & McCardle, 2017).

It is however important to note, that the standard deviation on the results was 16 points on the full score and that out of the 44 students that completed both surveys, 17 in their perception actually marginally decreased their mindset score. Although at this point the results have been isolated to the influences of the course, the pilot study has shown that there is variation on the mindset change that warrants further exploration.

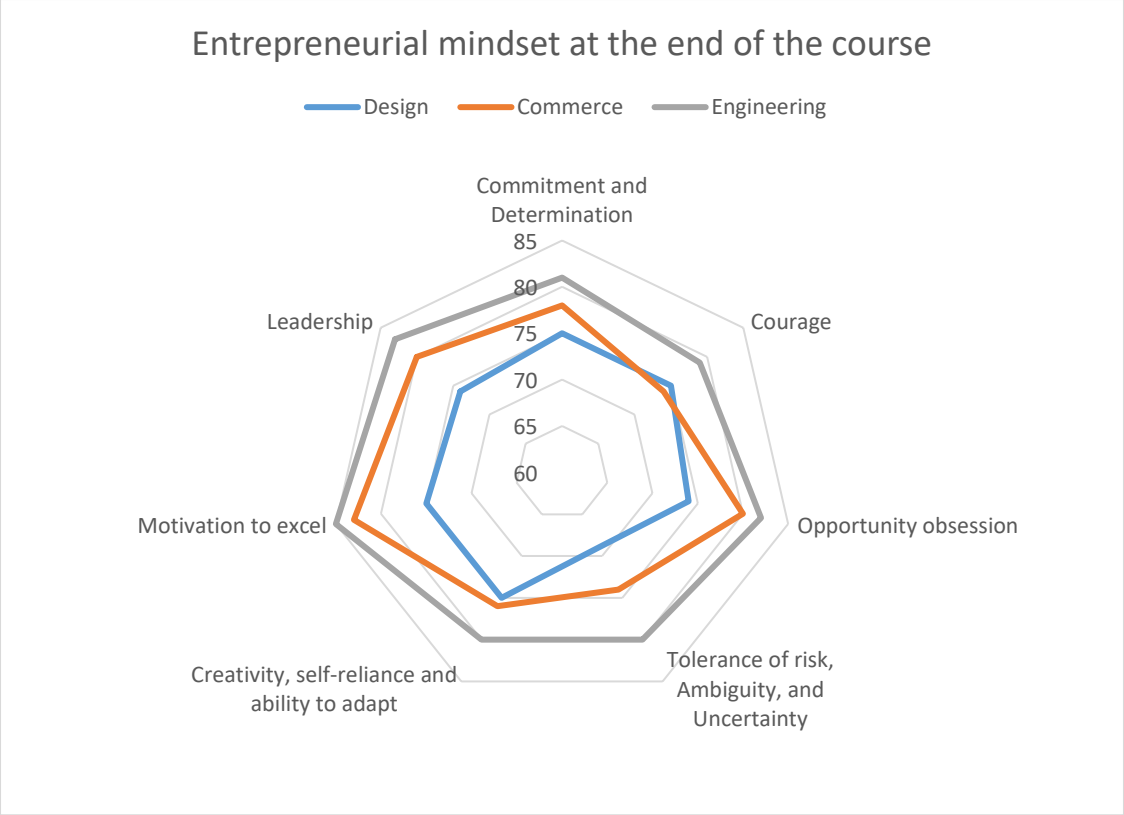

Figure 2: Entrepreneurship mindset traits of design, engineering and commerce students as perceived at the end of the semester

The commerce students' average mindset at the beginning of the course was 133/180, meaning it was at 74% overall and it rose to 140/180. This means overall the commerce students perceived a 4% increase in their entrepreneurial mindset at the end of the course. It seems the course had the most influence on their perceived creativity and the students also assessed their commitment and determination as higher by on average 5%. Although improved, their tolerance to risk and ambiguity still sits below 75%.

As the literature suggests, the students from business backgrounds start their mind-set perception at a higher point due to the fact that they are faced with pedagogies of uncertainty throughout their full educational program. Furthermore, they are actively pursuing this professional path through their education, thus they are more self-aware of the traits they currently possess and the ones they need to improve. Interestingly, the key weaknesses the commerce students highlighted in their qualitative responses at the start of the course had to do with discipline and patience. The course seemed to have helped with the perception of discipline, as it improved on average by 3%, whereas the patience trait of commerce students only improved by 1% at the end of the course. Table 2 further depicts the average score per mindset trait at the end of the course for all the students. The results are statistically significant at 5%.

After	*Design*		*Commerce*		*Engineering*	
	Average score	*Standard deviation*	*Average score*	*Standard deviation*	*Average score*	*Standard deviation*
Commitment and Determination						
Decisiveness	*3.6*	*0.8*	*3.8*	*0.8*	*4.0*	*0.8*
Tenacity	*3.7*	*0.8*	*3.9*	*0.8*	*4.1*	*0.7*
Discipline	*3.8*	*0.8*	*3.9*	*0.8*	*4.0*	*1.0*
Persistence in solving problems	*3.9*	*0.8*	*4.2*	*0.8*	*4.3*	*0.9*

Willingness to sacrifice	*3.8*	*0.8*	*3.7*	*0.9*	*3.9*	*1.2*
Total immersion in the mission	*3.8*	*0.7*	*4.1*	*0.8*	*4.2*	*0.9*
	22.5	*3.2*	*23.4*	*3.3*	*24.3*	*4.3*
Courage						
Moral strength	*4.2*	*0.7*	*4.3*	*0.7*	*4.3*	*0.8*
Fearless experimentation	*3.6*	*0.9*	*3.6*	*1.0*	*3.8*	*0.8*
Unafraid of conflicts, failure	*3.6*	*0.9*	*3.4*	*1.1*	*3.7*	*1.1*
Intense curiosity in the face of risk	*3.7*	*0.7*	*3.5*	*1.1*	*4.1*	*0.9*
	15.1	*2.2*	*14.7*	*3.2*	*15.9*	*2.8*
Opportunity obsession						
Leadership in shaping the opportunity	*3.4*	*1.0*	*4.2*	*0.8*	*4.3*	*1.0*
Having knowledge of customer needs	*3.9*	*0.9*	*4.0*	*0.8*	*4.1*	*0.8*
Being market driven	*3.5*	*1.0*	*3.9*	*0.9*	*3.9*	*1.0*
Obsession with value creation and enhancement	*3.9*	*0.8*	*4.0*	*0.9*	*4.1*	*1.1*
	14.7	*3.0*	*15.9*	*3.1*	*16.4*	*3.4*
Tolerance of risk, Ambiguity, and Uncertainty						
Calculated risk taker	*3.4*	*1.0*	*3.9*	*0.8*	*4.2*	*0.9*
Risk minimizer	*3.4*	*0.8*	*3.8*	*1.0*	*4.1*	*1.1*
Risk sharer	*3.5*	*0.8*	*3.6*	*0.8*	*3.7*	*1.0*
Tolerance of uncertainty and lack of structure	*3.3*	*0.8*	*3.1*	*1.2*	*3.6*	*1.0*
Tolerance of stress and conflict	*3.5*	*0.9*	*3.7*	*0.9*	*3.9*	*1.1*
Ability to resolve problems and integrate solutions	*3.8*	*0.7*	*4.1*	*0.7*	*4.3*	*0.7*
	20.8	*3.5*	*22.1*	*3.1*	*23.9*	*3.3*
Creativity, self-reliance and ability to adapt						
Nonconventional, open-minded, lateral thinker	*4.0*	*0.7*	*4.1*	*0.9*	*4.1*	*0.9*
Restlessness with status-quo	*3.5*	*0.7*	*3.5*	*1.0*	*3.9*	*0.9*
Ability to adapt	*4.0*	*0.8*	*4.4*	*0.7*	*4.5*	*0.8*
Lack of fear of failure	*3.5*	*0.9*	*3.3*	*1.1*	*3.5*	*1.3*
Ability to conceptualize and "sweat details"	*3.7*	*0.7*	*3.7*	*0.7*	*4.0*	*0.7*
	18.8	*2.7*	*19.0*	*3.1*	*20.0*	*3.4*
Motivation to excel						
Goal and results orientation	*3.9*	*0.7*	*4.5*	*0.6*	*4.5*	*0.6*
Self-imposed drive to achieve and grow	*3.8*	*0.8*	*4.3*	*0.9*	*4.3*	*0.7*
Low need for status and power	*3.4*	*0.9*	*3.6*	*1.0*	*3.5*	*1.0*

Ability to be inter-personally supporting (vs. competitive)	*3.7*	*0.8*	*3.9*	*0.8*	*4.2*	*0.9*
Awareness of weaknesses (and strengths)	*3.8*	*0.9*	*4.1*	*0.8*	*4.3*	*1.0*
Having perspective and sense of humor	*3.9*	*0.9*	*4.4*	*0.8*	*4.6*	*0.6*
	22.4	*3.3*	*24.8*	*2.9*	*25.4*	*2.7*
Leadership						
Being a self-starter	*3.5*	*0.9*	*3.8*	*1.0*	*4.1*	*1.1*
Having internal locus of control	*3.5*	*0.9*	*3.8*	*1.0*	*4.0*	*0.8*
Having integrity and reliability	*4.0*	*0.8*	*4.4*	*0.8*	*4.5*	*0.8*
Having patience	*3.8*	*1.0*	*3.9*	*1.0*	*4.1*	*1.0*
Being a team builder and hero maker	*3.7*	*1.0*	*4.1*	*0.9*	*4.0*	*0.8*
	18.4	*3.4*	*20.0*	*2.9*	*20.7*	*3.2*

Table 2: Average score per entrepreneurial mindset trait as defined by students at the end of the semester

On the other hand, the increase in the entrepreneurial mindset of engineering students after completing the New Venture Launch course was surprisingly high, moving from 132.7/180 (73%) to 146.5/180 (81%). The biggest increase within the entrepreneurial mindset of engineering students was assessed for opportunity obsession, followed closely by motivation to excel, tolerance of risk and creativity. The qualitative responses of engineering students supported this notion, as the pointed out that 'there is a structure to launching a venture and I now know I can do it.'

Figure 3 depicts the perceptual change in the mindset across the three disciplines, surprisingly showing the biggest change in engineering students' mindset.

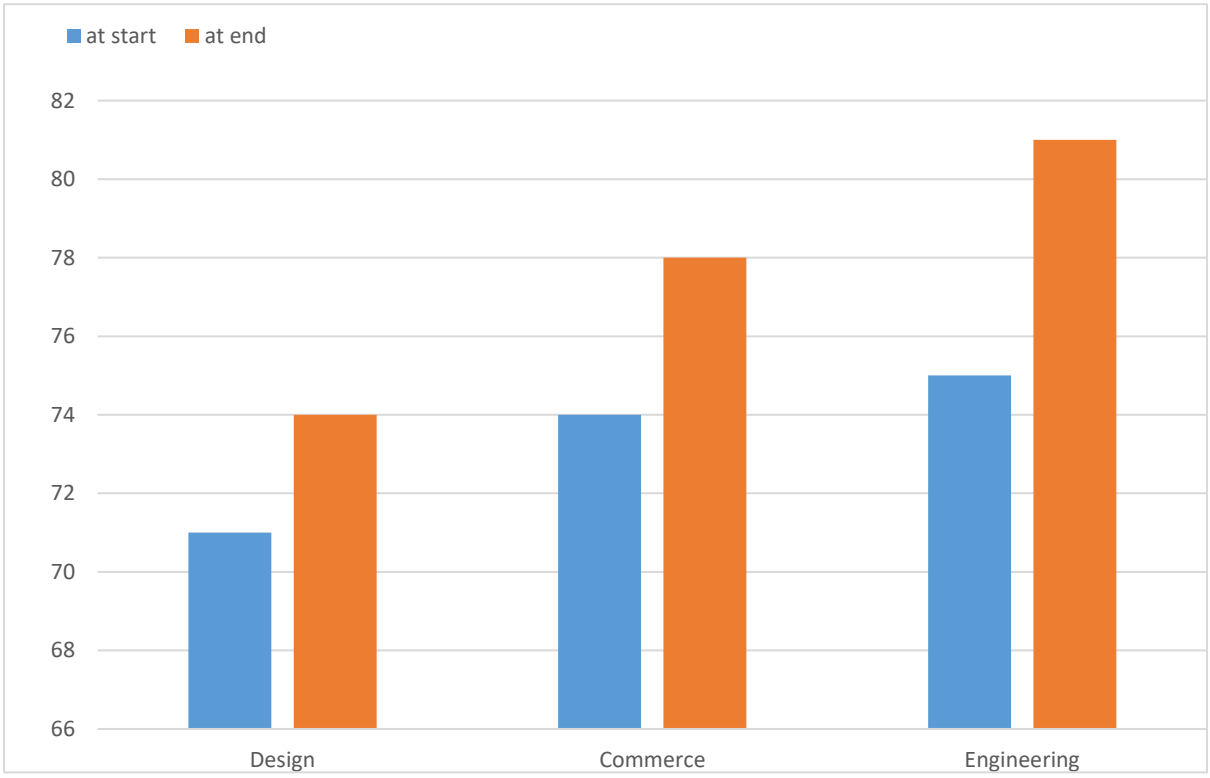

Figure 3: The change in entrepreneurial mindset across disciplines

Conclusions

The results from the longitudinal study of design students highlights that the approach towards teaching the communication skills had a positive influence on the mindset of the students, since on average their assessment of the entrepreneurial mindset increased by 3%. The practical approach to teaching entrepreneurship, where the students were tasked with launching their own venture also showed an increasingly positive effect for engineering students, as well as commerce students.

Overall, the survey showed that a variety of approaches can be beneficial for the development of the entrepreneurial mindset of students, but that the curriculum needs to fully adapt to the new environment the students are faced with and focus on developing the risk mitigating skills in the structured disciplines, such as design and build some of that discipline into the commerce curriculum.

In the context of our study, it is interesting to note that previous research has demonstrated that student self-efficacy beliefs and entrepreneurial intentions are influenced by the extent to which an entrepreneurship course is more theoretically-oriented versus practically-oriented and that in the context of entrepreneurship, theoretically-informed 'learning by doing' is preferable (Fiet, 2000a, b). In drawing on regulatory focus theory, Piperopoulos and Dimov (2015) showed that higher self-efficacy is associated with lower entrepreneurial intentions in theoretically oriented courses and higher entrepreneurial intentions in the practically oriented courses. In our study, we know that the business students and engineering students were being taught entrepreneurship from a very applied/practical perspective. In addition, it is also potentially important to note differences in where/when in each disciplinary program, the entrepreneurship course is taught. In a 4-year undergraduate program, is exposure to entrepreneurship occurring in 1st, 2nd, 3rd, or 4th year – since it has been argued that because entrepreneurship education is not simply about imparting knowledge but instead also involves the manner in which one looks problems and lifestyle which is linked to adolescent development processes (Welsh, Tullar & Nemati, 2016).

The authors used this initial survey as an experiment into the perception of students in relation to their mindset to determine the usefulness of the different approaches that have been taken in building the softer skills across the disciplines but have found an interesting gap in relation to the curriculum delivery and also perceptions of students.

These results will be used as a starting point into developing a full-scale project to determine which traits the students require, how the practice delivers them and how they can be translated into an effective classroom experience. Although beyond the scope of this initial study, it would be interesting to determine the extent to which 'inspiration' is a component of the various disciplinary programs since research has shown that with science and engineering students, between learning, inspiration and resource-utilisation as programme-derived benefits, it is inspiration that has the most significant influence on intention to start a business (Souitaris, Zerbinati & Al-Laham, 2007). The mitigating influences, which in the current study have been isolated to only reflect the teaching approach, will be further explored and relationships amongst the found variables explored. It is expected the full-scale project will spark discussion among the different disciplines as to how entrepreneurial mindset can be grown across the disciplines.

Refereces

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Appendix – the entrepreneurship mindset survey

	Weakest ◄——————————► Strongest					Total
Commitment and Determination						
Decisiveness	1	2	3	4	5	
Tenacity	1	2	3	4	5	
Discipline	1	2	3	4	5	
Persistence in solving problems	1	2	3	4	5	

Willingness to sacrifice	1	2	3	4	5	
Total immersion in the mission	1	2	3	4	5	
						/30
Courage						
Moral strength	1	2	3	4	5	
Fearless experimentation	1	2	3	4	5	
Unafraid of conflicts, failure	1	2	3	4	5	
Intense curiosity in the face of risk	1	2	3	4	5	
						/20
Opportunity obsession						
Leadership in shaping the opportunity	1	2	3	4	5	
Having knowledge of customer needs	1	2	3	4	5	
Being market driven	1	2	3	4	5	
Obsession with value creation and enhancement	1	2	3	4	5	
						/20
Tolerance of risk, Ambiguity, and Uncertainty						
Calculated risk taker	1	2	3	4	5	
Risk minimizer	1	2	3	4	5	
Risk sharer	1	2	3	4	5	
Tolerance of uncertainty and lack of structure	1	2	3	4	5	
Tolerance of stress and conflict	1	2	3	4	5	
Ability to resolve problems and integrate solutions	1	2	3	4	5	
						/30
Creativity, self-reliance and ability to adapt						
Nonconventional, open-minded, lateral thinker	1	2	3	4	5	
Restlessness with status-quo	1	2	3	4	5	
Ability to adapt	1	2	3	4	5	
Lack of fear of failure	1	2	3	4	5	
Ability to conceptualize and “sweat details”	1	2	3	4	5	
						/25
Motivation to excel						
Goal and results orientation	1	2	3	4	5	
Self-imposed drive to achieve and grow	1	2	3	4	5	
Low need for status and power	1	2	3	4	5	
Ability to be inter-personally supporting (vs. competitive)	1	2	3	4	5	
Awareness of weaknesses (and strengths)	1	2	3	4	5	
Having perspective and sense of humor	1	2	3	4	5	
						/30
Leadership						
Being a self-starter	1	2	3	4	5	
Having internal locus of control	1	2	3	4	5	
Having integrity and reliability	1	2	3	4	5	
Having patience	1	2	3	4	5	
Being a team builder and hero maker	1	2	3	4	5	
						/25

Case Studies

Case Studies Introduction: Case Studies from the Frontlines of Design Innovation Management

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When we initially proposed a case study track to Erik Bohemia, the ADIM's 2019 conference chair in London, it was a speculative exercise to ascertain whether an alternate form to the academic paper and the workshop could enrich discourse in the management design community. We are both business-design educators at Parsons School of Design in New York City. Our institution maintains its industry connections principally through our teaching faculty who are drawn from agencies, consultancies and in-house innovation teams globally. Based on our own experience with industry/academic hybridity and through our teaching approach, we developed a hunch that there may be a wide interest in, and applicability [with] this form and we're gratified for the high level of engagement in this initiative, exemplified by the inaugural set of cases in this volume.

We encouraged each case author to use plain descriptive English and empirical observation anchored by specific examples to contribute to applied knowledge in the emergent area of design management and design strategy. We hoped these cases would illuminate for the reader how tools, methods, practices and approaches have performed "on the ground" across cultures and sectors and within diverse organizational and institutional environments. The domain of practical application and integration is one that challenges us as educators and practitioners, we were therefore curious about whether these cases, in the aggregate, may begin to generate new knowledge through a heuristic approach.

The original business case study was developed at Harvard Business School around 1924 and it had a pedagogical function: business cases supported students' [vicarious] experience as they learned lessons from business concepts-in-action. These were (and still are) typically very distilled accounts that can run to fewer than 1000 words and may be three pages or less. Their intention is to provoke debate on the actions taken in the case. In this sense, a business case does not advance an argument, rather it is a simulation; a problem or context for action, an intervention and a reflection on lessons learned. Today business cases may be used internally within companies to sharpen employee engagement with the problems of the organization. Our cases are generally slightly longer in duration and we suggested a three-part structure for each case: i. context and problem/opportunity, ii. the narrative (or what happened) and iii. key learnings. Additionally, we encouraged authors to show rather than tell, through illustrating their cases with visual examples of the specific issues discussed.

The following case studies from the frontlines of design innovation management bring together twenty-six cases with authors from thirteen countries and engage with contexts as diverse as homelessness in Oakland, California, government land surveying practice in Portugal and clinical joint replacement procedures in an Australian hospital. The diverse range of each case found common ground in the application of design thinking and strategy to each.

We have grouped the twenty-seven cases twice into themes or domains of inquiry, these will determine the organization of the proceedings' structure. The following are the themes that were developed by us for the conference after the cases had been submitted through an open call:

- Transformations in methodologies and practices;
- transformations in healthcare/wellness/harm reduction;
- transformations in community empowerment;
- transformations in corporate management and innovation.

Transformations in methodologies and practices

Integrating Business Design through Experiential Learning (New Zealand), explores the challenges and opportunities of a business school educator's application of design into her classroom and culture. The iterative nature of student assessment is highlighted as holding great potential in business education while the challenges of instilling a studio-oriented culture into the conceptual and physical spaces of the business school is also detailed. *Design Thinking in Law School: A Case Study of SoloSuit* (USA), presents a design school-law school collaboration engaging the question of how to redesign a digital legal product to better serve the needs of many of its economically marginalized users. This project highlights how design innovation may support social justice through enhancing literacy and access within specialized legal languages and processes. *Thinking-through-making; physical model-making as a business model education strategy* (USA), discusses a specific example of a student's response to a class project that required her to create a business model or a strategy tool in three-dimensional physical form. The case explores this student's application of the tool she created into client interactions within her consultancy. *Breaking Boundaries: A Unique Inter-University Program Addressing the 21st Century Skills Gap* (USA), discusses an extracurricular program offered to university students from a diverse array of institutions and majors. This program introduced these cohorts to design and business innovation methods. The authors discuss the challenge of measuring results from this experience, and scaling it across comparable programs. *Design Thinking Mindset: Exploring the role of mindsets in building design consulting capability* (Australia), tests the relative utility and value of nine previously-developed design thinking mindset attributes—through interviews and surveys—with several consultancies. The authors share insights gained from this exercise in asserting that mindset may be of greater importance than method in both their own pedagogy and, potentially, in some industry contexts.

Transformations in healthcare/wellness/harm reduction

Community Based Naloxone Kits: Using design methods to transform complex user needs (Canada) details the authors' design-clinical healthcare collaboration to improve the uptake and effectiveness of freely distributed kits to save the lives of those overdosing from opiate drugs. The case demonstrates and tests how innovation in user experience design and communication design of these kits makes them more effective in emergency situations. *Development of JIT patient-specific implants: design-led approach to healthcare and manufacturing transformation in an Australian context* (Australia), examines how human-centered design can improve both patient experience and clinical outcomes in a hospital setting. The case explores how design innovation can streamline the organizational complexities surrounding the use of a JIT (just in time) process to 3D print joint replacement implants. *Discovery – co-designing the software requirements for use in Community Dental Services in the NHS* (UK), details the complex process of transitioning a legacy (paper-based) dental record-keeping system to centralized open-source digital record-keeping. This transition provided an opportunity for the author and her team to involve stakeholders in participatory processes to redesign aspects of the form; enhancing accuracy, salience and the value of data collected. In *Managing Vulnerability and Uncertainty: Developing design competencies within an American healthcare non-profit* (USA), the founder of an American healthcare not-for-profit organization describes how she has used design innovation to train and evaluate her staff. Ensuring consistency, quality and fit are imperative to her service-based organization in which her "product" are facilitators within a system who work closely with the families and caregivers of those suffering from Parkinson's Disease. *Empowering seniors' mobility to maintain a healthy lifestyle: a case study* (Netherlands), explains a plug-in designed for a popular app in the Netherlands. This plug-in facilitates senior citizens to locate like-minded companions and to undertake travel within the country. The case leverages an existing, widely-adopted, platform to support wellness amongst a, sometimes isolated and less physically mobile, population. *System Design for People Dealing with the Liminal Space* (Israel), describes the case of how service design tools and methods were applied to a system that could be implemented between Israeli inter healthcare agencies. This system is designed to support families and caregivers of terminally ill people. The author defines the role of case-facilitator, a type of doula who would assist the person's caregiver(s) to navigate the logistical and emotional pain-points of the journey through a terminal illness, describing the case-

facilitator's function across its liminal space. *Equity Listening and the Transference of Power* (USA), details the class project run through a design strategy consultancy with the American Heart Association as client. The case describes two contexts in which the group worked with a framework (developed with the consultancy), to listen with empathy and agency, to stakeholders experiencing health problems associated with complex systemic issues preventing access to healthcare or discouraging of healthy practices.

Transformations in community empowerment

Designing and Developing Entrepreneurial Culture for a Small UK Based University (UK) presents University of Dundee's work around design innovation management and the development of an outward-facing more networked entreprenurial culture in their city. With a goal of using design to promote cultural change, the University identified and leveraged strategic local cultural and economic resources. *Applying Equity Design to Address Oakland's Homelessness Human Rights Crisis* (USA) describes the work of Reflex Design Collective, an experimental social equity design consultancy based in Oakland, California who facilitated a co-design innovation summit where unhoused Oakland residents led collaborative efforts to alleviate the challenges of homelessness. Their design facilitation approach they propose, will provide managers and designers with an alternative mindset aimed to amplify the voices of marginalized groups and stakeholders. *Design + Social Impact: a Workshop in Cairo* (USA) describes how the case authors were invited by the US Embassy in Cairo, Egypt to give an intensive, five-day workshop on critical areas for those interested in taking a design-strategy approach for entrepreneurial or intrapreneurial ventures addressing complex social challenges. The case outlines their process and insights working with twenty-five Egyptian creative professionals from diverse backgrounds. *Causing a Stir: Co-creating a Crowd-voted Grants Platform for Creative Entrepreneurs* (Australia), presents an overview of the methodology and process used for a crowd-voted grants platform aimed at supporting creative youth in the early stages of their entrepreneurial journey. The author places specific emphasis on the characteristics of programs that target creative youth in Canberra, Australia. *We Need an Internet Connection* (Sweden) outlines a co-design approach addressing the digital transformation of Small-to-Medium Enterprises (SME'S) in the Jönköping region in southern Sweden. The authors describe the tension between proposal-level goals, operation-level goals and the design process which was operatively approached as a co-design activity involving multiple stakeholder groups. *A Design Contribution to the Entrepreneurial Experience* (Colombia) investigates the entrepreneurial environment of Medellín, Colombia. This ecosystem is experiencing recognition and growth but lacks qualitative analysis to fully understand the landscape and how it impacts perceptions and awareness and agency. The author proposes a number of concepts for the local government to improve the experience of establishing a startup in Medellín. *Project Kapıdağ: Locality of Production: A case of research for social design in complex collaboration* (Turkey) addresses the friction between industrialization and localized traditional production in rural Kapıdağ, Turkey. The authors along with a team of students from İstanbul Bilgi University Faculty of Architecture, identified the assets through a range of research methods for the collective wellbeing of the region. Their work revealed potential opportunities to promote and sustain the artisinal practices and traditions of Kapıdağ. *Designing a Coherent Land Registration System for Rural Portugal* (Portugal) presents the work of Lisbon-based "With Company," engaged by the Portuguese government after the launch of a digital platform to address the challenge of their centuries-old problem of rural land registration. The authors executed field research to better understand owners' relationships with their land, map their struggles with the platform and prototype ways to improve the service. In *Applying Design to Gender Equality Programming* (USA), the authors describe their application of design methodologies to the area of women's rights programming and feminist grant making. Working with the "Fund for Gender Equality," a grant-making mechanism of the United Nations Entity for Gender Equality and the Empowerment of Women the case presents proposals for a range of women-led civil society organizations.

Transformations in corporate management and innovation

Business as Unusual: Creative Industries and International Trade in the Era of Brexit (UK) is a survey of "Baltic Creative," a commercial space for creative and digital industries, housing almost 100 SMEs (small and medium sized enterprises). Policy-makers in the UK are concerned that the creative industries are not sufficiently engaged in global markets, however the authors discover that these industries—at least at Baltic Creative—are already very engaged in global markets; the key concern is now around the impact of Brexit on these markets. *Designing a Business Unit and Creating the First Ever Responsive Kitchen* presents a collaboration between Tipic an Italian strategy firm and Marmo Arredo a leading company in quartz surface production. The case outlines the design of a new business unit devoted to the development of innovative products which lead to Tulér, a stone work surface with fully integrated, gesture activated, kitchen technology. *Design Innovation Practices in a Global Supply Chain: A Fung Group case study* (Hong Kong), describes how the Fung Group—a leading Hong Kong-based company whose core businesses operates across the consumer goods global supply

chain—empowers and involves a wide range of stakeholders in in the co-creation of strategies involving absorptive, collaborative, and adaptive practices that aim to challenge or disrupt current company practices. *Towards an Interdisciplinary Knowledge Exchange Model: Uniandes design school helps to transform Avianca into a design driven company in the flight industry* (Colombia), presents a partnership between Design School of Universidad de los Andes and Avianca, the leading airline of Colombia. Students and faculty from the University collaborated with Avianca employees to introduce them to the methodologies of design-driven innovation. Explorations around the traveler experience lead to testing a range of prototypes at Bogotá's international airport. *Transitioning Business for a Circular Economy* (Hong Kong) describes the author's work with Lane Crawford, a retail company with specialty stores selling luxury goods in Hong Kong and Mainland China. Drawing on both academic and professional practice the case explores strategic business opportunities for the company to transition to a circular economy, which in turn can contribute to a regenerative society.In terms of theme, in this round, we were surprised not to have encountered cases from Financial Technology/Cryptocurrencies and banking and finance in general. We also did not see cases dealing with AI and automation technologies or with algorithm design. Just one case (*Empowering seniors' mobility to maintain a healthy lifestyle: a case study*) explicitly addressed aging and retirement, although several implied the existence of an aging population in a public health context. It will be interesting whether we will see these emergent sectors in future case study forums.

Additional to the themes, we discerned several frameworks—or conceptual groupings—that emerged as common threads. The first, using design to optimize or improve project management, outcomes and engagement united cases as diverse as *Equity Listening and the Transference of Power* (USA), *Design Thinking Mindset: Exploring the role of mindsets in building design consulting capability* (Australia) and *A design contribution to the entrepreneurial ecosystem* (Colombia). While Empowering communities through involvement in co-design or other kinds of "bottom-up" input were not exclusively confined to the "Transformations in community empowerment theme," and could be identified in many of the cases presented in the theme we identified as "Transformations in healthcare/wellness/harm reduction." The Application of design innovation to new or underexplored contexts unites any of the cases that may introduce unexpected contexts for intervention such as *Designing a coherent land registration system for rural* Portugal (Portugal), while Mindsets and practices informing new methods, tools and approaches may connect cases clustered in "Transformations in methodologies and practices" with cases nested in other themes that utilize any new or innovate methods of engagement and testing such as *Design + Social Impact: a Workshop in Cairo.*

Finally, we offer our sincere thanks to each of the authors represented here, you have an open invitation to submit cases to future proceedings and to spread the word amongst your colleagues in academia and industry.

We hope you enjoy reading these as much as we did in gathering them up and listening to the presentations.

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Research Perspectives IN THE ERA OF Transformations

Community Based Naloxone Kits: Using Design methods to transform complex user needs into innovative community partnerships

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The opioid crisis in Alberta is a public health crisis. In 2016, more people died from an opioid poisoning than from motor vehicle crashes. Naloxone is an opioid antagonist which means that it can reverse an opioid overdose for a period of 30–60 minutes, at which point, the overdose may return. In December 2015, the Take Home Naloxone (THN) Program was rolled out in response to the opioid crisis. Under the renamed the Community Based Naloxone Kit Program (CBNP), naloxone kits are now available free of cost at many pharmacies and community clinics around Alberta. The wide availability has led to a new challenge—that the kits may be used by people who have received little to no training. Some may encounter the kit instructions for the first time when there is an emergency in which they need to administer an injection urgently to someone who has passed out. Studies have found that most overdoses occur in the presence of another person—this provides an opportunity for someone to intervene. People often die from witnessed opioid poisonings because other people do not know what to do to help. A pilot study conducted through community partnerships involved 30 participants in two different urban centres (Edmonton and Calgary) who self identified as either experienced in substance use or friends/family of people with lived experience has revealed some interesting findings. Qualitative observations and data collected in the initial pilot work show that end users are experiencing unique challenges in accessing opioid education and have challenges using instructions on how to administer naloxone in an overdose setting. User testing and observation of user behavior has great potential to support educational material for opioid awareness.Human-centred design approaches that gather information with and about people using antidote kits are urgently needed in order to mitigate risk and ensure successful administration of first aid and naloxone in an emergency.

Keywords: design research, visual communication design, user centred design, information design, typography, human centred design

Introduction

The opioid crisis in Alberta, Canada is a public health crisis. In 2016 more people died from an opioid poisoning then from motor vehicle crashes. Naloxone (trade name Narcan) is that antidote to an opioid poisoning. Naloxone is an opioid antagonist. This means that it can reverse an opioid overdose for a period of 30 to 60 minutes while medical help arrives. In December of 2015 the Take Home Naloxone (THN) Program was rolled out in response to the opioid crisis. During the first year of the program 9,572 kits were distributed by over

900 sites across Alberta and 973 overdose reversals were reported. Now renamed the Community Based Naloxone (CBN) Program, 83, 286 kits have been distributed by 16,70 registered sites, and 4,505 reversals have been reported. While we usually hear about the overdoses that are due to the use of recreational/street drugs it is important to realize that anyone has the potential to be a victim of an opioid overdose. Studies have found that most overdoses occur in the presence of another person; this provides an opportunity for someone to intervene (Freeman et al., 2017; Davidson, Ochoa, Hahn, Evans, & Moss, 2002; Strang et al, 1999). In an effort to prevent mortality rates due to overdose, Naloxone kits are available at many pharmacies and community clinics around the province. Anyone is able to obtain a kit free of charge and with no questions asked. The person providing the kit (pharmacist, nurse, community support worker, etc.) is expected to provide some basic kit training however it is possible that training may be refused or may be forgotten when it comes time to use the kit. As a result, people are often left to rely solely on the instructions included in the kit.

Context & problem/opportunity area

Health agencies have begun distributing antidote kits widely which has led to a new challenge – that antidote kits may be used by people who have received little or no training. Some may encounter the instructions for the first time when there is an emergency and they need to give an injection urgently to someone who has passed out. Another factor adding to the complexity of the design challenge is the fact that current educational messages for Community Based Naloxone Kits have historically been designed (or "undesigned") *by* healthcare professionals *for* healthcare professionals, without asking people who use drugs or their support networks what information is important for them to have when they or their family/friends experience an opioid poisoning.

In an effort to address the opioid crisis and improve communications strategies around emergency overdose response, we designed, administered and analyzed a pilot study involving 30 participants in Edmonton and Calgary who self-identified as either experienced in substance use, friends/family of people with lived experience or opioid naive participants. Observations gleaned from the initial pilot work demonstrate that end users are experiencing unique challenges in accessing education and using instructions on how to administer naloxone in an overdose setting. The central message of this case study is that, based on our unique and innovative experience, additional human-centred design approaches that gather information with and about people using antidote kits are urgently needed in order to mitigate risk and ensure successful administration of first aid and naloxone in an emergency.

This project is notable because it aims to include individuals and communities affected by opioid poisoning using principles of human centred design in the evaluation of the prototypes. Using a method developed by the Communications Research Institute (CRI), it strives to answer the following research question: What are the perceived barriers to appropriate first aid and naloxone administration in an opioid poisoning and how can the educational and instructional materials surrounding the delivery of the Community Based Naloxone Program improve the end user experience with the aim to reduce deaths from opioid poisoning?

Academic insights came in the form of design methodology and experience from the design experts. Public health nurses and an emergency physician provided real world experience and data, while human factors representatives designed a protocol that tested end user performance measures that were relevant to both the design and public health messaging. Community partners and students relayed important information about the lived experience of opioid overdoses and responding to emergency situations with little preparation or education.

The narrative:

In November 2018 a research team made up of designers, nurse educators, students from the University of Alberta, emergency medicine physicians, a human factors team from Alberta Health Services (AHS) and community partners identified a communication challenge: the instructions included in a life-saving naloxone kit were not easily understood by the general public. This resulted in, at best, confusion and, at worst, a failed attempt to prevent an opioid related death. The research team came to a consensus that the goal of a naloxone kit was to provide specific information to users in an emergency overdose scenario. Through consultation with medical experts we were able to define performance specifications. These performance specifications are goals of the instructions that isolate information that we would like to test with users. User testing allowed us to access what is not working with the designs, set some benchmark goals and then revise

and retest to achieve our desired level of performance. We were able to identify these performance measures/tasks that the instructions in the kit must perform:

1. Define an overdose (OD) (identify what an OD looks like: slow breathing or no breathing at all, unresponsive to voice, lips or nails appear blue, gurgling or snoring sounds, choking or vomiting, cold/clammy skin, constricted pupils, seizure like movement)
2. Know when to call 911 (after an OD has been identified)
3. Know how to do a safety check (assess for hazards)
4. Know how to perform rescue breathing (gloves, mask, airway, rescue breaths, recovery)
5. Know how to inject naloxone
6. Know what to do after administering naloxone

We structured our testing to include 2 days in Calgary, Alberta and 2 days of testing in Edmonton, Alberta, both large urban centers. This allowed us to recruit from two sites, one in each city, that provide care and treatment for people with a history of drug abuse in the community. Both of these sites were stakeholders in the pilot project work. In Calgary we tested 20 participants and in Edmonton we tested 13 participants. We structured each day to reflect a time slot of one hour for each participant. We based our timing on an initial run through to determine how long the protocol would take. There were 4 members of the research team present for each interview: a nurse educator, an information designer, a human factors specialist and a research assistant. When participants arrived they were given information on background to the study, they were given instructions about what they would be asked to do, and they were asked to fill out a consent form. A nurse educator or research assistant went through a pre-questionnaire with them that included demographic information such as:

- Age
- Sex
- Highest level of education
- Occupation
- Can you speak / understand / read English
- Have you used opioids in the past
- Have you seen a naloxone kit
- Have you ever received training on how to use a naloxone kit
- Have you ever administered a dose of naloxone

As the facilitator started the scenario, the observation criteria was noted on a sheet. This sheet contained observation criteria such as:

- Did the participant try to wake their friend (how?)
- Did the participant provide rescue breaths
- Did the participant call 911?
- Did the participant check their friends' airway?
  Did the participant tilt head back, plug nose, and breath 1 breath every second for 2 minutes
- Did the participant reassess their friend?

After we ran through the scenario, we asked participants several questions about their knowledge of the procedure. For example, we asked questions like:

- Were you able to identify all of the contents in the kit?
- What factors would you look for to determine if your friend was experiencing an overdoes
- Did you know how to provide rescue breaths?
- What will happen if you provide Naloxone to someone who is not experiencing an opioid overdose?

We also asked some subjective questions such as:

- Did you find any of the pictures or terminology in the brochure to be confusing?
- What was your impression of the pictures or terminology overall?
- And finally how could the instructions be improved?

We determined through the use of testing, participation and surveying that recording and thematically coding the results that would inform changes to the design work of the insert. Through observation and testing in this way, it allowed us to determine the design strategy and implementation of the following work.

Figure 1: Testing materials

Figure 2: The torso mannequin for simulation of the procedure

Testing Protocol

In order to evaluate the effectiveness and usefulness of the naloxone kit instructions we had participants from the three different user groups take part in a simulated scenario. Upon arrival at the testing locations, the facilitator reviewed the informed consent form with the participant as well as a pre-questionnaire which asked a combination of demographic questions as well as questions about their experience with opioids and naloxone kits. Prior to the beginning of the simulated scenario a standardized verbal protocol was read aloud to participants which outlined what was expected of them. They were asked to imagine that they had entered the room to find their friend collapsed on the floor. Their friend (represented by a torso mannequin) was non-

responsive and was suspected to have overdosed. Participants were instructed to use the naloxone kit and the instructions included to help their friend (Figure 1 and Figure 2).

It was stressed to each participant that the goal of the project was not to evaluate their individual performance but instead to evaluate the usefulness of the instructions provided in the kit. Participants were asked to pretend that they were alone in the room and to avoid asking the facilitator any questions. They were also encouraged to talk-a-loud and say whatever came to their mind so that this information could be captured. At this time the facilitator informed the participant that the scenario was about to start. The facilitator read the following line with a sense of urgency: *"Please someone help, my friend is lying on the floor, I think they've overdosed."*

The participant was expected to use the naloxone kit and the instructions provided to attempt to help their friend. Facilitators used a standardized observation form to record predefined performance specifications. Once the participant had completed the task (used the instructions to provide a dose of naloxone) the facilitator ended the session by informing the participant that *"the ambulance had arrived and the paramedics will take over."* If participants were unable to complete the task or appeared to be too overwhelmed or stressed out the facilitator ended the scenario repeating the same line.

A debrief was administered which asked a series of questions about the kit (i.e. were you able to identify all of the contents in the kit?), the task (i.e. did you know where to inject the Naloxone in your friend's body?) and the design and usefulness of the instructions (i.e. were there any words/pictures provided in the instructions that you did not understand?). Any questions or concerns the participant had were addressed and additional education was provided by a nurse to those who were interested. Participants were thanked and a $20.00 gift card was provided in order to compensate them for their time.

The key learnings:

Many key learnings came from this initial pilot study. These ranged from task uncertainty to product unfamiliarity, compounded by the stress of needing to act in a timely, efficient manner.

First, it is not clear to many what opioids are. Many of our participants, when asked if they had used opioids in the past or if they had responded to an opioid overdose, responded that they did not know what an overdose was. Most participants had knew to refer to these drugs from their "street" names: meth, fentyanyl, etc. In the message strategy going forward, we limited the mention of the word "opioid".

Secondly, we discovered that there were similarities between the target groups that we tested. In particular we found that both used previous knowledge more than the instructions to accurately administer 1 ml of Naloxone. Participants were not able to understand that the package was designed to help in an emergency situation.

Text, Illustration and Layout

There were many differences between the target group as well. In particular, the participants read the pictures and the text equally in the non-experienced group. In the experienced group, however, participants only read the pictures, and rarely read the text.

Through the testing we concluded that it important to use illustration as a way to relate to what the reader already knows. It becomes essential to show what readers expect and recognize. Barnard and Marcel say that when people recognize pictures, "the visual form of objects is related to and invokes spatial, semantic, and other real-world knowledge" (Barnard & Marcel, 1984 p. 44). Pictures need to be able to provide the reader with new information but also need to be able to remind them of the real thing. For example, in the prototype, the illustrations that we used represented how a rescuer and casualty might look if performing artificial respiration. In this step, the rescuer is demonstrating how to clear the airway by performing a "head tilt, chin lift" (Figure 3).

Figure 3: Visual representation of how a rescuer and casualty might look while assessing response and breathing.

We depicted representational, rather than abstract illustrations of people performing Artificial Respiration. Images in these procedural instructions are intended to provide visual information to the reader. This is different than in other publications where they are used to provide pleasure or visual stimulation. How realistic do images have to be? Goldsmith says that "semantic unity requires recognition of the image, and representation adequate for this purpose relies not on slavish imitation of an object, but on the clarity of distinguishing features which give relevant information" (Goldsmith 1980, pg. 207). "The number of distinguishing features that any object possesses controls the extent to which its image can be distorted" (Goldsmith 1980, p. 207). In other words, it may not be necessary to exaggerate every detail of a hand for the reader to recognize it as a hand. In the case of the CBNK instructions, it was important to indicate that the needle should be inserted partly in to the vial containing the medication and that it was important to pull down on the syringe to push extra air out of the needle. It was also important to indicate the correct administration of the injection—in particular what the needle would look like when depressed and which place the on the thigh the syringe should be injected.

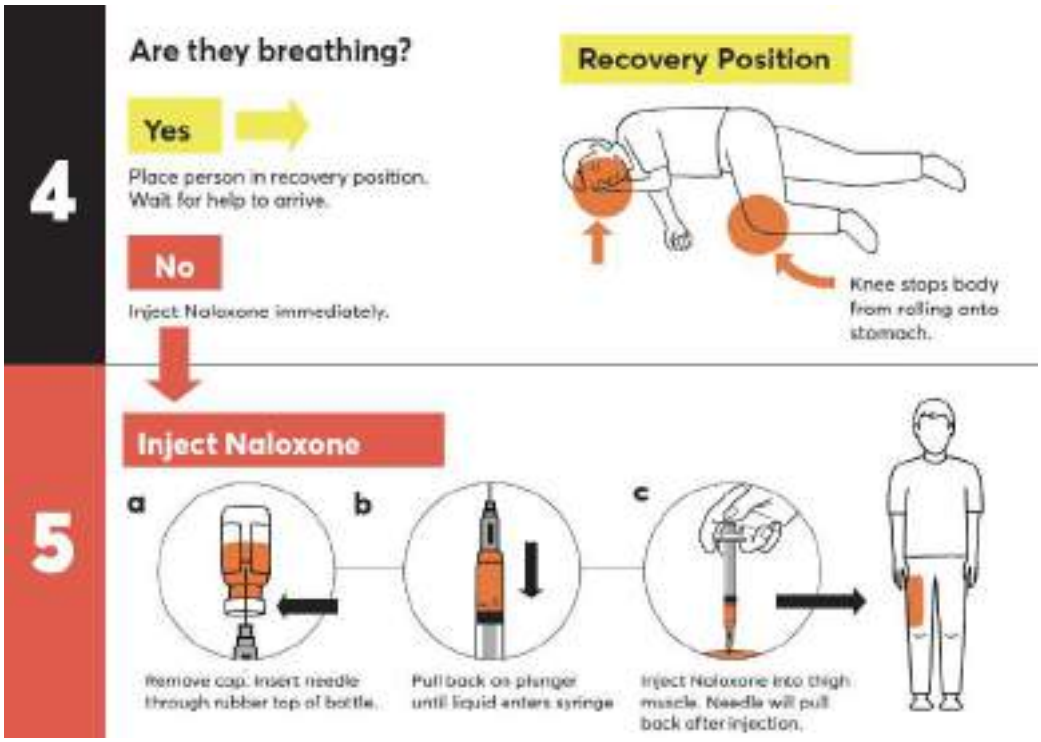

Figure 4: Steps 4 and 5 indicating a decision to be made

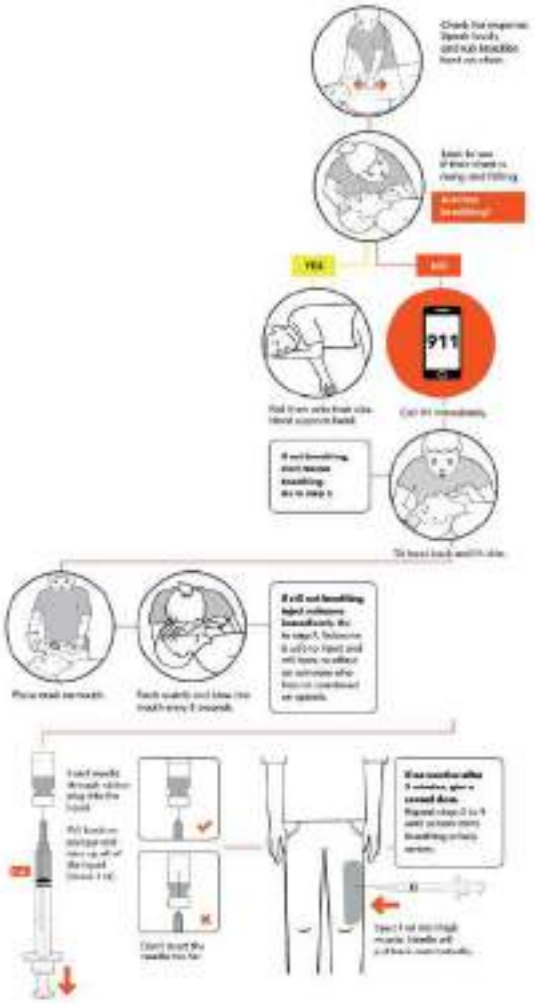

Figure 5: An alternative way of presenting the decision to be made

Evelyn Goldsmith's analysis of how people read illustrations is similar to Marcel and Bernard's analysis of how people relate to instruction. She proposes more of an analytical model that involves three levels of comprehension: syntactic, semantic, and pragmatic. One of the levels of comprehension that is important to these instructions is semantic knowledge – this is the knowledge that involves providing a frame or reference to show size or scale. In these illustrations, hands are an example of a tool that relate the viewer's size of semantic knowledge. The size of the hands shown in the illustrations is an important reference point because not only does it show how to prepare the plunger for injection, but it also provides a visual link to what the user knows, making it easier to explain the procedure of using a needle.

Layout and comprehension

In the participant testing, there was confusion over what to do if the person was discovered to be not breathing. This may have been because the options were not shown side by side in the layout (Figure 4). An alternative presentation to the layout was designed (Figure 5) which depicted the action in a tree diagram or linear branching configuration (Twyman, 1985).

However, we did not choose to test this option because it was felt by the stakeholder team that the layout was too cluttered and that the large steps and headings in the original design helped to provide more of a mental map of the procedure. The layout also meant that we would need to print on a larger sheets of paper, causing additional costs to an already small budget.

As Hartley writes "consistent spacing aids readers' perception of the structure of the document as a whole and thus helps them to understand its organization and structure" (Hartley 1985, p. 27). To this point, Anderson and Armbruster (1985) agree that "visual display, diagrams, and charts can facilitate comprehension presumably because of their ability to portray the 'big picture'' (Anderson & Armbruster 1985, p. 168). In this

insert, all of the steps are labelled consistently on the margin on the left hand side and the decision was made to keep the steps the same height, if possible, as the insert was unfolded.

The design of the insert into a flow chart or tree diagram did not help the reader to see comparisons within the text. As Hartley points out, "psychologists maintain that consistent spacing helps readers to see redundancies in the text, and thus to read faster" (Hartley 1985, p. 27). The use of a grid allows the designer to present ideas so that readers will expect how ideas will be organized (Anderson & Armbruster, 1985). It also "enables comparisons to be made between work produced in different places and at different times; and it leads to an overall approach to the structuring of information which makes it possible to deduce meaning through content and treatment in much the same way that meaning is frequently deduced in verbal language" (Twyman 1975, p. 11). A structured grid, emphasized by the folds of the insert directed the reader's attention and allow the reader to make comparisons between one frame and the next.

Word choice and order of action

The instructions were designed to reflect the way that people would perform the action of the instructions (Figure 5). For example, in order to start rescue breathing, it is essential to put on gloves, then mask, then give one breath every 5 seconds. It would have been possible to phase this operation as "give rescue breathing for 2 minutes by every 5 seconds giving one breath and do not forget to put on your gloves and mask". However, in long instructional sequences, it is helpful to have "the order of mention match the order of action" (Wright 1999, p. 58). Wright points out that in English we usually say things in subject-predicate order. An example of this in overdose first would be: "provide rescue breaths by pinching the nose and blowing into the mouth". However, as Wright points out in the article, when the steps are actually performed, the order becomes reversed: first you need to pinch the nose, then blow into the mouth and then continue providing rescue breaths. This is opposite from the way the instructions are written. Wright suggests that the "writer's choice of word order can slow comprehension but can have a much bigger impact on the ease of creating action plans" (Wright 1999, p. 57). This descriptive order becomes especially important for a procedure with many steps (Wright, 1999).

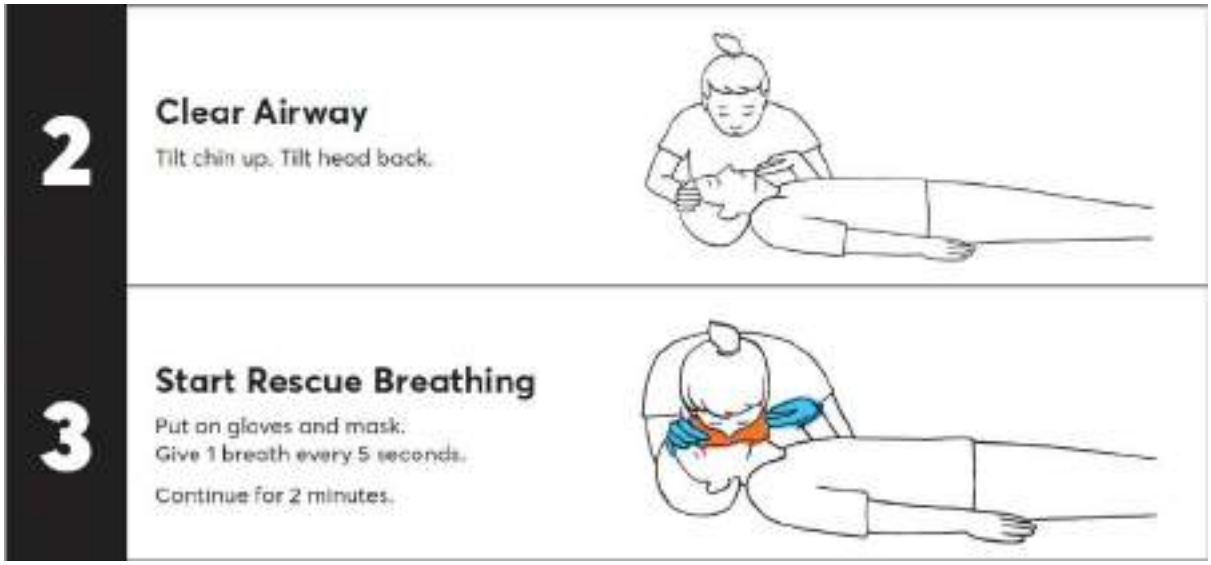

Figure 6: Indicating the sequence for performing rescue breaths

Typography

Short sentences using short phrases with few words and bullets wherever possible were used to aid comprehension. Waller, in his writing about type, emphasizes this point by adding that typography "adds the diagrammatic quality that can make such a structure accessible to the browsing or less committed reader" (Waller 1983, p. 4). Anderson and Armbruster reinforce this point by suggesting that "by simply skimming the text, the reader should be able to determine the author's specific topics, the purposes the author is addressing with respect to these topics, and the structure of the ensuing text" (p. 165-6). Using this logic, the large numbers, and short subheadings should make the steps in the procedure more obvious and easier to read, providing a "typographic roadmap ". The typographic roadmap in these instructions are emphasized by the steps that are in the same place down the left hand side of the insert and the headings which, when read

alone without the detailed instructions, will allow the reader to understand the procedure. Waller writes that "readers who cannot see the wood for the trees may benefit from a map – that typographic and spatial factors can be used to clarify the longer structural relationships in a text, easing the cognitive burden that long, featureless texts impose on the reader" (Waller 198, p. 3). The texts that he is referring to are most likely continuous prose texts in which there is no typographic distinction between different thoughts or ideas. Hartley also writes about the benefits of other formats over continuous prose text. He says that "research suggests that readers prefer text which has lists or numbered sequences spaced out and separated, rather than run-on in continuous text" (Hartley 1985, p. 51). It has been found that when tasks in an examination situation are made more explicit such as by space or typographic cues 'students spend more time and effort reading the relevant segments of text, and learning outcomes generally improve' (Anderson & Armbruster 1985, p. 160).

Conclusion

This collaboration between healthcare providers, information designers, human factors specialists and community members represents a novel approach to addressing a situation where clear communication really matters. Designing a coherent communication strategy for an emergency overdose situation identified unique challenges which required unique design solutions. Lastly, there is no substitute for training. These instructions should be part of a larger educational initiative that includes education and explanation, guided instruction and practice.

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Research Perspectives IN THE ERA OF Transformations

Design + Social Impact: a Workshop in Cairo

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In October 2018, the US Embassy in Cairo, Egypt invited Parsons professors John Bruce and Mark Randall to give an intensive, five-day workshop on critical areas for those interested in taking a design-strategy approach for entrepreneurial or intrapreneurial ventures addressing complex social challenges. This type of cultural exchange, one potentially charged with political issues, was a milestone for the Embassy. From over 200 applications, 25 professionals from diverse backgrounds – NGOs, education, film, design, architecture and performance – were selected to attend. A pre-workshop exercise focused intentions; themes included empowerment, cities, health and culture. All were action-oriented and addressed particular challenges within Egyptian society. The curriculum included innovative design-led research theories and practicable methods. Immediate outcomes revealed positive shifts in perspectives on systems, stakeholder activation, and narrative development for advocacy and implementation. The energy and emotion was palpable over the course of the week, culminating in an event for the public, press and top government officials.

Keywords: social impact, design strategy, Egypt, entrepreneur

"The revolution was the real wake up call, a realization that I also have to work on social projects."

– workshop participant Adham Bakry

Prior to the Arab Spring in January 2011, Adham Bakry was a freelance graphic designer in Alexandria, Egypt with a practice focused on branding for arts and culture. During the upheaval of the revolution he added activist and graffiti artist to his resume and took to the streets, using his creativity to comment on the Mubarak regime (Figure 1).

Figure 1: A protester during the Arab Spring with graffiti art by Adham Bakry. (source Adam Bakry)

Architect and urban planner, Taher Abdel-Ghani said that what inspired him to follow a path of social change was his "previous experience with the revolution" he goes on to say that this period was a "turning point in the way I viewed society and the environment I'm living in." Many of the participants in *Design + Social Impact, a Workshop on Strategies for Creative Intervention* hosted by the US Embassy in Cairo, Egypt expressed similar sentiments. At the Embassy's invitation, John Bruce and Mark Randall from Parsons School of Design in New York developed a five-

day intensive workshop for creative professionals on how to leverage design-led research and strategy to develop interventions to address challenging social issues.

Workshop context

Embassy programs for cultural exchange typically involve more traditional forms of art, film and performance. Dina Hafez Abdelhafez, a Cultural Affairs Specialist from the US Embassy in Cairo was looking for ways in which the Embassy could support the creative economy in Egypt. She was also interested in how design could be leveraged as a tool for social innovation. The open call for applications to the free workshop cast a wide net, with expectations for potential attendees being civic-minded, engaged creative professionals.

Figure 2: Branded materials developed by KMT House promoted the workshop across all forms of media. (source Mark Randall)

The Embassy partnered with urban-tech innovation space KMT House in Cairo to host the workshop. KMT House handled all marketing and outreach, (Figure 2) which attracted over 200 hundred applications prior to the deadline with an additional 100 individuals expressing interest after. The response exceeded expectations, and dramatically indicated a deep desire for this type of engagement.

Participants were early-mid-career professionals covering a wide array of disciplines; from communication and interior design, architecture and urban planning to filmmaking and fine art (Figure 3). In addition, individuals working within established non-profits brought the themes and projects they were exploring into the workshop. Participants were given a detailed assignment in advance to articulate their area of inquiry, which allowed them to engage immediately on the first day. The exercise also gave and Bruce and Randall valuable insight into each individual and an understanding of the emerging themes to better tailor the workshop to meet the needs of the participants.

Theoretical frameworks and approach

The Cairo *Design + Social Impact* case advances an argument for the value of image-oriented practices that embrace cinematic devices and support narrative perspectives during analysis and synthesis of the design-led research and design strategy process. The context addresses learning environments where theories and methods are presented via an intensive workshop format. Our curriculum and pedagogy involved confrontations with narrative artifacts and forms through embodied and multi-directional learning, and relied on a variety of tools and participatory engagements within a design process for rendering images in relation to movements through systems at various scales.

Figure 3: Participants were early-mid career Egyptian creative professionals. (source US Embassy, Cairo)

The term storytelling is thrown about very liberally in design strategy and management contexts. Too many assumptions are made around the potential usefulness of acts of telling stories within a design process. Yet, undeniably, narrative forms and artifacts possess great possibility for catalyzing aspects of design-led research and creative intervention. Stories emanating from events during the Arab spring operated with reflexive potency to disrupt entrenched power and shift system dynamics. The affordances of decentralized information via digital social media – still relatively new in 2011 were put to use during the 18 days of uprising in Egypt in ways beyond reportage, archive, or discourse. Media was used to mobilize people in real time. In the immediate aftermath, trans media projects such as 18daysinegypt.com by Jigar Mehta and Yasmin Elayat attempted to augment media activities with platforms to support generative environments for subsequent collective actions (Mehta and Elayat 2011).

In the years that have followed the major events of the Arab spring uprising of 2011, the socio-political atmosphere of contemporary Egypt continues to pose interesting questions in regard to the potential affect of stories in relation to efforts of design for social innovation. How might the flash points from 2011 continue to influence designers and strategists in their approach to using imagery for investigation and intervention? Memory plays an important role in struggle, and can catalyze energetic gestures for conscious efforts toward change; thus control of people's memory can impact their agency to participate in designing a future (Foucault 1975). In the wake of the 2011 events, alternative press outlets have been suppressed and opportunities for social exchange in public spaces has been atomized through restrictive urban regulations regarding gatherings in Cairo.

Stories in a variety of forms and formats can support vital communication among community members, and thus might serve as the bottom-up currency of exchange for social progress. The infrastructures for such dynamic mixing are often at risk of gentrification, spiritually as well as practically, and gentrifying forces might be motivated not only by market economics but also by desires to control people's ability to share experiences that might spur creative freedom (Schulman 2013). The projects of the Cairo *Design + Social Impact* workshop did not specifically address the politics directly involved with the Arab spring, while many focused on the symptoms of policy that resulted in the wake of the uprising, especially in regard to conditions impacting the potential of social fabric and public space (Figure 4).

In light of the context of Cairo, and in regard to the energetic potential of storytelling, the approach for curricular content and pedagogy of the *Design + Social Impact* workshop was developed in order to privilege stories as active design strategy tools. Our program utilized a dialectic approach to facilitation and visual phenomenon. It relied upon the use of a multiplicity of image-oriented narrative devices (Frølunde, Simonsen 2014). The approach acknowledges an array of players and meanings as operating in dynamic flux within

context, and allows for productive tensions to continuously occur in the construction of meaning (Frølunde, Simonsen 2014) (Bakhtin 2000). Lisbeth Frølunde refers to this methodology as neo-Bakhtinian, referencing Mikhail Bakhtin's theories of hybrid dialogic forms for efforts toward the generation of meaning (Bakhtin 2000).

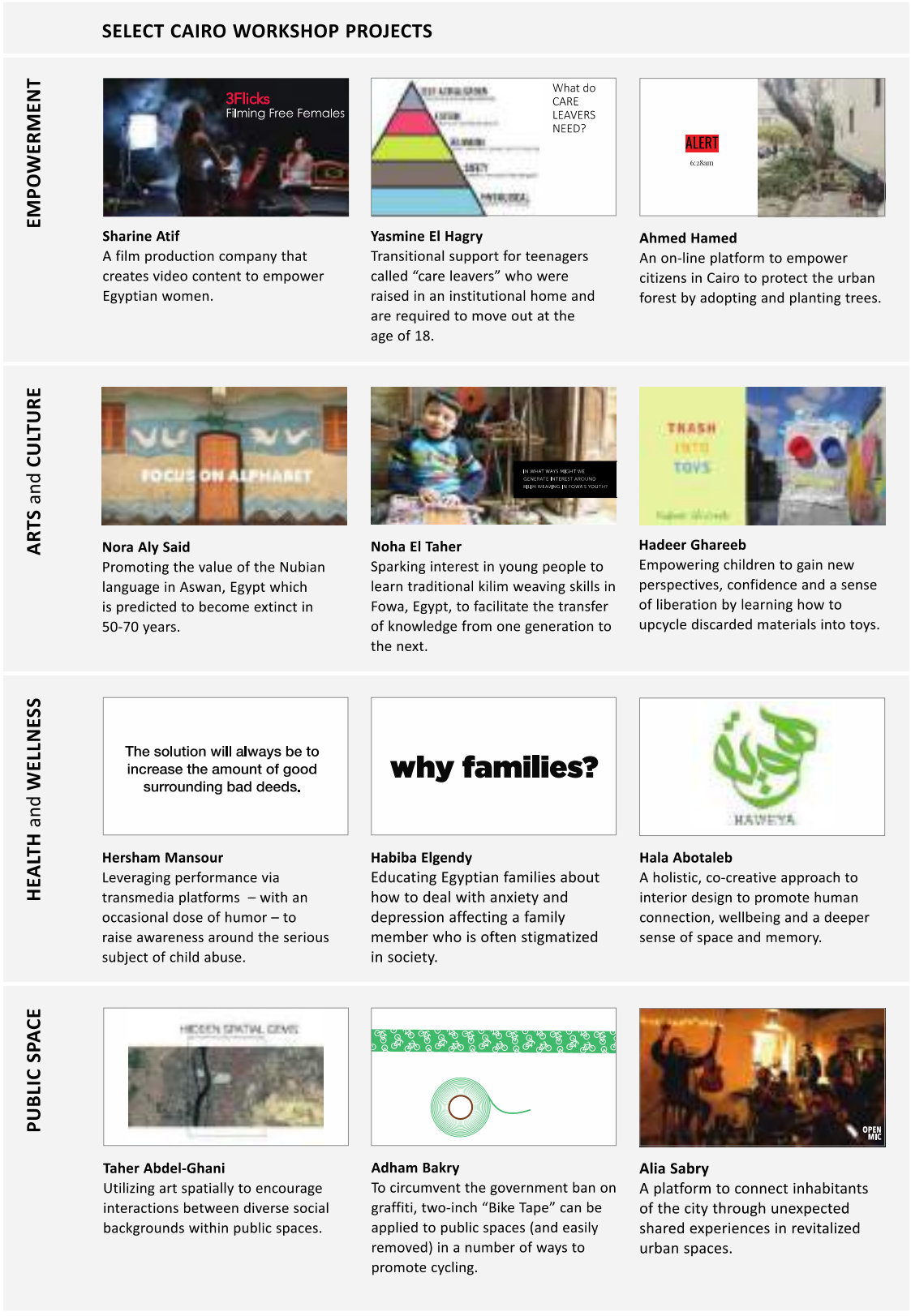

Figure 4: Brief abstracts of select workshop projects. Topics were roughly distributed across four themed areas. (source workshop participants)

Taking cues from design fiction, our attempts were to support iterative activities where narrative elements could be referenced, critiqued, invented, modified, and juxtaposed in order to charge and confuse perspectives within complexity. As such, the framing of the activities leveraged cinematic tropes – bringing to life, through multiple perspectives, the re-creations and speculative creations of situated moments at various scale and temporal junctures of the project ecosystem. In this way, the design process might enable the recognition of new co-creative spaces, counter-intuitive modes for addressing leverage points, and tactical gestures within strategic directions.

Methods: Images of crisis, images of change

The program relied upon a process of creating both reflective and reflexive exercises for workshop participants in order to catalyze narrative fodder and provide organizing infrastructures for sense-making activities leveraging an array of story elements (Schon 1984). Developed by Freedom Lab, the Wheel of Reasoning, (Figure 5) is a tool that maps the relationships of a problem space in order to engage in root cause analysis as well as propose trajectories for positive futures (Freedom Lab 2018). We have modified the original instructions in order to elevate cinematic visualization within the nodes of "crisis" or extreme opportunity, and "change." Instructions indicated that these nodes be articulated as though one were describing a 5-minute scene from a film. What is the moment of crisis in regard to people involved in a situation, in real time, in a particular setting? What are the action, atmosphere, and dynamic energy of this moment? What is immanent? Working in small teams, we tasked participants to craft their "image of crisis" and perform a recitation of these scenes.

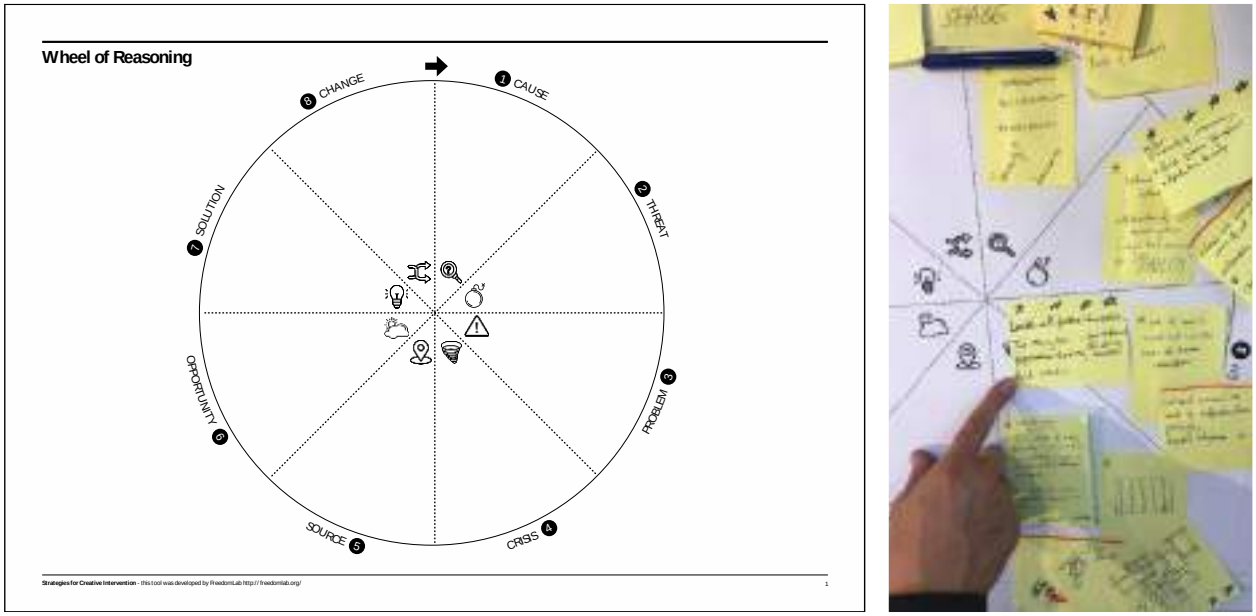

Figure 5: The Wheel of Reasoning maps the relationships of a problem space in order to engage in root cause analysis as well as propose trajectories for positive futures. (source left, Freedom Lab; right Mark Randall)

One participant working with the idea of teaching children how to make toys from trash related her "image of crisis" with the cinematic sophistication of shot/counter-shot vision. Shot: Children watch tourists board a bus, leaving trash behind as they disappear into a strange and unknown place from which they mysteriously had appeared. Counter-shot: View from a tourist bus as it leaves a rest stop in the desert on the way to Luxor, a group of idle children standing on a dusty trash-strewn road watching the bus move away. The "problem" that perhaps brought about this "image of crisis" was cited as: children of this remote and poverty-stricken location have no toys, and their environment is plagued by trash. While this problem is clear, the complexity and resonant possibility of the situation is revealed more profoundly in the "image of crisis." Later in the workshop week, having iterated with the Wheel of Reasoning and other tools, the same participant related that perhaps an even more serious "image of crisis" for her project might be the same children as initially described in the shot/counter-shot scene, but years later as adults who had never benefited from any intervention around this

problem. The visualized insight exposed the participant to notions of generational trauma, thus further informing the nuanced context of the project ecosystem for potential intervention.

Systems and movement: Perspective and reverberation

Workshop activities productively complicated the positionality of the participants, inviting them to alternate between design strategist and narrator. These iterations might involve shifts in scale as perspectives changed, and might demand attention to dynamic movements along relational paths within ecosystems. Movements through systems might be considered as reverberation. Reverb, in acoustics, is the sonic energy that moves through environmental objects, and continues even after the original source of the energy has stopped. Similarly, we might consider moments of intervention and their subsequent energetic movements through system states (Bruce 2017).

Raising narrative elements from the Wheel of Reasoning exercise, we asked participants to transfer these insights into exercises for the mapping of value creation and delivery. Journey mapping and stakeholder activity mapping examine the reverberation of intervention toward impact (Figure 6). These tools were framed to consider the acted out relationships of design value, stakeholder actions, and transformative journey movements in order to support the development of potential design principles.

Figure 6: Mapping and stakeholder tools examine the reverberation of intervention toward impact. (source John Bruce)

Utilizing narrative forms and image-oriented gestures for working through the constellation of stakeholder activities provoked fresh perspectives on leverage points and impact potential.

For example: the *Trash into Toys* project had been up until these mapping exercises focused on value creation in the form of education workshops for children (Figure 7). As the participant sketched stick figures into a journey-mapping template in the form of a graphic novel storyboard, an ancillary narrative emerged revealing upstream opportunities for intervention. Making toys from trash might be augmented if the trash was optimized in advance for the purpose of making toys. This odd notion, as derived through a storyboard image, led to an extended narrative involving the partnership of larger corporate entities producing goods that typically yield certain kinds of waste germane to the project ecosystem – food and beverage packaging, etc. These corporate partners might engage in co-creative sessions with children in order to redesign packaging with an extended life for functioning as toy parts. The formation of such an unlikely partnership might act as the Trojan horse for confrontations around other systemic shifts in production waste, as well as for garnering new attention to communities impacted by socio-economic disadvantages. The evolution of ideas around the *Trash into Toys* project emerged through visceral, narrative extensions.

Figure 7: Images from early Trash into Toys *workshops from the participant's final presentation. (source Hadeer Ghareeb)*

Outcomes

Through the program's cinematic framing for the use with tools of design analysis and synthesis, participants acquired new perspectives on their respective design practices, and projects evolved with actionable next steps around stakeholder engagement.

Participant Adham Bakry was eager to take back state controlled public space and to use it to promote cycling in Egypt. Bakry sees cycling as a way to positively impact the severe traffic congestion and pollution facing cities like Cairo. To combat the government ban on graffiti which carries with it a prison sentence, Bakry had to innovate new ways in which to publicly spread grassroots efforts around alternative transportation and support collective action toward policy change. His solution, *Bike Tape* is a two-inch roll of tape that can be easily applied – and removed – from surfaces such as roadways to create impromptu bike lanes, wrapped around poles to tag a safe place to lock a bike, or on messenger bags to unite the community of bikers – many of them women new to cycling (Figure 8).

Figure 8: Images from the Bike Tape *presentation, sample tape with mockups for an improvised bike lane and identification for a safe place to lock a bike. (source Adham Bakry)*

Recently, Bakry along with colleague Roba Mustafa an Egyptian educator and event planner have translated the tools from the workshop into universal Arabic so they can be engaged with across the Arab world. After the government demolished the Cultural Center in Bakry's hometown of Portsaid, Egypt, Bakry and Mustafa worked on a funding and relocation plan. They have identified a new space and are building a Heritage Museum and Culture Center. Bakry recounts, "the Wheel of Reasoning and Journey Mapping tools

were used in a grand brainstorming session involving 15 people to great success" (Figure 9). This demonstrates that once learned, these tools promote continued use along with an elevated attention to narrative. They are easily adopted and translated for other contexts - an unexpected yet rewarding outcome.

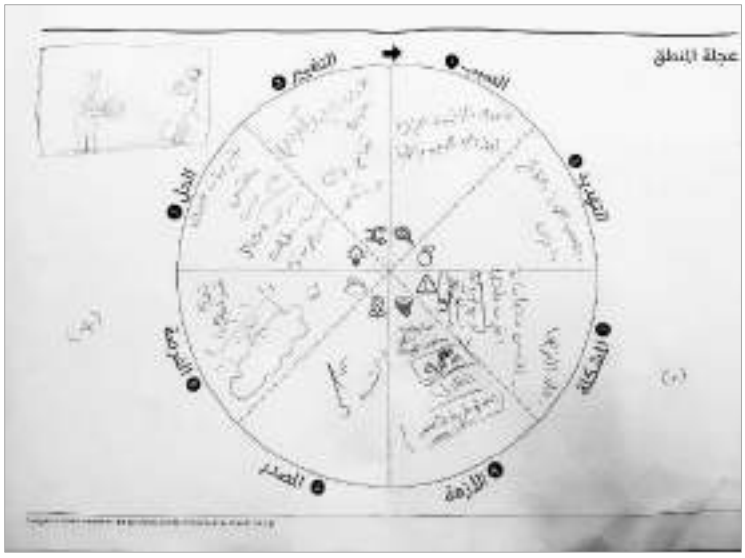

Figure 9: With the Portsaid Heritage Museum and Culture Center's future in mind, Bakry and Mustafa asked each of three groups to pick a moment of "crisis" and finish half of the Wheel of Reasoning. They then rotated the sheets so that each group finished the second half of the wheel for another group. (source Adham Bakry and Roba Mustafa)

Participant Taher Abdel-Ghani, an architect and urban planner, explored ways to utilize art spatially to encourage interactions among diverse social backgrounds within public space. His vision found traction through discovery of the steps necessary to move the project forward through hyper-local pilot programs in co-creation with existing networks of communities of art practice and social hubs operating in public/private pop-ups.

Hadeer Ghareeb shifted her systemic view for approaching the *Trash into Toys* project, re-framing her work to have impacts at the source by taking children into corporations to inform the design process around how packaging was designed. Currently she is developing her project in Zipaquira, Columbia. Over the course of one-year she plans to teach her students about sorting trash, decreasing consumption and making toys that will be distributed to underprivileged kids. Her next step will be at the corporate gates.

The workshop culminated in an evening event for the participants to present their work and reflect upon their experience (Figure 11). In attendance were US Embassy officials, the press and the general public. Dorothy Camille Shea, Deputy Chief of Mission from the US Embassy remarked to the organizers how moved she was with the outcome, and how impressed she was with the passion and commitment of the participants (Figure 10). It allowed her to see the power of design to address social issues on a deeply human level.

Figure 10: Dorothy Camille Shea, Deputy Chief of Mission from the US Embassy at the celebratory closing event. (source US Embassy, Cairo)

All were able to look beyond themselves, and as Nada Salem a filmmaker reflected several months later on her experience "The most transformational aspect of the workshop was realizing that we are not the heroes" She goes on to say, "our social intervention only works if it is truly dictated and driven by the people that we're targeting."

Following the Cairo program, this approach has been applied to an executive education setting where the client company was seeking to discover new innovation practices in order to evolve from their entrenched 20th century mindsets around consumer product offerings. Similarly, the advantages of seeing systems within situated narratives allowed for the revelation of potential new leverage points and approaches for value creation. Process approaches akin to

design fiction, and employing cinematic tropes, revealed relationships from multiple stakeholder perspectives within the value chain, thus elevating the potential for exploration and ideation.

Figure 11: A closing event was hosted by the US Embassy at KMT House in Cairo for Embassy officials, the general public and the press. (source US Embassy, Cairo)

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Research Perspectives IN THE ERA OF Transformations

Thinking-through-making: physical model-making as a business model education strategy

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Outline

Design thinking currently enjoys public recognition and is increasingly utilized in business consulting and strategic decision-making. It has given rise to university programs while opening up varied careers for design strategists. As design enters mainstream management consulting practice, a critical question being asked of educators, designers and businesses is what *kind* of design is privileged within design thinking-as-business strategy. Moreover, has this version of design thinking delivered additional creativity to business environments centred on process efficiency? Nussbaum (2011) argues that business has embraced a brand of design thinking that is recognizably process-oriented, and this has limited its capacity to deliver on its mission of enhancing business creativity.

This study examines a project delivered in the first semester of Parsons' Master of Science in Strategic Design and Management program, it is called *Understanding-through-making: building new dimensions in the new economy.* This practical studio-based project requires students to physically build a model that exemplifies their understanding of the dynamics defining and driving business in the 21st Century. This project attempts to counter a scientific, process-oriented design thinking with a more beaux arts, craft-oriented, thinking-through-making approach. Currently student outcomes are varied; some exist as pedagogic devices while others are recognizable as tools (e.g., navigators and compasses).

The study analyses these current outcomes, highlights the shortcomings of both the current project and its outcomes and proposes possibilities for future iterations that promise to explore other paradigms in the application of design thinking to business.

Background and context

In recent decades, Parsons School of Design has gained renown for its fashion design program, however, the past few years have seen its BBA (Bachelor of Business Administration) in Strategic Design and Management grow to become its second largest program by volume. In 2004 what was then Design and Management was reimagined (from a program with identifiable origins in fashion merchandizing) into a design thinking/business hybrid. In response to the BBA's growth and profile, and also due to current student demand, the School of Design Strategies (the "school," or sub-faculty in which the BBA is housed), was charged by the Provost of The New School, and the Dean of Parsons, with creating a post graduate-level program with the same strategic business design focus as the BBA. From its inception in 2012, the Master of Science, Strategic Design and Management (MS-SDM), a two-year, 36 credit program, has experienced a rate of growth from a 70 student intake, at the program's inception in 2013, to a peak 110 student intake in 2016 and 17.

The Chase School was founded in 1896 by William Merritt Chase a renowned Impressionist painter, however it was Frank Alvah Parsons, a teacher and subsequent head of school (in 1911), who led the school's transition toward instruction based around art in the service of industry. In 1909, it was renamed The New York School of

Fine and Applied Art to reflect new course offerings such as fashion design, interior design, advertising, and graphic design; the first of their kind in the U.S. It was eventually renamed Parsons in 1940. Even following Parsons' absorption by The New School for Social Research, in 1970, its design DNA retained its origins in a European fine art (or beaux arts) tradition extending from the late 19th Century to the present.

Today, fashion, interior, product, graphic design and architecture are all well-understood and defined as sub-fields within the broader scope of design. In contrast, strategic design and management is less broadly-understood externally, and is an emerging field situated between the domains of design and business. It is currently undergoing further definitional challenges as it is simultaneously developed in more or less different ways by varying institutions all of which have different origin stories. In North America, Stanford University launched their 'D-School' in 2005, while in 2006, the Institute of Design at the Illinois Institute of Technology (IIT) launched a nine-month executive master's program in Design Methods, both were roughly concurrent with Parsons BBA. In 2008 California College of Art (CAA) launched its MBA in Design Strategy and New York's School of the Visual Arts (SVA) launched its MFA in Design for Social Innovation program, graduating their first class in 2014 concurrently Parsons' MS-SDM. My current understanding is that CCA, SVA and Parsons all share beaux arts origins, while strategic design at IIT and Stanford have stronger scientific affinities related to definitions of user research derived from computer science, engineering and product design. This distinction is useful in relation to the status of what we, at Parsons, describe as "studio-based learning."

At Parsons, the MS-SDM program is currently grappling with what "studio-based learning" means in relation to strategic design, specifically what knowledge (or ways of coming-to-know) are integral to studio practices of the "plastic arts:" fine art and design. In their chapter "Design Matters for Management," from Managing as Designing (2004), Boland and Collopy characterized [then recent] management failures (e.g. Enron, Global Crossing, First Capital) as attributable to a 'famine of good ideas,' which were largely the result of managers trained to make choices from among alternatives presented to them, rather than from a training in the design of new alternatives resulting from the generation of new business ideas. Boland and Collopy quote Herbert Simon in making a case for what they arguing was "the manager's professional responsibility [which] is not to discover the laws of the universe but to act responsibly in the world to transform existing situations into more preferred ones," in their quote from Simon, he states, "Engineering, medicine, business, architecture, and painting are concerned not with the necessary but with the contingent — not how things are but how they might be — in short, with design. (Simon, 1996, p. xii).

It is instructive that the Boland and Collopy wrote these words very slightly before the first programs of the kind I described here emerged in North America. Their words are more prescient today as we see "design thinking tools" packaged and utilized in ways that industry voices such as business journalist Bruce Nussbaum summarize in the following way:

> *Design Thinking originally offered the world of big business–which is defined by a culture of process efficiency–a whole new process that promised to deliver creativity. By packaging creativity within a process format, designers were able to expand their engagement, impact, and sales inside the corporate world. Companies were comfortable and welcoming to Design Thinking because it was packaged as a process. There were many successes, but far too many more failures in this endeavor. Why? Companies absorbed the process of Design Thinking all too well, turning it into a linear, gated, by-the-book methodology that delivered, at best, incremental change and innovation.*
> (Nussbaum, 2011)

The project I co-created seeks to address the problem of a studio-based experience within a design-business degree in the following section through describing an attempt to both redress a perceived process-bias in design thinking while grappling with the question of what value a beaux arts tradition in design might offer business strategy in the early 21st Century.

Project 2, Understanding-through-making: building new dimensions in the new economy

Because strategic design is an emerging field and is inherently dynamic (evolving with changes in business conditions), the MS curriculum is re-evaluated and modified on an annual basis. In the late summer of 2017, I was tasked with leading a substantive re-write of three projects, designed to anchor three modules in a course called Strategic Design and Management (SDM) in New Economies. My instructions from former director Rhea Alexander, my co-author on this task, for was to retain and bolster the physical "making" components of the

three projects, keeping in mind that one of the unique (or at least distinctive) value propositions in MS-SDM was the engagement with a Parsons' perspective on studio-based [design] learning.

SDM New Economies is important in establishing the contextual and methodological basis for the subsequent three semester applied strategy and innovation work which is often, (though not exclusively), manifested, by students, within their "studios." Fig 1. shows this course in the context of the four-semester, two-year program, occurring as it does, in the first semester of the first year:

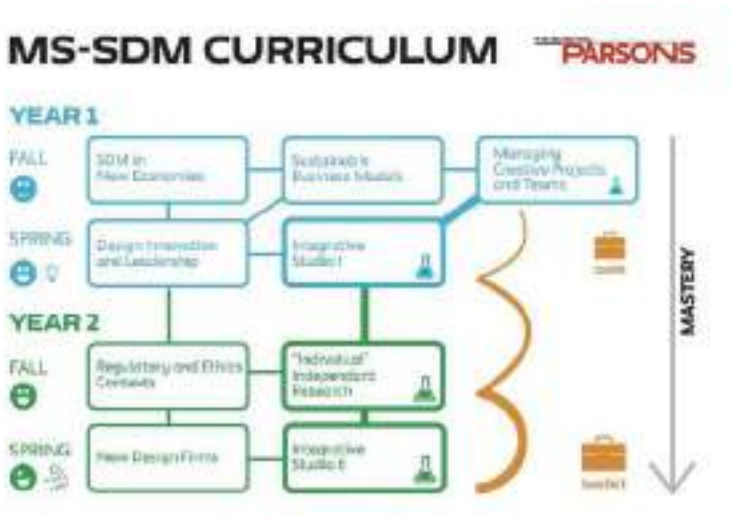

Fig 1. curricula diagram of MS-SDM developed by Rhea Alexander with assistance from Isabel Escobar in 2016 https://www.newschool.edu/parsons/masters-design-management/?show=program-curriculum

My response to this brief was to build upon an existing three-project arc, the emphasis of these three projects are summarized in the following table:

Table 1: The three-project structure in SDM New Economies, redesigned for fall semester, 2017

	Title	*Table heading*
Project 1	Mapping New Economies	Mapping in two-dimensions, using information visualization to communicate complex systems with interdependencies
Project 2	Understanding-through-making: building new dimensions in the new economy	Building models (for business and strategy) in physical three-dimensional form. Figuring out and testing these models using iterative making-thinking-interacting
Project 3	Design Frames and Heuristics	Written reflection on readings and how design tools might be used to address some of the issues raised in the readings. Generate your own game-based tool

Although this three-project structure corresponds to a specific learning progression in SDM New Economies, the single case I discuss here is Project 2: *Understanding-through-making: building new dimensions in the new economy* because this project was my clearest effort to engage with studio-based learning as a function of business modelling and design-inflected strategic business planning. The project brief addresses thinking-through-making by asking students "What bearing does an understanding of the dimensions of the physical world have on our ability to think, and act, in creative ways that may open up new insights[?]" The brief invokes Heidegger in his reflection on craft:

> *A cabinetmaker's apprentice, someone who is learning to build cabinets and the like, will serve as an example. His learning is not mere practice, to gain facility in the use of tools. Nor does he merely gather knowledge about the customary forms of the things he is to build. If he is to become a true cabinetmaker, he makes himself answer and respond above all to the different kinds of wood and to the shapes slumbering within wood—to wood as it enters into man's dwelling with all the hidden riches of its nature. In fact, this relatedness to wood is what maintains the whole craft. Without that relatedness, the craft will never be anything but empty busywork, any occupation with it will be determined exclusively by business concerns. (Heidegger, 1976)*

In the project brief I note that Heidegger contrasts this intelligent engagement with "empty busywork" that will be determined by "business concerns," and I speculate here (not in the brief) that lack of what Heidegger describes as "relatedness" may be have a connection to the "famine of good ideas" referred to by Boland and Collopy.

The case: Janet Hoy's Strategy Clock and Barometer

In fall 2018, Janet Hoy was an online student in my MS-SDM New Economies class, this course is offered in the first semester of the first year of a two-year program making Hoy, then a newly-admitted student. Hoy had spent two decades working since her undergraduate degree making her a more professionally experienced than the majority of her online cohorts. Her company, Janet and Co., currently provides project and design lead consulting on hotel projects internationally. Hoy is based in Sydney, Australia but also works extensively in Europe. For Project 2, it was Hoy's intention both to utilize her professional knowledge as a season project manager and to develop a model or tool that would help her to integrate—in a practical manner—the two hemispheres of her work as a consultant/project manager across the domains of what she describes as the "known" and the "unknown."

In Hoy's words she was "trying to create a tool that gives a framework to think through the challenges presented through having her feet in both more traditional cost/time/quality decision-making while simultaneously managing design teams and therefore engaging with the unknown [the design question] or the not-yet-created." (J. Hoy, personal communication, March 3, 2019). She used Project 2 to create a model, or tool to reconcile these two very different mental processes: traditional project management and designed/speculative (or abductive) practices. For Hoy, a key reading, and inspiration for this project was Nigel Cross' book Design Thinking: Understanding How Designers Think and Work of 2011, which, she says, gave her an "ah-ha moment" of recognition that she had always been involved with abductive reasoning but had experienced difficulties in communicating this aspect of her work to clients in a way that made sense in terms of their grasp of the project as-a-whole. Abductive reasoning is the logical process where one chooses a hypothesis that would best fit the given facts. Cross identified it as a process of inference in which "design develops innate abilities in solving real- world, ill-defined problems" (1982), Hoy identifies these in the right hemisphere of the barometer in Figure 2. below:

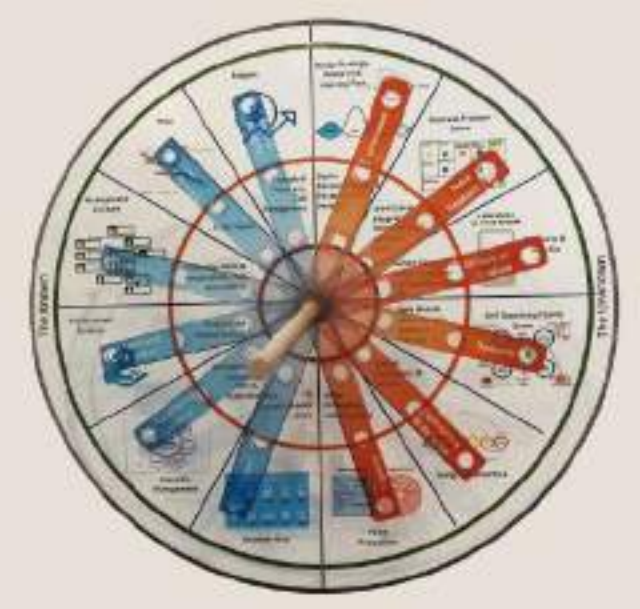

Fig 2. Janet Hoy's Strategy Barometer, 2018.

Hoy stated that abductive and designerly ways of working have frequently put her at odds with traditional project management thinking. In the course of her twenty plus-year career she points to The Project Management Body of Knowledge (PMBOK), a set of terminology and guidelines first published in 1996 by the Project Management Institute, as instigating a mindset she describes as increasingly process-oriented and ever-decreasingly holistic. Hoy's process for making her barometer began with rough prototypes. Hoy stated that she "started by looking at the barometer an instrument for measuring the outside environmental conditions; an idea that can be applied to a project's environmental contexts and conditions." Her barometer has a sliding scale which can be articulated along multiple axes. In her articulation of the known/unknown hemispheres, Hoy's barometer could be compared to a colour wheel in which complementary pairs (of colour) sit on opposite sides of the wheel. These pairings of oppositions (or complements) can be seen in the table below:

Table 1: shows Hoy's oppositional pairings from her barometer, see Fig 2

"Known" hemisphere	*"Unknown" hemisphere*
Budgets	Value proposition
Time (Gantt charts)	Design increments (sprints etc.)
Management structure	Self-organizing teams (scrums etc.)
Products and services	Solutions and benefits
Scientific management	Business problem space
Business plan	Design strategy research and learning plan

Hoy designed her barometer to be used with Plexiglas sticks, each of these corresponded with one of the six oppositional pairings and these were intended to allow the user to play with and reflect upon and then represent the intensity of each aspect of given project in terms of both domain and intensity along the known-to-unknown axis. Blue is more known while the red end of the spectrum is more unknown (e.g., established business vs. new venture), see Fig 3. below:

Fig 3. demonstrates varied intensity along three axes within a single aspect of a project

As she began real-world testing of the barometer, Hoy realized that her own project management experience made the barometer less useful in her client interactions. She felt it was too complicated and somewhat self-evident (to her). Application of the barometer however, enabled her to develop the Strategy Clock; a simpler schema which allowed her to try to hone in on the broader implications of where the value she is creating is derived from. Key attributes of the clock are the same two hemispheres: known and unknown, Hoy states that a stick is chosen on the scale depending on the characteristic it represents which then is placed on clock relative to the management tool or approach that would best manage that project characteristic. See Fig. 4:

Fig 4. Shows Hoy's more simplified Strategy Clock, in this configuration, Hoy states that the clock "Keeps it simple. The hands on the clock face indicate current team focus e.g., this clock shows our current focus is on design research and learning which will be done with our design team through quick sprints over the next month. Concurrently our operations team are establishing our delivery capability by looking at our overall organizational structure."

Hoy elaborates, the face of the clock orients you in relation to the two hemispheres broadly. Then more specifically, it allows you to prioritize your immediate project actions. The clock is your first stop, whereas the barometer is a subtler and more complex tool. As an experienced project manager, Hoy believes that the barometer may be more useful in assisting a junior-level employee, believing it to be overly complex and perhaps of peripheral value (to her) compared with the clock, which, in contrast, "allows the user to locate themselves and then dig deeper in a more focused manner." Hoy generally uses her model indirectly, that is, she generally interfaces with CEOs and founders, therefore the clock "has not been used to build team consensus but rather to formulate her thoughts and understand and create her consulting value via the framework before communicating it to clients." For example, if there is an issue with formulating a global team for a specific project, Hoy may use the model to elicit a recommendation. She does however think it may have value in teambuilding and understanding and focusing collective intent and action.

Summary and next steps

I chose Hoy's Project 2 for this case from a variety of interesting models developed in both this and a concurrent on-campus version of the same course I taught this past fall. I sought out Hoy's work for this case because she almost immediately began beta-testing her model-as-tool in a consulting context, and, in fact, had used the heuristic of client relevance to develop the clock from the initial barometer design. As a new student in the course, Hoy's recognition that her model could be immediately deployed was somewhat of a revelation to her but I believe her success in initial implementation and testing was partly due to her prior professional experience and this rapid real-world deployment, is, at the time of writing, the exception rather than the rule with these class cohorts and their projects.

Project 2 helped Hoy in shifting her own mindset about the role of design in her business as much as it provided specific practical guidance; she stated to me that "the design process of learning-by-doing has been huge in her process and has helped to transform her business currently and her future strategy for the direction of the business."

The case I present here provides one practical example for how one business use of design thinking may evolve and it indicates what a beaux arts pedagogy—fused with a business education—may uniquely offer. Specifically, the case points the way toward achieving two pedagogical objectives that have been partially achieved through Project 2 thus far:

- Encouraging students to be the makers (as well as the users) of strategy tools;
- encouraging students to develop and test models, tools, maps, methodologies etc. using a thinking-through-making heuristic rather than a pre-determined abstract framework that lends itself to a process-understanding of a given business problem.
  My next steps as an educator are to better articulate and more deeply embed characteristics of thinking-through-making (from my education and practice in fine art) into projects supporting the creation of new tools, methods and frameworks in business education broadly and specifically in design strategy. I aim to investigate whether, and how, these tools may scale and work in practice, within a variety of applied business and consulting contexts.

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Research Perspectives IN THE ERA OF Transformations

Managing Vulnerability and Uncertainty: Developing design competencies within an American healthcare non-profit

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This case study explores building design competencies and a design-driven organizational culture within an American healthcare non-profit. With a staff are primarily from the healthcare space, as well as some in banking and sales, we look at how the staff has adapted to working within a design-driven organization. By applying iterative design methods and embracing innovation and uncertainty we observe how the organization's founder has helped guide team members through a process of discomfort and vulnerability within an experimentally-driven and human-centered organization.Using interviews with employees and the founder at various points in new employee on-boarding processes we chart a transformational arc over six months. The learnings to share include both the universal and the particular: what are the core competencies to develop in all organizational members, and what are the specific and different ways competencies can take form. From building explicitly shared languages to facilitated sensemaking this case study offers an opportunity to share new and developing practices for embedding design-driven innovation and management practices in new fields and contexts.

Context & Problem/Opportunity Area

Parkinson & Movement Disorder Alliance, PMDalliance, offers opportunities for people impacted by Parkinson's and other movement disorders to learn, live more fully and connect to a support community by including the often neglected spouse or loved one that is the primary caregiver, support group leaders and adult children. Through an inclusive, human-centered design approach, they fill a gap in the American healthcare system, by addressing the needs of caregivers providing critical opportunities for connection, support, and community. Their business model is a non-profit service and network. Facilitating workshops and meetups for the groups they serve, PMDAlliance offers not only an opportunity to connect with others in similar situations but an opportunity to learn management tools and coping mechanisms to help them better manage their responsibilities and quality of life. They also offer emotional support opportunities for self-care for caregivers an often neglected group that suffer alongside the afflicted. PMDalliance's staff is distributed, with team members operating from different parts of the country who travel to other parts of the U.S. to help support PMDAlliance activation hubs.

Design-driven practices are critical to PMDalliance's success. By regularly attending to the needs of their constituents, PMDAlliance continues to innovate and prototype new approaches. In the words of their founder, Sarah Jones: "Our prototypes are our programs." PMDAlliance relies on this model to ensure that they consistently can deliver value to members, nimbly and with low overhead. Team members need to be adaptive, quick-footed, emotionally available to hear unmet needs, and able to operate within uncertainty and ambiguity as they continually test, learn, assess the impact and try again to improve.

This process is all within the context of highly rigid and structured medical and healthcare systems. With a staff all trained outside the design field, including healthcare backgrounds, team members come in with high comfort for rules, and familiarity with approaches grounded in didactic, non-user centered methods, typically framed in the language of 'best practices. While often viewed as a design opportunity, many interventions are limited to realms of physical space and equipment, and not addressing underlying cultural norms at play (Bown et al, 2010). While strategic design could be seen as a point of high leverage, to date its impact has been somewhat limited (Taylor et al, 2011).

The three authors connected through Parsons ELab, a design-driven academic incubator at The New School. The founder of PMDAlliance, a contributing author, was a 2016 Fellow, and the remaining two authors at Parsons ELab, including its founder, have been advisors and mentors to her work since then. The authors are drawn to collaborate in this case study because of its application in extending of design into new fields. They find the approach of PMDAlliance, and its focus on the underlying mental models and emotional competencies necessary for design innovation to be novel and generalizable to other similar organizations.

This case study explores the ways by which PMDAlliance, through their hiring and onboarding process, help facilitate the development of designerly competencies, comfort within the design process, and embed design-driven innovation throughout their organization.

Narrative

PMDAlliance views their goal as having new team members able to facilitate a conference within 4-6 months of joining. This goal is seen as the culmination of an onboarding process steeped in a designerly approach that begins with the pre-hiring phase. (see figure 1, PMDAlliances Roadmap for Onboarding)

Figure 1: PMDAlliances Roadmap for Onboarding and Design Training. Source: PMDAlliance

Potential employees for PMDAlliance are screened and interviewed, but also are assessed on their ability to complete a values and position based exercise in the second round and an interactive project brief in the third round. These tests are not just about competency, but more for the ways, they can assess potential employees' openness to risk-taking, capacity to engage in vulnerable work and empathically engage with PMDAlliance members. An example might be a project brief around a new artifact to help support a member, but also simulated communications with members. These soft skill assessments are PMDalliance's way of understanding if there is good culture fit, and also if there is potential to develop, within these non-designers, the designerly competencies needed to be a self-starting innovator within PMDAlliance's distributed network model.

Once hired, a critical artifact given out in the onboarding process is their ecosystem map. Developing a systems-level understanding of the interdependencies within the lives of those impacted by Parkinson's and

other muscular disorders, their caregivers, support networks and touchpoints throughout the health and medical system. This map is used as an anchor for staff and members. This phase is the initial 'knowledge transfer' phase of the on-boarding process. Formally, it takes place over a 2-week process, with once per day lessons and introductions to the variety of tools and operational practices of the organization (see figure 2, PMDAlliance Support Ecosystem Map).

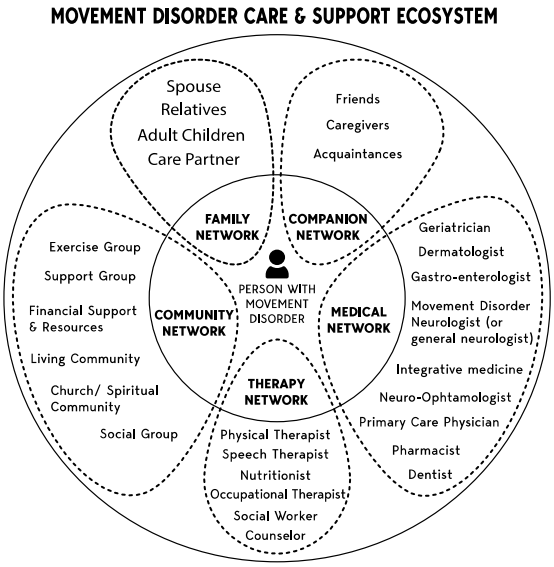

Figure 2: PMDAlliance Movement Disorder Care and Support Ecosystem. Source: PMDAlliance

One design-driven skill at the core of the PMDalliance process is empathy. Empathy not only is a critical person-to-person service skill that builds trust for the organization, but also a foundational skill for other competencies, including design research and also for building comfort with vulnerability and uncertainty as members constantly prototype and test new models of service delivery.

Empathy begins with personal storytelling and modeling from within the entire organization. Staff share and show their own vulnerability, and engage in open and honest discussions about where they are in their own lives during their quarterly meetups, zoom video meetings and even their day-to-day communications over Voxer. They share videos and readings, from Brene Brown and her writing on vulnerability and openness to enneagrams as models of behavioural motivations to help build confidence, comfort, and attentiveness to their own emotional states in preparation for, and as part of the work, they do with others. Crucially this is modeled from the beginning of employees interactions with PMDAlliance, so by the end of this 2-week on-boarding process, they are immersed and enmeshed in a culture that values and prioritizes emotional attunement and intelligence.

From here, curriculums become more personalized and individualized based on the needs and capacities of each member of the team.

One element that all team members will engage in is design research. Typically taking the form of fly-on-the-wall observations and design ethnography, new members are instructed to undertake their own process of discovery. This research is a facilitated learning experience. After observation of a support group, PMDAlliance will debrief with the new team member, discussing observations and understanding key takeaways. This process of facilitated research allows for new members to slowly build a more embodied sense of what PMDalliances' work truly entails, and allows the team to understand and see where their new hire is struggling and thriving. This reflection also begins a practice of deep listening, as they guide new hires into understanding the underlying pain points being expressed by participants and helps build intuition and skill to identify and start creating design hypotheses around the needs of PMDalliance's constituents.

If a particular challenge is emerging, Sarah and the team may use other design research methods to help new members. One example was a new hire struggling with the lack of clear directives and operating procedures for each conference and event. PMDAlliance needs to be nimble and reactive to the needs of its constituents, but this member, a former healthcare (Director of Surgical Services) professional, continued to express deep

discomfort with this approach. Using analogous research to surgery department operations, wherein the best-laid plans of the morning are scuttled within minutes, their team member had an 'aha!' moment. The use of analogous research, this time in a context more familiar to the team member, facilitated discovery and development of competency and capacity within the new hire and helped bring them along this journey of becoming a more design-driven practitioner in PMDalliance's work.

The second element that needs to be developed, and draws from the combination of vulnerability and empathy work started on day one, with the facilitated design research and discovery process, is a capacity to prototype. Prototyping involves being able to identify unmet needs, combining the observation skills of design research with the emotional attunement to meet their constituents. It also involves a belief in one's own skills and a comfort with discomfort and uncertainty as not all prototypes can succeed. In a caregiving environment and context, there is much discomfort with possibly failing, and prototyping necessitates both an emotional and practical element of facilitation.

For PMDAlliance, testing is an existential necessity. It is continuously in an experimental state, iterating endlessly, and also evaluating the efficacy of its work. Prototyping is how they build and develop programs. There are no scripts or similar organizations for the kind of work PMDalliance does, and that means that they must continuously be in dialogue and engagement with participants in order to serve their community best.

By building these successive competencies, PMDalliance arrives at their target goal, which is a hosting or facilitation of an event by a new hire within 4-6 months. For employees to do so, requires many operational and organizational competencies. They must be able to manage the event logistics, and deliver on critical parts of the PMDalliance experience. They will need to appropriately document, track and report on the event using the variety of platforms that PMDAlliance uses in their operations.

However, it also demands numerous designerly competencies. They must be attentive, aware, and attuned to their own emotional needs and the needs of those around them. As care partners and support group leaders share their personal stories and seek support within this community, the new team member must be able to meet them emphatically and empathetically at their level. They need to pair that capacity with a design research lens allowing them to identify opportunities for alternative methods. They need a caring vision in order to see where PMDAlliance could be offering more, and how exactly it helps. These then must also be combined with a capacity and familiarity with a prototyping process and iterative mindset. They must be able to adjust quickly, find new ways of testing new possibilities, and embrace the uncertainty and risk involved in that process. They must be able to test nimbly and learn quickly, and embody the kind of agile approach that PMDalliance uses as the foundation of its value proposition.

Key Learnings

PMDAlliance's experience of developing design-competencies maps the second arc of capacity building and transformation in the onboarding of new employees. They show how a facilitated design-education process can help build critical competencies and an organizational competitive advantage for, in this case, a distributed not-for-profit.

Within a healthcare system that struggles with innovation, PMDAlliance's approach is exciting and promising. Their success in building high-level design competencies and a design-driven innovation mindset within their team highlights an opportunity for other healthcare organizations. As the call for a more human-centered approach to healthcare continues to be heard, they offer a practical study on how to address the underlying human and cultural problem in the implementation of design innovation.

A key learning for the authors are the many subtle ways that these competencies are developed. As opposed to a singular process, the journey of each employee is distinct, with its own educational inflection points. It is notable that as opposed to experiencing a series of design workshops or design sprints, these competencies were developed through a more collaborative and coached model of education.

The authors observe that an approach grounded in a design research and empathy development process could allow for a more bottoms-up approach to developing design capacity within organizations. By creating mechanisms and opportunities for staff to safely practice design as a form of learning and doing, teams have the space for growing a design approach that is reflective of, and responsive to, the needs of the team and organization.

In many sectors, and particularly in healthcare, calls for innovation are often heard and left unaddressed. This case study begins to look at ways to approach the underlying mental models within the practice of healthcare and suggests ways by which design processes can themselves help transition an organization to become more design-driven in its practices. A process that builds comfort with uncertainty and vulnerability and that creates space for prototyping and testing, can help build a muscle and capacity for design innovation. Such approaches must be contextualized for the specific work being done by the organization, by the individual and by the competencies and capacities of all participants involved. That said, the authors believe that the core principles that are exposed through this case study offer avenues for other organizations to find similar success in bridging design innovation and management in challenging and novel sectors of the new economy.

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Research Perspectives IN THE ERA OF Transformations

Transitioning Business for a Circular Economy

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This case study explores the strategic business opportunities, for Lane Crawford, an iconic luxury department store, to transition in a circular economy towards sustainability. A new experimentation framework was developed and conducted among cross departmental employees, during a Design Lab, with intention to co-create novel Circular Economy business concepts towards a new vision: the later was a reframe of the old system based on the principles of sustainability; to move beyond a linear operational model towards a circular economy that can contribute to a regenerative society. This work draws on both academic and professional experience and was conducted through professional practice. It was found that innovative co-created concepts, output from the Design Lab, can create radical change in a circular economy that is holistically beneficial and financially viable; looking forward to extract greater value a)Internal organization requires remodeling to transform towards a circular economy; b)Requirement for more horizonal teams across departments vs solely vertical; c)New language and relationships are required to be able to transition towards a circular economy; d)Some form of physical and virtual space requirements, for cross-disciplinary teams to come together to co-create; e)Ability to iterate, learn and evolve requires agency across the business

Keywords: Experimentation, Design for Sustainability, Circular-Economy, Business-Transformation, Methodological-Framework

Context and opportunity area

The circular economy model continues to gain attention from global companies (Lewandowski, 2016), yet a recent report, by (PACE, 2019), identified that the linear economy is 'baked in' to the global economy, only 9% is circular, and that progress towards sustainability is in reverse.

From the perspective of business transformation in a circular economy there is a gap in tools and methods as while "Sustainable business model innovation is an emerging topic, … only few tools are currently available to assist companies in sustainable business modelling" (Geissdoerfer, Bocken, & Hultink, 2016) and "To date few if any processes for sustainable and circular business model experimentation have been developed" (Bocken, Schuit, & Kraaijenhagen 2018).

The economic paradigm is shifting, thought to happen at times of revolutionary development, with significant changes in societal and business values, and interrupt periods of continuity, as first discussed by Kuhn (Shapere, 1964); Brand & Rocchi (2011) and Gardien, Djajadiningrat, Hummels and Brombacher (2014) discuss the change to the future economy as the transformation economy.

With paradigm shifts come changes in design processes, methods and tools (Gardien, 2014). The latter argues that by adapting to the new paradigms 'will allow companies to extract more value from the marketplace'. There are four paradigms, spanning from the 1950's to the future, defined by people and business mindsets,

each with a specific economic driver, namely, 1) the industrial economy (mass production), 2) Experience economy (marketing and branding), 3) Knowledge economy (knowledge platforms) 4) Transformation economy (value networks). This study leverages the research method types of the transformation economy described as 'Empathic, in-context experimentation and data collection through living labs', (Gardien, 2014), whereby the design deliverable is imagined to fit beyond the needs of the individual to include society and planet, suggesting that design processes may take place in a circular economy for sustainability.

This case study aims to explore, through the use of action research and a systems and design thinking approach, (The Design Lab), a new methodological framework to co-create novel business concepts to radically change business practices in a circular economy that can be implemented in a business circular economy experiment in the form of a living lab.

Circular economy

The circular economy is used as it presents a 'more targeted focus on resource-related issues to facilitate experimentation' (Bocken, 2018) and contributes to sustainability (Mentink 2014). It was first introduced by Stahel and Reday (1981) as a way to minimize resources impacts, wastes, emissions, energy use and energy loss by slowing, closing and narrowing materials and energy loops. In this way regenerative loops aim to create, Innovation opportunity, Job creation, Economic competitiveness, Resource savings, Waste prevention. There are now various frameworks that highlight the opportunities and ways to integrate and evaluate circular economy concepts, all with their roots in the earlier work of Stahel et al., (1981), built on the looped system theory, these include Resolve (Ellen-MacArthur-Foundation, 2015) and the work by Van Renswoude, Wolde and Joustra (2015) and Laubscher and Merinelli (Lewandowski 2014). Most recently the work of Lüdeke-Freund, Gold, & Bocken (2019) proposes a framework for circular economy business model (CEBM) development, drawn from an assessment of literature of 26 published circular economy business models (CEBM). The framework relates six CEBM patterns, with four design strategies and links the different strategies back to the key circular economy resource strategies of slowing and closing; and value strategies of retain product and material value.

This work is situated at the 'upfront end', of the design process, (Sanders & Stappers, 2008) uses co-creation, through experimentation (Hall, 2011) and in this way, informs and inspires exploration of an open ended question and addresses fundamental and radical challenges, beyond the cutting edge (Hall 2011) to innovate new business concepts in a circular economy. The latter will have wider impacts on the eco-system and so, ideation is initiated through a holistic sustainability lens (Boons & Lüdeke-Freund, 2013) to enable reflection (Schon 1983) on the consequences of any intervention on the system (Cross 1972). Co-create is used as embraced by sustainable development to increase efficacy of interventions (Bell, 2012).

This case study builds on and contributes to the discussion of strategic design methods, tools and processes to transition business from the linear economy to the circular economy; through the exploration of a new methodological framework to co-create, with transdisciplinary dialogues (Banerjee 2008); (Stock & Burton 2011), that seek to propose new business opportunities beyond the leading edge, that can evolve technologies, markets, user expectations and behaviours (Hall 2011) in a circular economy for sustainability (Stegall, 2006). Output concepts are implemented into the business eco-system, the living lab, among suppliers, other stakeholders, customers and employees for experimentation.

The context: Lane Crawford - Iconic Luxury Department Store

Lane Crawford department stores are located in Asia. Awareness and commitment from senior management to transition towards responsible business in a circular economy for sustainability. This company relates most clearly to Paradigm 2,(Brand et al., 2011), 'The Experience Economy', such that the business economic driver, is 'marketing and branding' and the business focus is 'brand experience'. This can be observed both, externally, from the offer that is heavily invested in the physical, an integral and tangible brand touch point; the brands and messaging, and internally from the company operational and siloed set up and the way interactions are organised across the eco-system.

The competitive landscape is fierce and includes well-funded digital first companies and start-ups, such as Net-a-Porter, for example, that tend to operate in paradigm four, the transformation economy; as their technology advances so company learning and iteration accelerate due to leveraging the research and tools of paradigm 4; that includes the use of Living Labs 'which involves users as co-creators and enables

experimentation in real-world settings' (Almirall, 2011). Development is amplified by exponential growth in processing speeds as given by Moore's Law and grounded in the lean start-up methodology (Ries 2011).

By comparison the approaches used in Paradigm 2, operate on much longer developmental time frames and rely on limiting research methods. It is complicated and difficult to transfer from an earlier economic paradigm to another "companies that grew up in an earlier paradigm risk being bogged down by an outdated mindset and ways of working" Gardien et al., 2014, p.137).

Strategically, over the past 18 months, the senior management set new purpose, principles and values with business goals. The latter are aligned with two key global themes as identified by the Sustainable Development Goals (SDG's) one of which targets waste (Figure 1). Measurements for KPI's are in progress and currently driven by specifics from individual projects.

The case study discussed in this paper is the first prototype project to systematically address a move towards a circular business economy with intention to change behaviours and measure impact. To initialize and test this type of change a specific and bounded, controlled event was set up and measured by the internal team. In this way a business experimentation was set up with its employees, including relationships with other stakeholders and their users, over a controlled time period with specific changes.

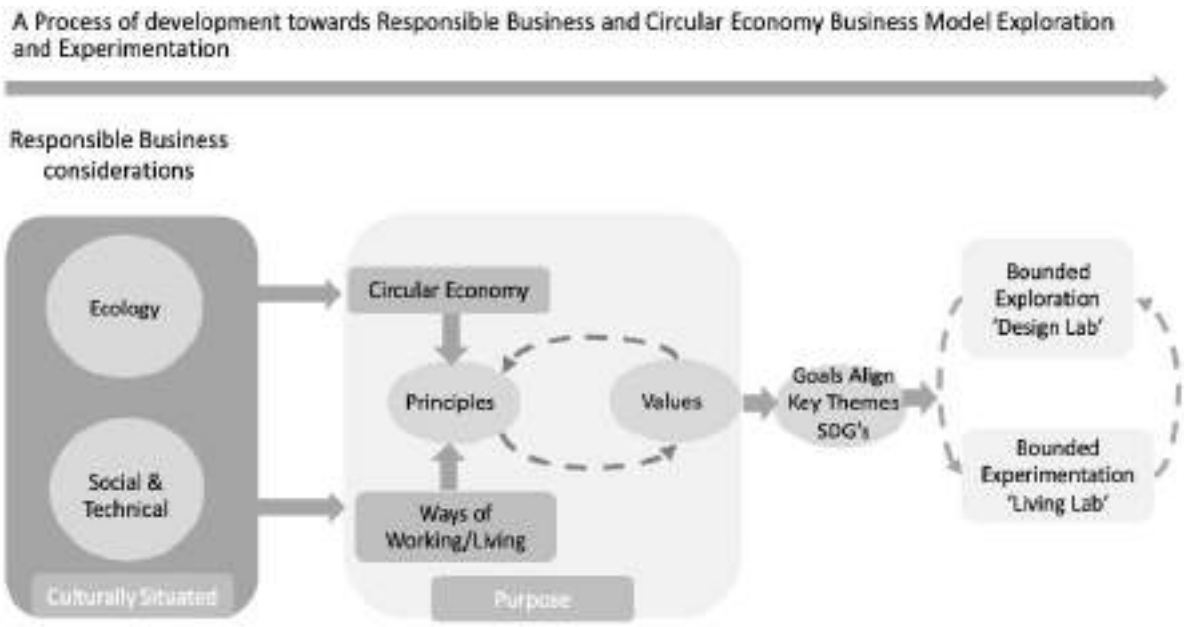

Figure 1: *A Process of development towards Responsible Business and Circular Economy Business Model Exploration and Experimentation*

The Narrative

This research was conducted with the belief that a diverse group of eco-system business stakeholders in a design led co-create environment, using the new methodological framework, could innovate viable, desirable and feasible business concepts in a circular economy.

The research question proposed to kick off the Design lab was 'How might we design responsible Christmas packaging and retain our excellence and luxury offer in a circular economy?

A three-hour Design Lab was conducted among a diverse group of eco-system stakeholders including, store management, communications, design, brand strategy, technology and academia who are involved with the organization and contributions to the implementation and outcomes of the research; to co-create novel concepts that can radically change the business eco-system in a circular economy.

It should be noted that the time frame was extremely short to implement this first experiment in a circular economy, such that concepts moved forward were believed to be feasible in the time frame.

The new methodological framework

The methodological framework (Figure 2) has been developed with intention to explore, support and accelerate novel business and systems scenarios in a circular economy using co-create and a systems and design thinking approach. It has drawn on the behavioural change work of (Dolan, 2012) with intension to change the context from which participants tackle the challenge to raise automatic behavioural responses in a circular economy: specifically resetting norms, raising salience in the potential of the challenge and in this way priming participants prior to co-creation. The work of Schon (1983/4) is leveraged such that the visionary view is changed and, in this way, encourages participants to co-create towards a circular economy rather than the established norm of a linear model.

The framework consists of three parts, namely, Empathize, Ideate and synthesize; the first phase,

Empathize phase, has intention to change the context, through which participants consider the norm, moving their perspective from a linear business model to a circular business model, using a future novel vision, case studies, and facts and in this way changes the context and sets the challenge.

- An alternative supply chain visual is created in several steps; the first considers the core principles of the circular economy (Lewandowski, 2016); secondly social impacts (Boon et al., 2013) and thirdly the concept of data usage. This acts to change the context (Dolan et al., 2012), the norm and so shift the view of the problem with intension for participants to consider alternative solutions (Schon 1983).
- Case studies included leading packaging examples that use renewable resources, non-toxic, design led products to design out waste and design in regenerative behaviours.
- Facts: Included: Relevant changes in policy that fundamentally change the flow of waste and so resources in a production and supply chain, current local and regional facts, State and user perspectives, global goals as defined by the SDG's in the area of consideration.

The second phase, Ideation, invites participants grouped in teams representative from diverse departments, to strategically design concepts that meet the challenge by re-considering, through a holistic and new view the eco-system and supply chain. This allows the co-ideation of new narratives and potential futures in a circular economy.

- Conversation mapping is used at the early stage of a co-create design process as it enables many new themes, through capturing plurality (Fry 2010).
- This is followed by future scenario planning that uses a visual plotting method to identify the business strengths and weaknesses of various new concepts using qualities of desirability (what users want), Feasibility (what is technologically possible) and viability (what is financially possible).

The final phase, Synthesize, summarizes the themes and through decision making dialogues aided by the soft system tools, the team progresses to create conceptual future narratives within the system of interest; with greater clarity of how and what might be and so set project goals the team believes are achievable.

- Participants individually created their own Root definition using the given format as presented as: How might we *(problem to solve*) through/by (*doing something*) so that (*we create an impactful outcome*)?
- Pairwise analysis is conducted, and the top definitions were reconsidered.
- Following this exercise, a stakeholder responsibility road map is created.

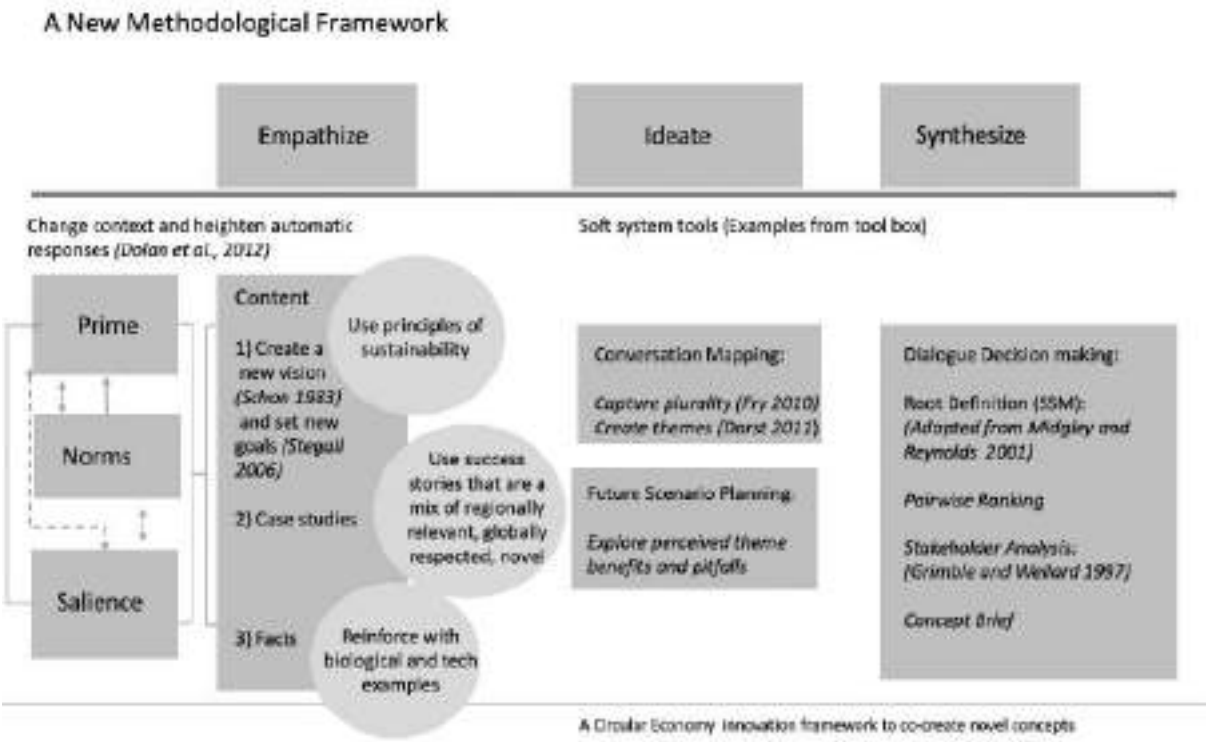

Figure 2: A New Methodological Framework – A Circular Economy Innovation Framework to Co-create Novel Concepts

Key Learnings

Findings from the Design Lab

Overall, we can say that the participants in the Design Lab, using the new methodological framework were able to co-create many innovative business concepts (Sanders et al., 2008) from a different context and view in a circular economy (Dolan et al., 2012); (Schon 1983).

In the following section the concept findings are discussed using an evaluation framework adopted from the Resolve framework (Ellen-MacArthur-Foundation, 2015) with additions from the work of Laubscher and Merinelli (Lewandowski 2015).

Outcomes: These are the first and immediate steps taken to change the Christmas packaging in a circular economy as made during the 2018/2019 season.

Regenerate*:* 'Focuses on the use of renewable energy and materials'. Participants recognized the issues with their product in terms of its non-renewable materials and toxic pollutants prior to the design lab. This contribution was further explored and expanded to understand the full lifecycle and what happens in the afterlife; after use. From this reflection, mixed materials were brought to the forefront as an issue for recycling and so significantly more likely to keep the products in a linear system; also, the lack of infrastructure locally to aptly process biodegradable products led to further thought on how to better manage the product after-use. In turn this led to further discussion and a build through exploration of what can happen further up the chain to reduce materials entering into the system?

Beyond Christmas packaging dialogues explored the increase in packaging due to their online sales and delivery, this provided wider opportunity to redesign packaging for online sales.

Action taken:

- Redesign of Christmas packaging and for online purchases
- Renewable and non-toxic supply chain for packaging
- Removal of mixed materials
- Ongoing discussions on how to better manage after-life

Share: 'Maximize utilization of products through share'. As part of the full lifecycle and extended life of a designed product, seasonal holiday boxes were viewed as limiting for their desirability to re-use due to their colour.

Action taken:

- The team changed the colour as they believed that a more neutral colour would allow for the box to be re-used given its quality, durability and aesthetics.
- Secondly, old stock was donated to local schools for a specific Christmas project.

Optimize: 'Aim to increase performance/efficiency and remove waste'. Once the teams focused on waste, they realized that there were some habits that were consistent and frequent that led to high volumes of waste that could be addressed prior to materials and resources entering the system, for example: double or triple bagging goods; or customers asking for extra wrapping papers and accessories; double use of tissue paper for perceived greater aesthetic effect. Strategies were developed to address minimizing unnecessary product entering into the system with consideration for various relationships, such as, clients, staff usage and also beyond into other types of products, curtesy umbrellas for example. All of which add to inputs to the circular economy loop, energy and resources and potential outputs in terms of waste and again energy to address end of lifecycle.

Action taken:

- New informed strategy and road-show to inform staff of new positioning packaging and perspective on packaging and its contribution to healthier life (self, family, community and planet)

Loop: 'Retain materials and components in the system'. Until now all materials and products were sent to landfill. Raised consciousness on the lack of infrastructure to process appropriately in a circular system

Action taken:

- The team is exploring ways to recover and increase likelihood that biodegradeable products can be treated appropriately so that after use product can naturally biodegrade and so contribute to regenerative systems.

Exchange: 'Replace old items with new technologies'. At the customer level the offer and service experience changes between the customer and the staff. The staff and customer are more actively involved in the transaction. The customer at the moment when interfacing with the sales and packaging staff will actively make a decision based on some new information (Mentink 2014).

Action taken:

- New micro-systems put into place to deliver on new processes and relationships. New language, new considerations, new meaning.

Building trusted partnerships: From the perspective of the team these changes will be exploratory and iterative, the effects will disrupt the eco-system so collaboration and trust to ensure that these changes can be optimized is key

Action taken:

- Changed packaging processes and materials, required new learning and practical applications to use materials that are less agile and less convenient for packaging purposes at time of packing and take longer to apply. Team managed disruption in the eco-system supported by trusted relationships and belief in the purpose stakeholders moved through discomfort and arrived at a circular economy solution.

Incentives and capabilities: Incentives are in discussion with intension to align with responsible business practices and a strategic move towards a circular economy and sustainability. Capabilities there are beginnings of practice and experimentation internally. This Is a time, people, budget balance

Action taken:

- Learning is continually taking place and with this comes iterations.

Participants had short term deadlines to meet and were able to use the scenario planning tools to identify concepts that they felt they could make happen in a relatively short time space. This was based on the ability to collaborate seamlessly and to roll out the road map as they had planned during the synthesize session.

The CEBM according to the framework , Lüdeke-Freund et al., (2019 p54), can be said to place emphasis on a CEBM pattern of 'Recycling'; and a design strategy of 'Design for biological cycles (using biological nutrients e.g., organic, plant-based materials)': a change in material ingredients to improve the potential of recycling, cascading and organic feedstock that can lead to closing loops.

The challenge space to move forward was set by the participants:

'How might we design responsible Christmas packaging, retain our excellence and luxury offer by exploring opportunities among our customers, staff and supply chain to reduce consumption of paper bag and wrapping by 30%, average per customer sale, over the Christmas 2018/2019 compared with 2017/2018.'

Follow up

Following the Design Lab activities further work was conducted on viability to implement biodegradable packaging materials. It was calculated that a 12% reduction in packaging materials, as compared with previous year, would be needed to balance investment in the change. With this knowledge and an absolute minimum goal for change in packaging entering into the system, the project was established, and first steps were made towards a CEBM.

The transition was accomplished over the Christmas period 2018/19. Early feedback indicates that key goals to reduce packaging entering into the eco-system and financial targets were met a) financially accounts were balanced (key to the continuation of this project and next projects) by creatively and strategically reducing resources entering into the system (in the form of packaging) this reduced financial outgoings to compensate for the added financial outgoings associated with a change to renewable and non-toxic resources, materials and production b) Messaging represented a paradigm four value proposition that is appealing to social leaders (beyond the individual inclusive of social and environmental); c) staff were motivated and enthused to be involved in this project d) An alignment with global as well as local goals added more weight to the necessity to act e) the project was highly desirable with real purpose and goals that highlighted the consequences for their personal lives and those of the people around them as expressed by one of the team leaders as "doing something meaningful" f) general raising of consciousness on waste and its impacts throughout the business.

Gaps in the system

Lack of systems technology that can accelerate decision making processes based on circular economy (systems) changes. Operates mostly in paradigm two The Experience Economy: complicated to gain decision making information and takes time as this involves a process of contacting various departments to access data that can then be assessed.

Discussion

We can say that the methodological framework was successful. It aimed through the empathize stage to reset the context, by priming participants, resetting norms and raising salience in the challenge space. The outcomes demonstrated that participants switched thinking into a new context (Dolan et al., 2012) co-creating ideas from a different view in a circular economy (Schon 1983). Participants were able to co-create many innovative concepts (Sanders & Stappers, 2008) that expanded scope and implementation opportunities to apply circular economy practices (Ellen-MacArthur-Foundation, 2015).

During the Design Lab, an introduction to the principles of the circular economy, a wider view of the eco-system and supply chain participants opened up to a greater number of opportunities for circular economy business practices.

Participants considered the full lifecycle from upfront design aspects through to the long cycle which extends the lifetime of existing products and processes (Van Renswoude et al., 2015); (Lewandowski, 2016) and considered reverse logistics and creating relationships with other companies and customers to assure closing of material loops (Mentink 2014). In this way the value proposition, delivery, creation and capture of the CEBM (Lüdeke-Freund et al., 2019), for experimentation in the living lab, was explored through Design Lab dialogues, reflections and the narrative creation of potential Circular economy business concepts.

Finally, the teams settled on changes that they believed they could make in the short term which could have significant impacts on reducing waste, toxic materials, pollution and production as associated with their packaging offer.

Technology

This first step and accomplished change to the supply system represents a fundamental and successful step for a traditional company that is baked in an earlier economical paradigm. It is evident from the process needed to collect and assess KPI data that technology on many levels is not available. Improvements can be made to support measurement of, flow, quantity and types, of materials; the customer and staff feedback systems; the relationships between customers, suppliers and other system influencers, with staff. Reflection on this specific project and how data could be captured and turned into decision making knowledge, relevant to users, staff, suppliers, quantity for example, that can promote better relationships through more informed interfaces and can give guidance for development and for further research using paradigm four methods.

Conclusions

This case study was conducted with Lane Crawford and found that novel, viable, feasible and desirable, concepts co-created in a circular economy, among a diverse group of stakeholders, using a new methodological framework, were able to radically change the specified eco-system from linear to circular practices through experimentation in a living lab. Further, that a shift in thinking happens through use of the new methodological framework such that a greater number of eco-system opportunities in a circular economy are opened up once participants start to view the system differently.

Early feedback from Living Lab Experimentation indicates financial costs associated with changes to materials and products in the system were balanced through creative strategic tactics to reduce materials and energy entering into the system such that both financial and reduction of waste goals were achieved; meaning no extra cost to Lane Crawford with circular economy benefits. It was found that a) the business rallied around the concept and purpose of change; b) a transformational economy positioning was found to be highly desirable by staff and stakeholders; c) the message and action raised behavioural consciousness around waste and materials; d) amplified beyond the specific business goals.

Forward looking: to support further change, Internal organization requires remodeling to transform towards a circular economy, sustainability and responsible business practices; this might include a) Operations to include collaborative project team work with use of physical (and virtual space), for cross-disciplinary teams to come together to co-create as 'future innovation will require intensive collaboration between stakeholders', (Gardien et al., 2014) b)Requirement for more horizonal teams across departments vs vertical; c) New language and supported relationships (to include: customer, other stakeholders and staff); d) Ability to iterate, learn and evolve requires greater and perhaps dedicated agency across the business.

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Research Perspectives IN THE ERA OF Transformations

Empowering seniors' mobility to maintain a healthy lifestyle: a case study

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Ageing population is one of the most pressing societal issues that current and future generations will need to face. As part of her graduation research, a student from Industrial Design at University of Technology Eindhoven looked at the Dutch context and researched how empowering independent mobility could intrinsically motivate seniors to maintain a healthy lifestyle. The research culminated in a concept, YouGoIGo, which is the subject of this case study. YouGoIGo is a participatory mobility service that aims to suit the needs of every traveller, regardless of their age, physical abilities or access to technology. The service lets anyone become a "travel buddy", by matching seniors and regular travellers according to their planned routes and providing rewards. In this case study, we will firstly illustrate the steps of the participatory design process used to develop YouGoIGo; secondly, we will discuss which probes have been designed to collect quantitative/qualitative data (from different stakeholders and users) and how they have been deployed. As an example of innovation by intersecting engineering, social sciences and design, this case study aims to contribute towards a body of research that looks at holistic prevention and intervention systems, to engage the elderlies in healthy lifestyles.

Keywords: ageing population, healthy lifestyle, senior mobility, prevention, empowerment

Context

Ageing population is an ill-defined problem. However, its consequences have been researched and outlined: there is an international concern that current social infrastructure will be insufficient to provide care to an always-increasing number of elderly people, whilst carers and taxpayers reduce in number. Ageing makes people's lifestyle less active on a mental and physical level, thus a preventative approach is needed to elicit the behaviour of maintaining healthy habits in later life stages. In light of this societal challenge, multiple disciplines, such as engineering, design and social sciences, are cooperating towards preventative holistic solutions. Physical activities are of great importance to older adults as it can not only help to improve their psychological well-being and overall quality of life, but also enable them to be care-free for a longer period of time (LeRouge, Ma, Sneha, & Tolle, 2013). However, due to ageing, the amount of physical activities taken by older adults naturally reduces.

The first author, referred to as the designer in the following paper, focused on ageing population in the Dutch context, where the rate of elderlies over 65 years old is expected to increase to 26% by 2035 (Smits, 2013).

This reported case study focuses on design for promoting physical activities among older adults, by empowering prolonged efficacy and independent mobility and it illustrates a 'research through design

process'. The designer worked closely with multiple stakeholders and developed a concept that encompassed their insights and addressed their needs. The stakeholders were:

- 40 senior participants from Zuidzorg Extra (a business unit of ZuidZorg, a large home care organization in the southern part of the Netherlands), referred as participants in the following paper.
- 2 students from Summa College (a secondary vocational education) of which one was perspective Zuidzorg caretaker in training, referred to as students and trainee in the following paper;
- an account manager from 9292, the largest and most popular mobility service used in The Netherlands;
- the director of the ZuidZorg Extra unit in Eindhoven, The Netherlands;

The steps of this process are organised as follows:

- 'Problem scoping': probes designed to gather an understanding of seniors' lifestyle;
- 'Design process': probes designed to co-create (Sanders & Stappers, 2007) and validate YouGoIGo, the design solution, with senior participants.

The Narrative

Problem scoping

First experiments

As the design challenge was still broad, the designer studied the role of social influence through a small social experiment with some of her family members. The objective was to understand how social context plays a role in motivating seniors towards positive behaviour and a more active lifestyle. She created a group chat on WhatsApp with 12 members of different ages, from 14 to over 65. She created couples, usually grandchildren with grandparents. The rules of the game were that every member had to challenge their respective partner in a physical challenge twice a week. Everyone had to provide evidence, with a video or photo, of the executed challenge, so all the members of the group chat could see the results. This 'challenges game' was played for two weeks. The insights obtained were in line with social influence, as described by behavioural theories:

- Some of her elderly relatives would not enjoy doing the challenges, as they would openly admit, but would pursue their challenges anyway, in order not to be disliked by the group, as addressed by the principles of social acceptance and rejection (Fogg, 2009).
- Some shared the view that being more in contact with their loved ones was a strong enough motivation to keep up with the challenges. This is in line with the principle of consensus (Kaptein, Markopoulos, Ruyter, & Aarts, 2015), by mimicking other people's good behaviour, participants would perform certain tasks they were not intrinsically motivated to do by themselves.
- Some asked to change their challenge according to their capability to achieve the goal and to make the challenge fit in their routine. For instance, three hours of gardening instead of a half an hour walk. This is in line with Fogg's findings (2009) on simplicity profiles.

Figure 1 Screenshot from WhatsApp group's challenge game, representing a senior performing a physical exercise.

Understanding seniors' experience

The behavioural insights gathered from this experiment inspired the designer to further investigate what intrinsically motivates (Ryan & Deci, 2000) seniors to maintain a healthy lifestyle. Ryan (2000) describes motivation as "the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn" (p.70). Particularly in group/social settings, this seemed to be a key factor that needed deeper understanding.

In order to do so, the designer adjusted a design probe (developed by a PhD researcher from Eindhoven University of Technology) to have an overview of which everyday activities the Zuidzorg participants already practice as a collective in their everyday, which one they miss out and which to reintegrate in their lifestyle. This probe presents 12 icons with text, in the middle, representing individuals or social groups (e.g. family, volunteers, relatives, neighbours, etc..) and presents two questions on opposite sides of the canvas:

- Which activities do you do already with others?
- Which activities do you wish to do more with others?

The task is to place some activity/hobby icons into either side of the canvas and link the activities to the persons in the middle. During 2 sessions of half an hour at the ZuidZorg centre, the designer gathered canvases filled out by 27 senior participants. After processing the results, the main insight was that the participants wanted to spend more 'dagen uit', days out, as a group activity.

Figure 2 Example of compiled adjusted Canvas. Translated from Dutch, the question on the left is "Which activities do you do with others?", while on the right "Which activities do you wish to do more with others?".

Figure 3 Senior compiling the adjusted canvas and linking activities with people.

Mapping first-hand and literature insights

Research shows that compared to other age groups elderlies do not travel as long in time and as far in distance (Böcker, Amen, & Helbich, 2016). Based on the insights from the culture probe study in the previous step, the designer decided to focus on creating a concept to support older adults to have more days out with their peers. To gain first-hand insights about their 'day out' experience, she created a flyer that was filled out by 13 participants, with the following questions:

- What does your day out look like?
- Where would you go?
- By which means?
- What activities do you do?
- With whom would you go?
- How do you organise it?

- Do you foresee any problems/difficulties?

Figure 4 Example of compiled flyer by two participants (in Dutch).

The main insights were the following:

- Perceived autonomy: the respondents who noted difficulties (e.g. too much walking, health issues, mobility issues (e.g. rollator), checking information online, having to ask for information to strangers), also reported that they go on days out autonomously. Those who did not foresee any problems or difficulties during their journey, also reported that they would rely on others to organise and take care of them during their day out.
- Means of transportation: in line with Böcker's findings (2016), participants expressed a preference for car or private vehicles (e.g. buses from tourism organisations) as transportation means, rather than public transport, because of difficulties in boarding or alighting (Arentze, Timmermans, Jorritsma, Kalter, & Schoemakers, 2008).

Böcker (2016) and Arentze (2008) argue that there is a sustainability concern regarding supplying the mobility needs of a growing segment, such as the older adults market, with private vehicles. They argue that research and efforts should be invested in improving public transport infrastructure, for both its social and environmental benefits. In light of this insight, the designer chose to focus on the systemic challenge of designing a service that would lower the threshold for Dutch seniors to choose public transports over privately owned vehicles.

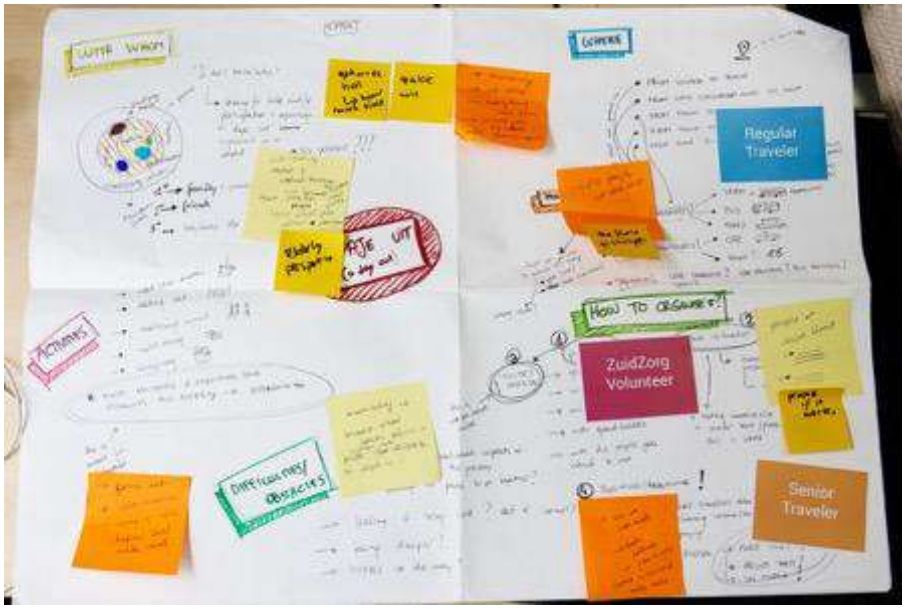

Figure 5 Problem mapping on the topic of 'spending a day out'.

Design Process

In the first ideation phase, the designer came up with the idea of a buddy system that would pair regular travellers with senior travellers, to be able to travel together. Inspired by sharing-economy concepts (BlaBlacar, Uber in early phases) she wanted to design a 'win-win' situation concept, rather than relying on a volunteering buddy, accompanying a more vulnerable and less mobile buddy. Inspired by the Self-Determination Theory, she wanted to address three needs, described in Ryan (2000) as "essential for facilitating optimal functioning of the natural propensities for growth and integration, as well as for constructive social development and personal well-being" (p.68).

- the need for competence, in organising and spending a day out;
- autonomy, in travelling independently;
- relatedness, in relying on a participative support system to spend a day out.

The outcome of this process was YouGoIGo, a participative mobility service that suits the needs of every traveller, regardless of their physical abilities, their age or their access to technology. The concept is a two-ends system and it is built upon the infrastructure of 9292.

Figure 6 Example of YouGoIGo interface.

Each feature of the concept has been co-designed as the final users of the service (the seniors) played the role of 'experts of their experience' (Sanders & Stappers, 2007) whilst the designer iteratively created and deployed probes, as tools to empower the expression of their expertise and knowledge.

Scenario's

The preliminary concept was sketched in two vignette-style scenarios. The task for the participants was to give feedback with sticky notes of different colours on the parts of the canvas they liked and the ones they disliked. The purpose of the exercise was to:

- envision themselves as 'protagonists' of a potential future mobility service;
- empathise with other potential roles in this scenario.

On Scenario 1, the journey of a group of three elderly ladies was described: with the help of a Zuidzorg carer a group of elderly ladies publish on this buddy service their route and requested a buddy to accompany them. After a while, they find one and decide it is a match. On the day of the trip, the senior ladies meet with their buddy and commute together, who supports them at challenging steps (managing tickets, navigating stations and stepping on or off trains and buses). When they arrive at destination, they shout out goodbye.

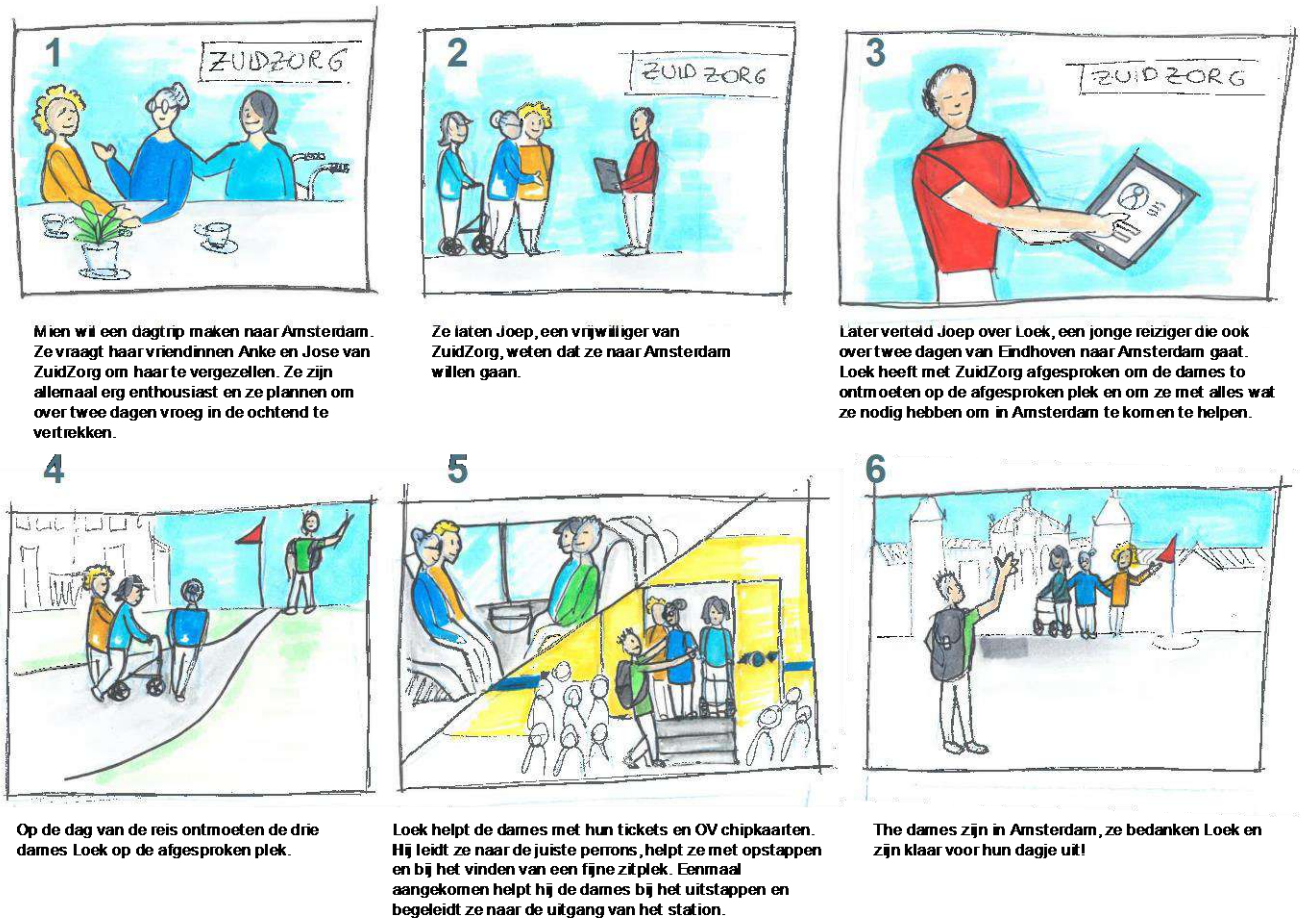

Figure 7 Canavs Scenario 1 (in Dutch).

On Scenario 2, the regular traveller's perspective of the same journey is described: a regular traveller creates a buddy account by using 9292. He checks if there are seniors travelling on the same route. Once a match is made, he meets with the seniors and accompanies them to the set destination. He helps them with all their necessities (like Scenario 1) until they arrive at destination.

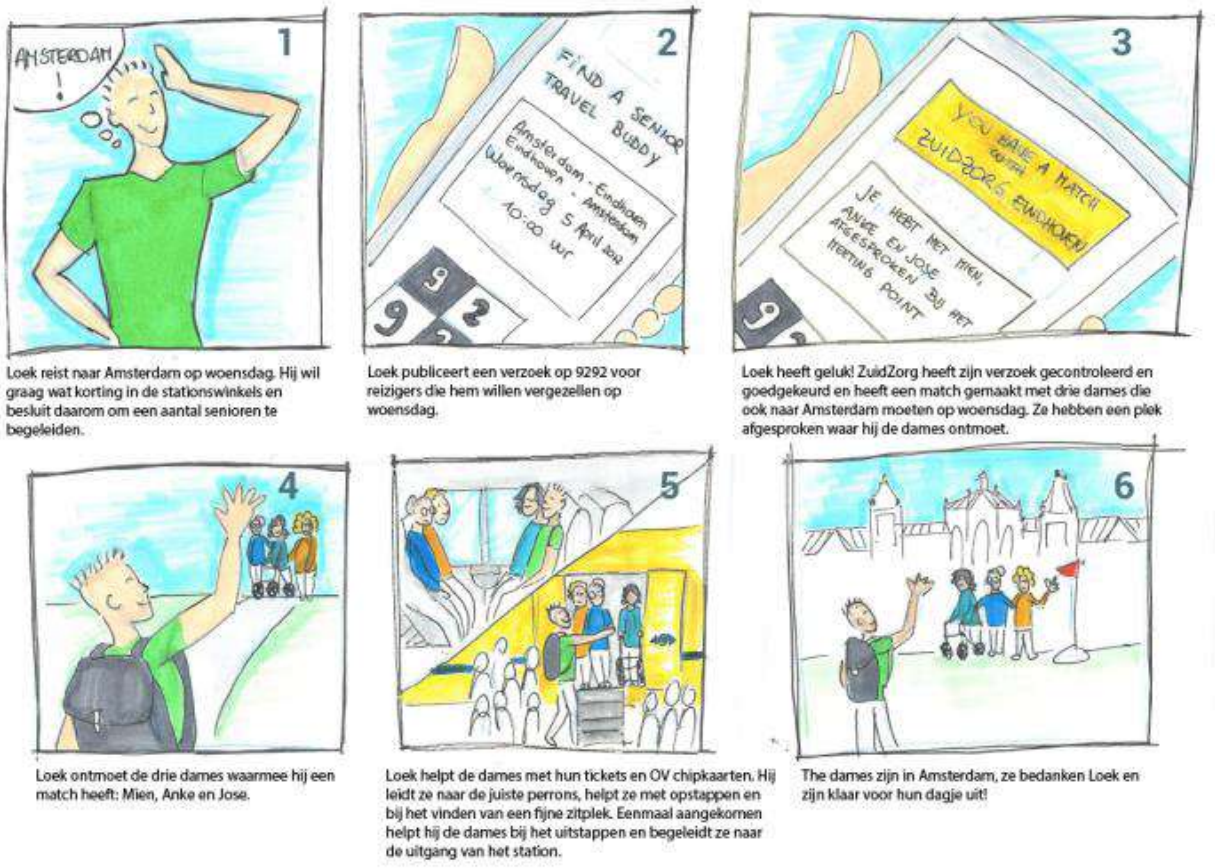

Figure 8 Canvas Scenario 2 (in Dutch).

During 2 sessions of an hour, the designer collected qualitative feedback on both scenarios from 15 senior participants. The two main insights from this exercise were that:

- for some participants, it seemed hard to trust a stranger to accompany them on their journey. Some of them refused to believe that anyone would invest effort in helping senior travellers.
- It seemed hard to find a consensus among participants regarding the purpose and how to reward a regular traveller accompanying seniors on their journey.

Figure 9 Zuidzorg participants giving feedback on Scenario canvases.

Figure 10 Example of participant's feedback (in Dutch).

Role Play

At this stage, the designer conducted further investigation in order to unfold the issue of trust (between regular and senior travellers) that emerged from the previous exercise, as well as to figure out a safe way to reward regular travellers.

She organised four role playing sessions with 6 participants, asking them to 'act-like' one of one the regular travellers' personas that she created. They were asked to build arguments why a senior traveller would choose them and how they would like to be rewarded.

Figure 11 Senior and researcher in a role play session. Persona cards are displayed on the table.

Role play is widely used by design agencies such as IDEO, because it is an effective tool to stimulate empathy and creativity. Inspired by Simsarian's framework (Simsarian, 2003), the goal of the role-playing session was to let participants immerse in a 'what if' context, perform a role and formulate observations from the perspective of the role they played. The main insights of this exercise were the following:

- Seniors travellers want some specific information (picture, phone number and proof of ID) to be able to trust a regular traveller to accompany seniors on their journey. Moreover, the participants expressed they would feel safer if they were represented by an established organisation (e.g. Zuidzorg) within this system.

This insight informed the design feature of YouGoIGo that enables ZuidZorg, or any other elderly centre, to build a company profile on the service. By doing so, they can represent their guests and publish their routes on their behalf. In this way, elderly care centres can function as authorities that guard the seniors' safety and make sure the system runs smoothly.

Figure 12 Example of interface where Zuigzorg publishes routes on behalf of its senior guests.

Figure 13 Example of interface displaying matching routes for senior and regular travellers.

- Participants expressed that they feel unsafe when handling money in public, thus many other proposals arose (e.g. not rewarding at all, offering coffee). A decision regarding reward was therefore not taken yet at this stage.

Semi-structured interviews

Two interviews were held with the student and the trainee in order to understand the perspective of potential regular travellers, as well as of a Zuidzorg carer, on the matters of trust and being rewarded on this developing travel service. The questions were the following:

- what would the impact be of using the company profile of ZuidZorg to publish seniors' routes?
- what would a ZuidZorg caretaker need to know about a regular traveller to confirm a match with him/her?
- how would she/he reward a regular traveller for the support she/he gives in accompanying senior travellers on their journey?

The trainee shared her perspective on the issue of trust: in order to feel safe in matching seniors with strangers, she wanted to know contact details, see a picture and a small biography, to have a complete overview of the other person. Reviews would also be helpful to make a more personalised choice. As Ert, Fleischer & Magen (2015) studied on Airbnb, a popular sharing economy platform in the tourism industry, pictures and reviews might have an important role in building trust between the multiple users of the service.

This insight informed the final 'privacy versus safety' compromise that is featured on YouGoIGo: the users, whether business accounts or personal accounts, have to authenticate by default with a proof of ID. Besides, users have to share a phone number (which can be accessible by different channels e.g. WhatsApp, Messenger or just regular dialing). This information is crucial to allow seniors or carers to contact regular travellers and make arrangements, if needed. However, this information is not stored in the system and is deleted once the trip is over. A phone number associated with a name and surname is the only sensitive information that travellers need to share with other users. Any other profile details are optional to share and reviews from other trips can be hidden. However, regular users are encouraged to share as much info as possible, to increase the chances to be chosen for a match.

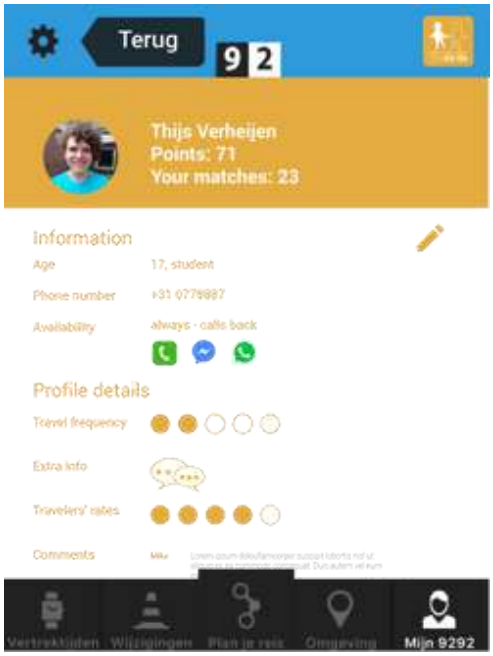

Figure 14 YouGoIGo interface, displaying regular traveller's info.

Regarding the 'how' to reward regular travellers, the student and trainee agreed that a scoring system to gain a discount would be an appropriate way to be rewarded for accompanying the seniors. In this way, cash money would not be needed, by making the system safer for the seniors and more convenient for regular travellers.

This feature has been implemented in the final design of YouGoIGo: a regular traveller gains scores for their service, which can be transformed into discounts. Any shop or promoting enterprise can join the system, by offering their discounts on the interface. The scores gained by the regular traveller double for return trips and for positive reviews by the seniors they accompanied. Next to this, they get to travel for free each time they accompany seniors, by showing the details of the trip to the conductor on the train or bus.

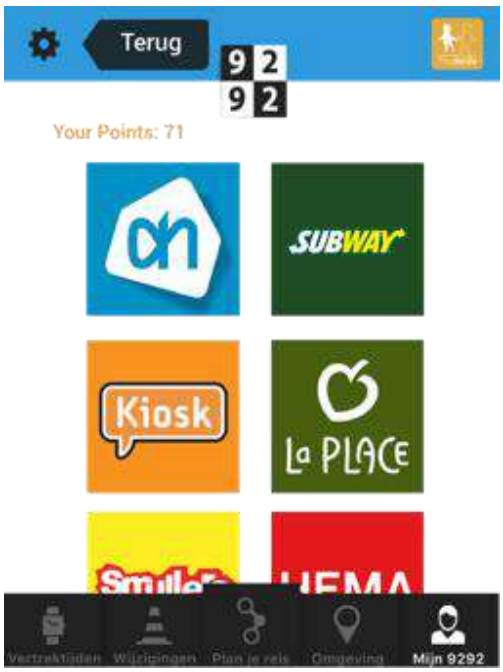

Figure 15 Example of interface through which a regular traveller can use her/his points to get a discount at different shops.

Service simulation

After the main features of the design had been defined, the designer organised a day out to Utrecht. A group of 6 participants, accompanied by the students, experienced the service, finally named YouGoIGo. The students had been instructed to behave as regular travellers using the service: they had to support the seniors in navigating public spaces (such as bus stops and stations), support them with their ticket purchasing and help them physically overcome barriers (such as stepping on and off the train).

The designer behaved as the intermediator (a ZuidZorg caretaker) and she showed the seniors, on a designed interface, that they had a match with two students for their trip to Utrecht. She gave them information about the students and showed them pictures of them. She also asked them if the information provided made them feel more comfortable in trusting the students. Their response was largely positive.

Once they met, the seniors were able to recognise the students and the group travelled back and forth to Utrecht. Simulating the system was effective to test its features and highlighting the potential bottle-necks (e.g. such as potential disruption during rush-hour and the need for further investigation of viability and feasibility of the system at a policy level).

Figure 16 Participants and students simulating YouGoIGo on a day out.

Figure 17 The group of seniors with their travel companions at a train station in The Netherlands.

Key learnings

From a design management perspective, the following key learnings have been found:

- Trust in the design process and by technology: in line with principles of cultures of participation (Fischer, 2011), it can be argued that the systematic democratisation of the design process (by creating probes that empowered users and stakeholders to participate in both the problem definition phase and in the design development phase) enabled a reciprocal feeling of trust and shared responsibility. Signs of this newly established trust could be perceived during the YouGoIGo simulation-day and by the participants' enthusiasm to see the service implemented. However, research on sharing economy services claims that built-in trust (within the app or website) is what makes them so successful (Richardson, 2015). YouGoIGo was developed in a process that entailed shared trust among all stakeholders involved throughout. However, the final design also relies on a trust-built-in mechanism: senior travellers need to trust their travel buddies from their online profiles, prior to meeting them offline. Further research is needed to assess whether trust between seniors and regular travellers remains when they are not involved in the design process and if other factors play a role (e.g. digital confidence in older users).
- Empowering processes support an empowering solution: as 40 senior participants were empowered to be co-creators and all stakeholders involved contributed as 'problem experts', a sense of agency and ownership over the final outcome appeared to grow throughout the process. By building reciprocal empathy, it was possible to thoroughly understand potential barriers to a healthy lifestyle, identify a design opportunity and create a 'win win' solution. This is in line with Manzini's (2010) insights on the role of the participatory designer in projects for social change. In practice, her role is to 'trigger interests of multiple stakeholders, align their motivations and empower their capabilities' (Manzini & Rizzo, 2011). As a result, it can be argued that YouGoIGo is an embodiment of multiple stakeholders' perspective and it empowers them by giving them responsibility. Senior travellers, regular travellers, mediator organisations (e.g. Zuidzorg), partnering enterprises might have different motivations to join YouGoIGo and they can gain different benefits from it. However, by design, they have to assume key responsibilities, in order to achieve those benefits.
- Strategic and sustainable implementation of the service: YouGoIGo's proof of concept has been validated in a limited simulation, in terms of number of participants and iterations. Nevertheless, it was sufficient to highlight the need for further research to address liability and policy concerns, should the service exist at scale, once implemented in the Netherlands. A 9292 account manager and the director of ZuidZorg Extra have been consulted regarding the matter. They suggested collaborating on a strategic implementation roadmap starting with more extensive pilot studies to test and overcome the current bottle-necks of the service. This highlights the need for a collaborative culture, across industries and disciplines: in the case of YouGoIGo, designers, developers, behavioural experts, carers, policy makers as well as seniors and regular commuters, would need to come together to affect systemic change.

In light of the challenges set by ageing population, we argue that more focus should be put on empowering solutions to support one's sense of agency and efficacy, to maintain a healthy and active lifestyle. Such solutions should be integrated in a societal infrastructure that distributes their risks and benefits among different stakeholders.

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Research Perspectives IN THE ERA OF Transformations

Integrating Business and Design through Experiential Learning

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This case study highlights how design merged with business studies addresses some of the key issues facing management teaching and learning. It outlines a pedagogical design framework, capturing both content and process through balancing analytical and creative thinking. The students interpret and use theory throughout various stages of a design challenge; through presentations and written submissions, students turn knowledge into reflection and action. The case study highlights how the developed framework engages the students in continuous learning cycles that are supported by an iterative assessment structure and catalysed by curiosity, creativity and courage.

Keywords: Design thinking, experiential learning, business studies

Experiential learning foundations

Drawing on 17 years of tertiary teaching experience and seven years of experimental course delivery - exploring new tools and visualisation techniques – this case study outlines how the use of experiential learning (Kolb, 1984) and design principles, tools and activities (Dunne & Martin, 2006) played a crucial part in redesigning a 3rd year undergraduate course (50-70 students) at a traditional Business School; as such, it provides insights into how design principles integrated with more traditional theoretical content may assist in addressing some of the key issues facing management teaching and learning, for example, emphasizing inquiry based learning and guided discovery (c.f. Starkey & Tempest, 2009). The pedagogical framework supports the students' learning journey; more specifically, it:

- Captures both content and process
- Catalyses curiosity, creativity and courage (traditionally not emphasised in Business Schools)
- Engages students in a positive team-work experience
- Creates a mutually meaningful interaction between academia and industry

Theory-in-use and reflective action: an iterative learning cycle

The foundations of the pedagogical framework is based on the experiential learning cycle (Kolb, 1984), where content is linked to practice through experience and reflection; learning is an iterative process and it is important to conceptualise/ abstract reflections in order to take action (i.e. learn) in future scenarios and hence provide new (learning) experiences (Figure 1). Thus, as illustrated in Figure 2, three key activities support the learning cycle: theory-in-use, reflective action, and iteration. This case study will further explore how these key principles were addressed when merging service marketing theory with design practice.

Figure 1 The experiential learning cycle

Theory-in-use	Balancing the Concrete Experience with Abstract Conceptualisation *Perception continuum 'How we think about things'*
Reflective action	Balancing Reflection with Active Experimentation *Process continuum 'How we do things'*
Iteration	Re-experimenting and reinterpreting

Figure 2 The experiential learning cycle with three key activities

Engaging students in a positive and real-life (teamwork) learning experience

Drawing on the experiential learning foundations, the course approaches (a) learning as a process which is continuously recurring (i.e. the experiential learning cycle), (b) learning having direction – experiences are related to our goals and needs and (c) learning styles as individual – different people emphasise different parts of the learning cycle (active, reflective, concrete, abstract). Thus, through knowledge about an efficient learning process, we can address our individual shortcomings (once we know about them) and become better learners. With regard to teamwork, different learning styles complement one another in an efficient team. This deeper understanding of the learning cycle and their own learning styles assist the students in understanding the rational for the team formation when they are placed in teams based on their different learning styles; it also lay the foundations for deeper understanding of one another, i.e. different people solve and approach problems in different ways. Furthermore, the teams are supported through a team kick-off process in which they thoroughly work through parts of the team formation process before even getting introduced to the task ahead. In addition, in iterative and structured peer assessments, the members provide feedback to one another continuously throughout the course. Finally, the teamwork activities has been moved into the classroom; students are responsible for bringing their individual, outside-class activities and contribute to the team discussion during class. In line with Beckman and Barry (2007), different learning styles shine through at different phases of the design process: the teams experience that different people (i.e. with different learning styles) contribute more (or less) during the various design phases, and that a diverse team is necessary to complement the team's learning experience.

Understanding service marketing and management through design principles

With emphasis on design principles, the course challenges conventional approaches to teaching service marketing and management. It bridges and balances theory and process. A so called 'service perspective on marketing' provides the theoretical underpinnings and emphasises a relational and value-based approach. Design, with emphasis on the human experience, provides tools and activities, and a way of thinking and doing useful for marketers (and others) facing challenges linked to the increasing importance of creating and maintaining relationships with customers and future users. Explicitly, the course addresses service design and innovation for the future; implicitly, and in focus in this case study, it addresses the learning experience.

The building blocks of the course

The course consists of 12 weekly four-hour workshops divided into five blocks (refer to Figure 3). The first block introduces service marketing and design practice, and kicks-off the team formation process. The last block concludes the course and provides an opportunity for the students to discuss organisational challenges and opportunities as well as reflect upon their own personal design journey. The three mid-blocks are the core and heart of the course; through addressing a real-life industry design challenge, the students are challenged to discover and comprehend the service experience, ideate and create the service innovation, and finally experiment with, and deliver, the service concept. Each block contains both content and process/practice dimensions. In the content parts of the course, the students read relevant literature and summarise, discuss and reflect upon key insights and how they can use these learnings in the design challenge and/or future careers. In the process parts of the course, the students get to address (through individual and team work) the (service) design challenge. Iteratively the teams go through the three stages of discovery, ideation and experimentation, and emerge towards the end of the course with a concept prototype of a solution to their team's identified problem.

Week	Workshops	BLOCKS
1	Service Marketing & Team Kick-off (1)	SERVICE MARKETING & DESIGN PRACTICE
2	Design Thinking & Team Kick-off (2)	
3	'Theory'	DISCOVER & COMPREHEND
4	'Practice'	
5	Insights Presentations & Feedback	
6	'Theory'	IDEATE & CREATE
7	'Practice'	
8	Idea(s) Presentations & Feedback	
9	'Theory'	EXPERIMENT & DELIVER
10	'Practice'	
11	Concept Presentations & Feedback	
12	Course Review & Summary	REFLECT & EVALUATE

Figure 3: Overview of the course

Discover and comprehend the service experience

The Discover & Comprehend phase starts with the customer and the concept of desirability. It is important to understand that what the customer/user might think that they want may not be what they actually need. In this initial phase, the students gather knowledge and information in order to comprehend the background to

the presented problem area as well as discover new things about it. Individually, they do observations and empathy interviews, and possibly some secondary research. As a team, they discuss and analyse the initial findings, start identifying patterns and analysing overarching problem areas, pain points and opportunities, group them into themes and create so called insights and point of view statements. Finally, through the first presentations, the teams will receive guidance and feedback. In this phase, a big 'aha-moment' for the students is usually when they realise that they, as a team, have to identify the problem, rather than solve a problem having been handed to them.

Ideate and create the service innovation

In the Ideate & Create phase, the key is to make the insights actionable and frame opportunities. This often includes an element of going back to the Discover & Comprehend phase in order to ensure that the defined opportunity areas actually correspond to the identified customer need. In this phase, the students are in the mode of 'ideating' - narrowing and culling information: making your insights actionable and framing opportunities (i.e. translate insights about the reality of today into a set of opportunities for the future). The teams have to generate so called 'how might we…' statements, conduct a brainstorm session and generate a lot of ideas. Additionally, they will start creating: they need to select a promising idea(s), refine it and start describing it. Finally, the teams present idea(s) and their 'journey' and receive feedback and further guidance.

Experiment with, and deliver, the service concept

In the Experiment & Deliver phase, it becomes important to bring the ideas to life in order to learn more about how they can be refined. In this phase, the student teams turn ideas into service concepts. They experiment through prototyping in order to bring the concepts to life. In the end, they include discussions about service models, client interface, technological options, delivery system etc. They will also need to analyse what is technically and organisationally feasible and develop some type of understanding of whether the idea is financially viable. Finally, the teams present their concept and hand-in a so called journey document.

Design practice and its links to the experiential learning cycle

It is important to note that even though the course is presented in a linear format, the students work iteratively through the challenge. For example, after having received feedback on the initial idea(s) most teams need to revisit their insights. In fact, throughout the years of course development, it became clear that the design process itself addressed the students learning experience. More specifically, the course explores the practical activities and tools linked to design practice, as well as its epistemological and cognitive foundations. The process dimension includes using activities and tools such as observations, ethnography, early and fast prototyping, visualisation and interdisciplinary teams; it emphasises the importance of working iteratively, combining abstract and concrete activities as well as divergent and convergent approaches (Brown, 2008). The cognitive dimension provides a deeper understanding of how knowledge is created (Martin, 2009). Firms (and individuals) need to make sure they balance analytical and intuitive thinking to achieve both reliability and validity. Design practice emphasises the importance of using both abductive reasoning - the 'logic of what could be' (Peirce, 1994) - and reflective practice (Schon, 1983) in order to achieve this.

This is in line with Beckman and Barry (2007; drawing on Owen (1998) and Kolb (1984)) highlighting design as a learning practice, proposing that:

> *The design process has both analytic and synthetic elements, and […] it operates in both the theoretical and practical realms. […] Movement between [these] realms happens as participants in the process draw insights from what they have learned in the world of practice, convert them to abstract ideas or theories, and then translate those theories back into the realm of practice […] (Beckman & Barry, 2007, p. 27))*

Thus, one key element in the course design has been the development of an assessment and activity structure that supports the iterative journey the students go through. The implications of this will be discussed next.

Key learning dimensions: iterative assessments, design catalysts and critical reflection

The pedagogical framework addresses both the perception continuum and the process continuum in the learning cycle. More specifically, all the course activities inside and outside class as well as the assessments

support the key dimensions of theory-in-use, reflective action and iteration. Additionally, it is clear that the design process itself catalyses the students' journey towards a deeper learning experience.

An iterative assessment structure catalysing the learning experience

In the course, in addition to addressing a real-life industry challenge, the students read and use service theory. Throughout the course, they need to put this theory in use, i.e. they need to balance abstract content with the actual experience of using it. This approach goes beyond 'just' applying theory, rather the students need to interpret theory, make a decision on if and what to use and when. Additionally, through emphasising reflective action, the students then reflect on their experiences and get to action their learnings in the next iteration. The iterations are extremely important for fuelling the learning cycle. Supported by the assessment structure, the learning cycle is reiterated and reinforced or changed a number of times throughout the courses (as illustrated in figure 4).

	Assessments and Activities *developed to support the key concepts*		
	Individual	Teamwork	
Key concepts supporting the learning experience	Reflection & summaries of readings (including self and peer reviews)	Individual contributions to the team challenge	Team contributions to the team challenge
Theory-in-use	Interpret theory and identify key concepts to use in practice	Put key concepts into practice through interviews, observations, prototyping or examples	Combine individual knowledge bases and make sense of findings
Reflective action	Reflect on readings and activities, digest feedback and demonstrate learnings	Reflect on role within the team, digest team feedback	Reflect on complementary abilities within the team, provide feedback
Iteration	Written submissions 3 iterations	Three contributions (e.g. observations, interviews, secondary research, prototyping)	Three presentations and feedback sessions.

Figure 4 Overview of how the assessment structure supports the learning experience

Curiosity, creativity and courage: design catalysts supporting a deeper learning experience

Drawing on the years of working with student teams and design professionals in the course, it is clear that three interrelated design catalysts further enhance the learning experience towards a deeper learning experience: curiosity, creativity and courage (illustrated in figure 5). Seemingly, they transcend the three design phases, as such they can be associated with design attitudes (c.f. Michlewski, 2008). Curiosity catalyses empathy and deeper understanding of the users and, in this specific course, the service experience and its context. Creativity supports divergent thinking and disruption of cognitive and perceptual sets (Amabile, 1983).

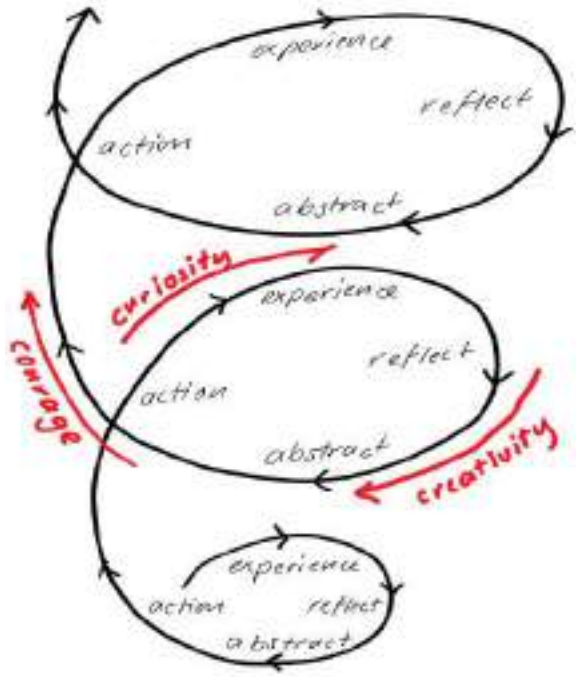

Figure 5 Curiosity, creativity and courage –catalysing the learning spiral

In the course, curiosity and creativity are highly interlinked. The curious teams gain higher empathy and a larger knowledge base, seemingly building stronger foundations for creativity. Courage mitigates cognitive bias with regard to assumptions present in curiosity and creativity-driven activities. The teams and individuals that are willing to test and learn and hence challenge their assumptions - try, fail, reflect, learn and try again - get a deeper learning experience. Drawing on a pragmatic approach to design practice (Dalsgaard, 2014; Steen, 2013; Windahl & Wetter-Edman, 2019), curiosity catalyses a situated and systemic understanding of the design challenge, creativity catalyses an interventionist and transformative approach, and courage catalyses the movement between the two, i.e. explorative inquiry.

Industry context – supporting the real-life learning experience

The relationship with industry goes far beyond so called guest lectures traditionally used in Business Schools. By involving professional individuals throughout the semester in a continuous interaction with the students, the course has created a mutually meaningful interaction between academia and industry. The so called design mentors (mentoring the students through the design process) and industry partner (providing the context for the design challenge) mentor between four to eight teams through three presentations, and give qualitative and quantitative feedback to each team after each presentation. Through these interactions, the students are exposed to a 'real-life' experience. This includes, not only a fuzzy process, but also ambiguity with regard to the feedback they receive and how to address it. Seemingly, the theoretical foundations of the course assist the students when questioning and challenging some of the external input they receive. In fact, this critical reflection is key to the students' growth: rather than 'ticking the boxes' for industry, they are allowed, encouraged and supported to question, challenge and rethink the challenge and its solution.

Work in progress – integrating business and design

Even though the course has been rather neatly described in this case study, many questions remain with regard to its survival and further development within a traditional Business School. A course like this pinpoints numerous challenges linked to the institutional inertia of a large university. Operational and immediate issues are linked to resourcing and space, as well as implementation of transformative assessment structures: How can we ensure appropriate resourcing for an interactive 50-70 students 'only' course (a small course in a Business School context)?; and, How can we support creative assessment structures with emphasis on formative as opposed to summative assessments? Strategic and structural issues are linked to capabilities and interdisciplinary collaboration: How can we encourage interdisciplinary involvement of both teachers and students? To me as an educator and researcher, it is clear that the use of design practice in business studies is breaking the existing and artificial academic boundaries and that the time has definitely come (c.f. Starkey & Tempest, 2009) to further explore the power of combining the two.

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Breaking Boundaries: A Unique Inter-University Program Addressing the 21st Century Skills Gap

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According to the World Economic Forum 2020, some of the most critical skills needed to thrive in the future economy will be the ability to collaborate in multidisciplinary teams, build diverse networks, and be human-centered problem solvers. However, many university students have limited exposure to interdisciplinary problem solving, and tend to build connections within their bubbles (socioeconomic level, college, the field of study). In this study, we'll review Innovate NYC (iNYC), an extracurricular program addressing these skills gaps. In three cohorts between 2016-18, 50 students from 12 New York City colleges, collaborated in multidisciplinary teams to solve real-world problems using innovation methods like HCD (Human Centred Design) and lean business strategies. The challenges were provided by partners like NYCEDC (NYC Economic Development Corporation) and other locally focused non-profits. However, did the program achieve what it set out to do and how might we apply the learning? In this study we aim to: 1. assess the strength and diversity of social connections between former iNYC participants, 2. identify any effect the program may have had on their career pathways, and 3. assess their continued use of innovation methods. To do this, we will examine the structure and delivery of the program, as well as review qualitative exit surveys and longitudinal survey results.

Context

In 2015, a workshop was held that brought together some of the biggest players in NYC higher education to discuss and seek to address some of the most pressing needs in the sector. Facilitated by the DO School, a Berlin based social enterprise, in coordination with the former Under Secretary of Education for the Obama Administration, Martha Kantor, the workshop's purpose was to not only identify shared challenges but to design a new program that might tackle them together.

Guided by a human centred design approach, Deans, Provosts, senior administrators and faculty from over ten New York universities, public and private, converged upon three key issues that all institutions were facing. These were, (1) the increasing cost of higher education leading to debilitating student debt for those who can least afford it, (2) the growing dropout rate among working class and immigrant families, and (3) the inability for institutions to adapt and design new programs quickly enough in order to adequately teach skills and mindsets for the new economy, leading to a 21st century skills gap. This skills gap issue was identified as most promising and suitable to explore further, and consensus was reached that it should be via a student facing extracurricular program that would provide real-world experience to students in interdisciplinary problem solving.

In 2016, the DO School launched Innovate NYC (iNYC) with funding support from Newman's Own Foundation and in collaboration with the following NYC higher education institutions: the New School, Columbia University, New York University (NYU), Pratt Institute, Fordham University, Cooper Union, Borough of Manhattan Community College (BMCC), Guttman Community College, Bronx Community College, and Macaulay Honors College. The program ran for three years, with up to 20 students recruited and selected each year from the partner universities, who would form a student design innovation studio that would respond to a city-based challenge set by a local non-profit organisation. Selection of student fellows was intentionally tailored to ensure diversity amongst the cohort, explicitly concerning their college, background, and level of experience with innovation, human-centered design (HCD) or interdisciplinary studios. Programs were designed and facilitated by experienced innovation and HCD facilitators.

The authors of this case study came together as representative stakeholders from two participating universities and the DO School, to assess the program's efficacy. Rhea Alexander is an Assist. Prof of Strategic Design and Management in Parsons School of Design at The New School. She is also Founder and Director of the Parsons Entrepreneurs Lab and served on the board of advisors for the Innovate NYC from 2015-2018. Her research focuses on how to integrate human centered design practices into impact entrepreneurship and innovation education. Shane Snipes is business faculty and Deputy Chair, Business Management Department at BMCC teaching and researching in the areas of entrepreneurship education and mindfulness. He also served on the board of advisors for Innovate NYC from 2017-18. Matt Stewart is an experienced strategy designer and innovation consultant. He's designed and facilitated human-centred innovation programs across the world, guiding diverse teams through the design process to tackle complex challenges. He managed and facilitated the Innovate NYC program in 2018.In this case study, we explore and assess the development, approach, learning and outcomes from our program with the aim of applying the insights to future programs, our practices and contribute both in academia and in applied innovation practice.

Narrative

Innovate NYC program operated annually in two parts, following a design innovation process. First, selected participants were invited to join for a mandatory two-day 'base camp' weekend in April. The purpose of this intensive workshop was to bring the team together and start to build trust and rapport. It involved a host of team-building exercises, with a specific focus on understanding different working and conflict styles, as well as identifying one's purpose and sharing that with new teammates. After a two month break, in the June summer holidays, a three-week studio took place where participants were guided through the various phases of a human centred design process, tackling a local problem.

To illustrate, in 2018, iNYC's local partner was non-profit organisation, Here to Here. They presented a challenge closely aligned to their organizational mission - to empower Bronx-based youth to reach 'family sustaining' careers. Students were asked to develop solutions that might help bridge the gap between education and employment in a borough that has a $20k a year lower average wage than the rest of the city.

After an initial 'challenge handover' to the 2018 cohort, industry experts and community members were invited to share different sides of the problem, and the students were taught to map the ecosystems and stakeholders, condensing key learnings to prepare for fieldwork. Regularly breaking up into new groups, the students then conducted simple ethnographic research methods, including interviews with youth and observing different environments across the neighborhood. Interview findings were condensed into some critical insights in a synthesis phase which were shared to the partner for feedback along with some early stage solution ideas. Based on validated insights, an ideation phase commenced, and two concepts were developed. Guest mentors offered input in storytelling, branding, and engagement which helped the students refine their ideas into basic prototypes. The final results were shared with Here to Here at a pitching event and celebration.

The solution concepts for this project were:

1. A card set and game for engaging community members as mentors, based on the insight that while many youth would like a mentor, they lack the skills to be a good mentee
2. A fashion traineeship program for Bronx high school students, based on the insight that many youths care more about fashion than grades

The Innovate NYC schedule also included a social event where all participants from previous cohorts were invited to attend and mingle. Below, figure 1 demonstrates various aspects of the program with photos from the process.

Here to Here's feedback, from a 'client' partner perspective, demonstrate the value they took from the initiative. First, they gained a new perspective to help with strategy and improving their work - *the students highlighted genuine insights that H2H hadn't thought of, including: finding out via local interviews that few people in the neighbourhood had actually heard of H2H, and highlighting specific challenges and perspectives of the target group (Youth)*. Second, their staff had a chance to work with creative young people, to share directly about their work and be inspired by new energy and ideas.

Figure 1. Participants during the 2018 iNYC program. Credit: the authors.

Post-Program Survey

In late 2018, it was decided that the program would no longer be supported and funded by the DO School and Newman's Own Foundation. Concluding a three year lifespan which involved many stakeholders from all levels of 12 NYC colleges, 50 participants, three local challenge partners and an impressive list of experts and contributors.

In December 2018, the authors sent out a survey to all 50 participants of the program (2016, 2017 and 2018). The purpose of the survey was to accurately evaluate the program against its ability to be a catalyst for healthy and diverse social connections between participants, have a positive effect on their career pathways, and also their continued use of innovative methods.

The survey was created on Google Forms, and former participants were recruited via email. There was a 70% response rate to the survey - 35 out of a possible 50 - with an even spread across cohorts, 14 from 2016, 10 from 2017, and 11 from 2018.

Survey Results

Innovate NYC offered participants a unique immersive opportunity to work in interdisciplinary teams and directly apply human-centered design methods and mindsets in order to tackle a real city-based challenge. The data which the authors gathered through the survey can give some robust indicators as to the short term impact on participants post-program.

Did iNYC increase the size and diversity of the participants' social network?

The researchers estimate that Innovate NYC has been a catalyst for approximately seven new strong connections and over 90 weak connections between participants. Connections were diversely spread between students from different colleges.

Diverse networks are valuable for future career development (Shipilov et al., 2007), and improve one's ability to work in interdisciplinary, cross-cultural teams. Indeed in over a dozen cases, participants have already found these connections helpful when making career choices or in gaining business introductions (Figure 2).

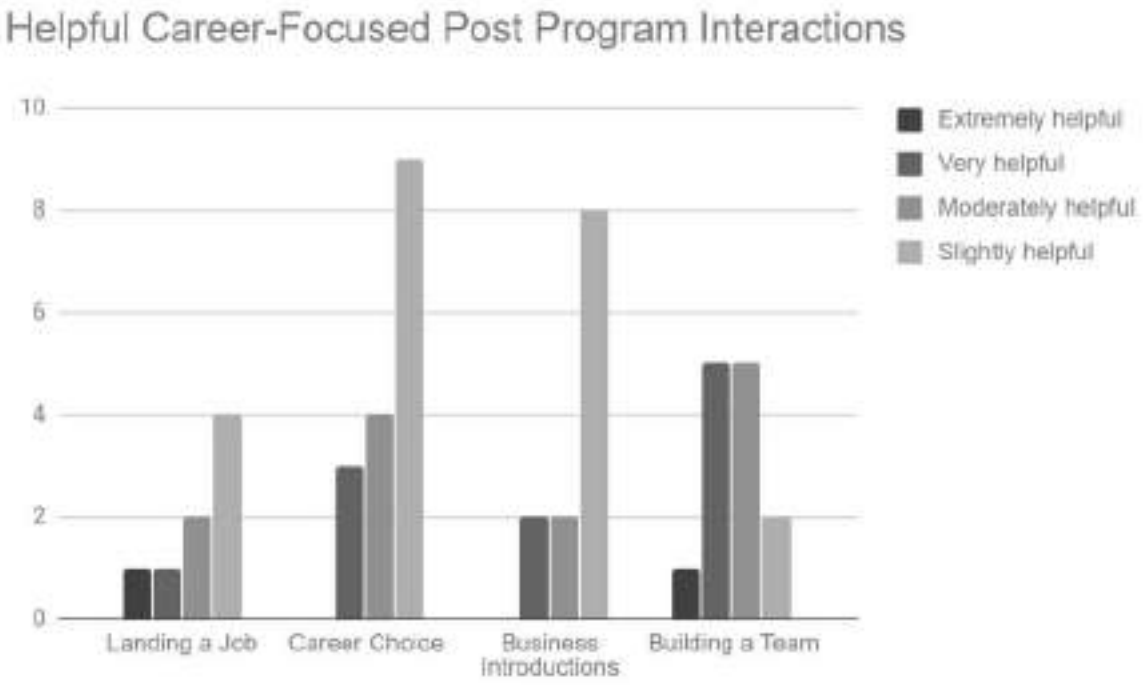

Figure 2. Participants who said that post program interactions were at least slightly helpful, taken from all cohorts (n=35).

"I met a wide variety of people and put a new perspective in my life."

- Innovate NYC Participant (taken from post-program survey)

How has iNYC affected participants career pathways and use of innovation methods?

On average, participating in the program made students more likely to want to work in an innovation related career with a mean response of 3.3 on a five point likert scale. Meanwhile 97% percent believed that they would use human-centered design in the future (Figure 3).

Many survey respondents said the program helped them validate ideas they had about careers in business and/or social innovation, allowing them to experience the design and consulting process first hand. Others noted that it was great for their CV and experience, in this way it validates such a program as a genuine competitor to internships, which offer similar value to students. Meanwhile at least nine of the thirty-five

respondents have graduated and are now working in a job that, based on the title, would likely involve business innovation.

In a time where being able to apply design methods helps bridge the skill and mindset gaps facing workers today, the authors found that Innovate NYC's 20th century approach of learning by doing , based on John Dewey's education theory (1938) and David Kolb's model of experiential learning (1984) combined with HCD (Cooley, 1989) and social entrepreneurship lean methods (Kickul & Tohmas, 2016), was an effective format for students to learn the approach first hand, learning from mistakes directly with a real societal problem and community partner need instead of studying the concepts.

"iNYC gave me important experience that will be relevant not only in my current position but in the plans I have for my career as a whole."

- Innovate NYC Participant (taken from post-program survey)

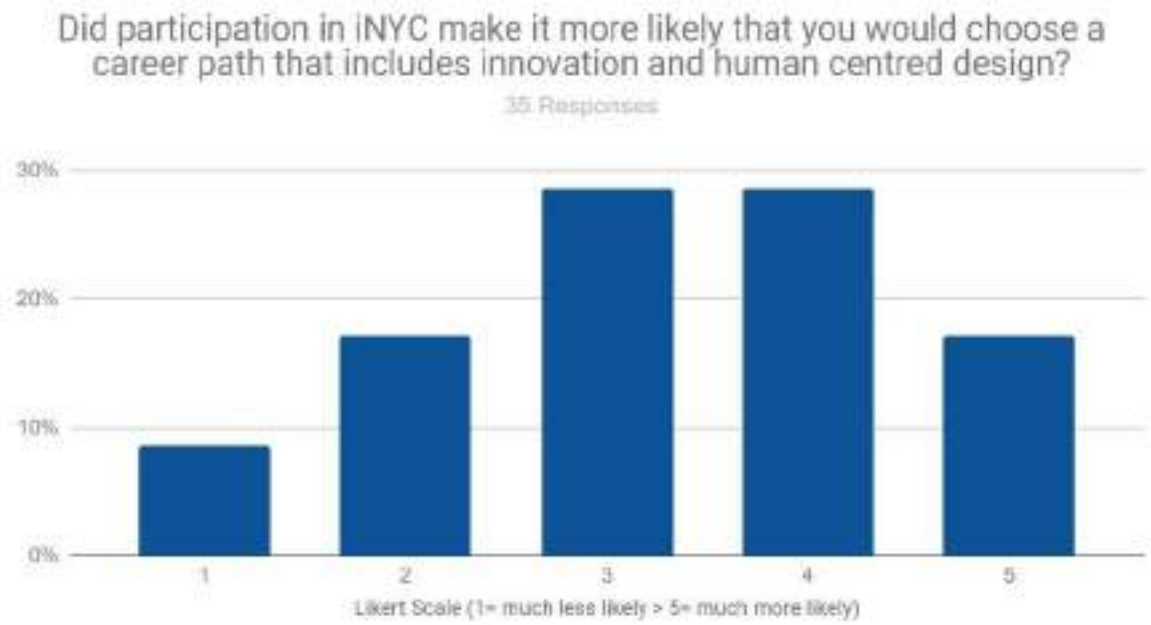

Figure 3. Participants who said that post program interactions were at least slightly helpful, taken from all cohorts (n=35).

Exposure to 21st Century skills, mindsets, and working in interdisciplinary teams

For many participants, Innovate NYC was their first time being exposed to design and innovation methods including user research, system analysis and mapping, ideation techniques, prototyping, and storytelling. They also learned transferable collaboration skills and tools such as conflict management amongst colleagues with different working styles, peer coaching, and client management, that can help them form and enrich future teams they work with.

Students from each cohort overwhelmingly agreed that after iNYC they are much more likely to want to work in diverse teams (Figure 4). They said it would inspire them to what to work in diverse teams, and that participants mainly saw value in offering them a new perspective.

21st-century jobs are affected by many factors including environmental sustainability, urbanization, increased inequity, political uncertainty, technological change, globalization, and demographic change (Bakhshi et al., 2017). Creative, design and engineering have bright outlooks according to Bakhshi. Championing design thinking and creative problem solving would allow students to remain employable throughout their lives. Higher order cognitive thinking like originality and active learning are also important. There is a need to negotiate the global context of work which will continue to expand (Dulebohn, 2017).

There is an eminent need to address the modern world of work skills gaps highlighted by the World Economic Forum (n.d.) and human resource firms (ManpowerGroup, n.d.). PayScale published in a 2016 Workforce-Skills Preparedness Report findings from responses of almost 64,000 hiring managers across a wide range of industries who were asked about the disconnect between the skills students have when they graduate from college and the skills companies need. In summary, 60% of managers said new graduates do not have the critical thinking and problem-solving skills necessary for the job, 46% said new graduates lack the necessary communication skills, and 36% reported new graduates have inadequate interpersonal and teamwork skills. Design and creativity around a specific community problem can help with many of these required career skills as students are forced to learn quickly about a specific problem, organize as a team, and execute on a creative process resulting in a solution for a specific client.

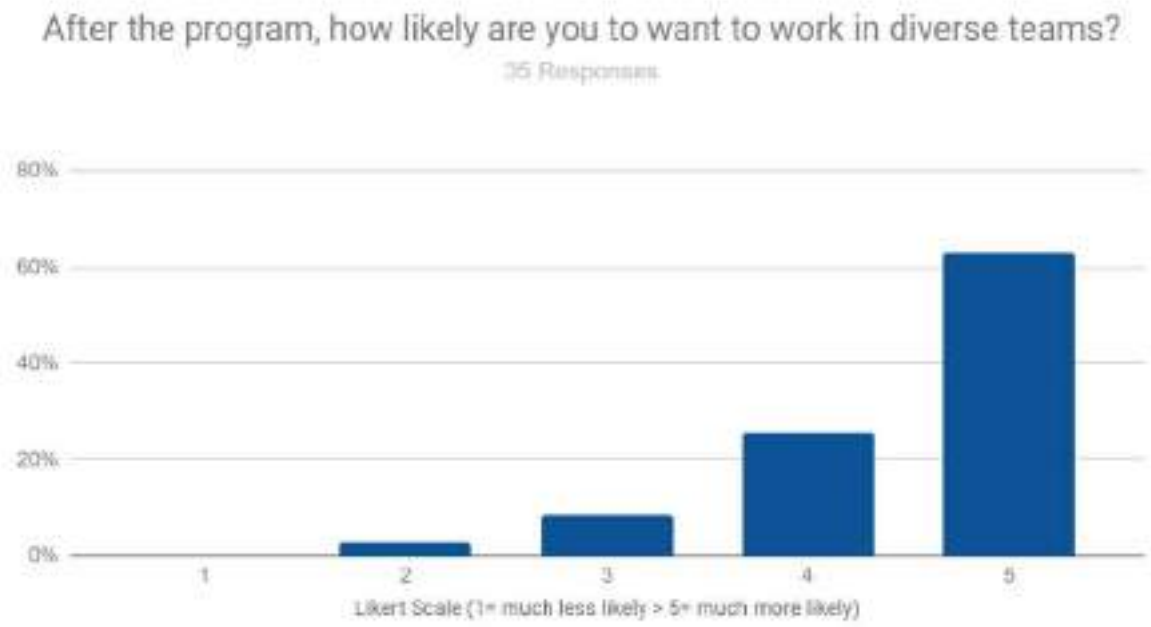

Figure 4: Participants on whether they were likely to want to work in diverse teams after taking part in iNYC (n=35).

"[Innovate NYC] gave me the confidence to find innovative solutions to problems on my own and develop a team"

- Innovate NYC Participant (taken from post-program survey)

Key Learnings

In this section, the authors share the key learnings that emerged throughout the research and discussions:

Coordination of iNYC took place in a VUCA environment, where change is the only constant.

With each passing iteration the researchers began to realize that with the rapid changes in the higher-education landscape most of the university representatives unintentionally changed each year, as did the DO School facilitators. These sit alongside the time and resource challenges of real life non-profit partner organisation and students juggling choices and other opportunities.This constantly shifting environment was analogous to what is happening in the economy across sectors, a more volatile, uncertain, complex and ambiguous (VUCA) atmosphere was developing (Alexander et al., 2016).

iNYC led to a small increase in the size and diversity of participant's social networks.

Clear limitations exist against the program's goals of catalysing diverse connections across fields and class divides, most prominent of which is the short nature of the engagement. Sociologists have identified three conditions that are considered crucial to the development of friendships: proximity; repeated, unplanned

interactions; and a setting that encourages people to confide in each other while letting their guard down (Williams, 2012). Innovate NYC includes all three elements; however, the authors (two representing university stakeholders and one from the DO School) believe that it would have been possible to increase the number of strong connections and levels of interaction post-program between cohort members if the program were to:

- Be longer in duration - to enable more time for the group to build strong bonds
- Involve more interaction outside of workshop hours - allowing more socially focused bonding that could take place by living together, cooking together and more.
- Included Follow-up engagements post-program - ensuring social contact is maintained, maximising opportunities to support each other in career endeavours.

iNYC provided students with a valuable hands-on taste of a career in design

The program was able to offer a short-term, hands-on glimpse into a career in innovation and HCD, carefully guided by expert facilitators. For non-design students, the program experience opened them up to the methods, and practices design innovators use, and they expressed these learnings were transferable to their chosen career paths. This was supported by research highlighting what non-designers bring to the design process (Morehen, Wrigley, & Wright, 2013). For those wanting to launch their career pathway in HCD, they require ongoing guidance and support far and above what iNYC could offer, both in time and input.

iNYC strongly demonstrated the benefits of working in diverse teams

Not only did feedback suggest that the diversity of participants was a clear highlight of the program but also that the students would be very likely to want to work in similar environments in the future (receiving a mean score of 4.5 on a five point likert scale).

The 2018 cohort included participants from nine countries and vastly different backgrounds, but despite their diversity each participant offered unique value and knowledge to the program. By way of example, a number of the local students offered direct experience and empathy to the challenge which no international could share, but the international students brought new perspectives and in some cases experience with the design process which helped guide solution and prototype development. This corroborates the benefits other researchers are finding with an international student perspective in the classroom (Beykont & Daiute, 2002).

Applications to the industry

Such a program could potentially offer opportunities for addressing mid-career skill gaps as cycles of economic and industry change become more frequent (Rosen & Jerdee, 1992). A tailored version of iNYC could offer someone looking to pivot their career a chance to gain exposure to new working styles and apply new methods while still offering a unique and valuable perspective to a challenge, based on their previous experience. It might also act as a format for different stakeholders in an industry to work together tackling a sector-wide problem while concurrently building connections across silos and giving those involved a fresh perspective and ability to support one another in a rapidly changing world.

Next steps

The data gathered about these three cohorts has the potential to become a longitudinal study. At the time of the survey, former participants were still in the early stage of their career, and hence identifying any actual long term impact from such a program will require time.

Conclusion

Innovate NYC was developed using innovation techniques and HCD as an extra-curricular program in response to a pressing shared challenge recognised by key stakeholders from the New York City higher education landscape. The program itself, which ran for three years, brought together a diverse spectrum of NYC college students and stakeholders, exposing many for the first time to design approaches and interdisciplinary teams, across universities and colleges and socio-economic divides to address some of the 21st century skills gap. It helped some students validate their career path, build hands-on project experience, and it exposed them to diverse new perspectives and networks which may play an increasingly valuable role as they advance in their careers.

Our evaluation of the program has touched on the difficulty of managing such a program in a VUCA world, the importance of quality time together in the building of lasting connections, the value of diverse teams in innovation and, hands-on 'learning by doing'. These lessons can be applied to any similar program that aims to bring together diverse stakeholders or teach human centred design skills.

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APPENDIX : POST-PROGRAM SURVEY RESULTS

Qualitative Feedback:

Participants valued the diversity of people they met during the program, including fellow participants but also amongst experts and during the research phase. Specifically, they liked that it offered them a fresh perspective.

"I met a wide variety of people and put a new perspective in my life."

“The different types of people we interviewed and the people types of people I met from around the world.”

The program gave participants hands on project experience which enhanced their CVs but also helped some validate whether they wanted to pursue a career in innovation and design.

“It solidified my desire to work in the innovation/design field.”

“iNYC gave me important experience that will be relevant not only in my current position but in the plans I have for my career as a whole.”

It also gave participants a fresh perspective on interdisciplinarity and the value of diverse teams.

“I definitely enjoyed working as a team and will look for that in my career.”

“Gave me the confidence to find innovative solutions to problems on my own and develop a team”

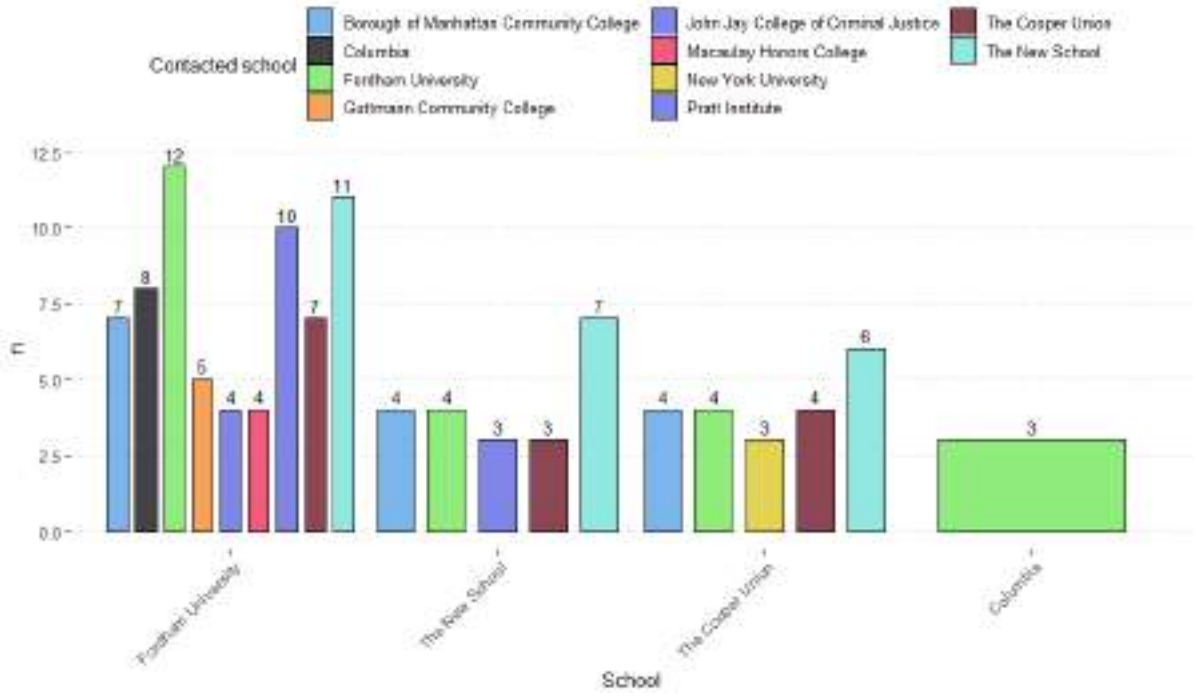
Quantitative Results:

With regards to whether the program could be a catalyst for lasting connections the results were mixed.

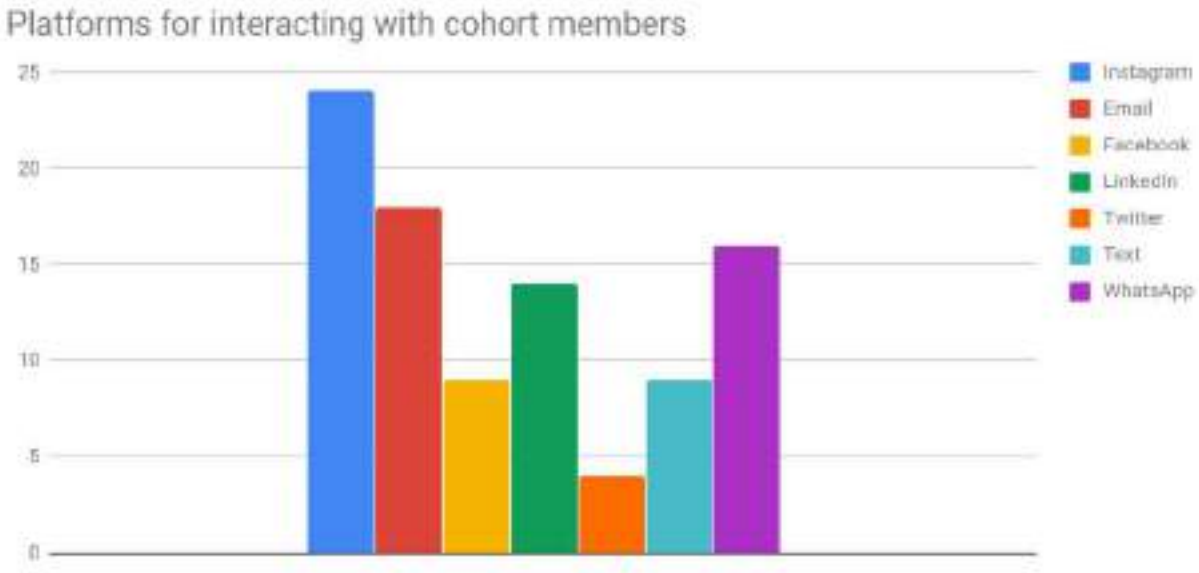
The researchers asked each participant to identify which members of their cohort they have had contact with following the program. They could choose between 'several times' 'monthly' or 'weekly'. Aggregating the responses, the authors inferred from the data that for every two cases (one case is if someone denoted that they'd been in contact with another at a certain interval) would serve as an approximation for one two-way relationship. The researchers defined a weak connection as one where two people have connected several times since the program, and a strong connection when contact is made weekly or monthly. From this, the researchers conclude that their remain 94 weak connections and 10 strong connections between cohort members.

It is known that in three of these cases, a friendship already existed before the program and thus it is likely iNYC only had a limited impact in strengthening their connection. Leaving 7 new strong connections made from the three cohorts.

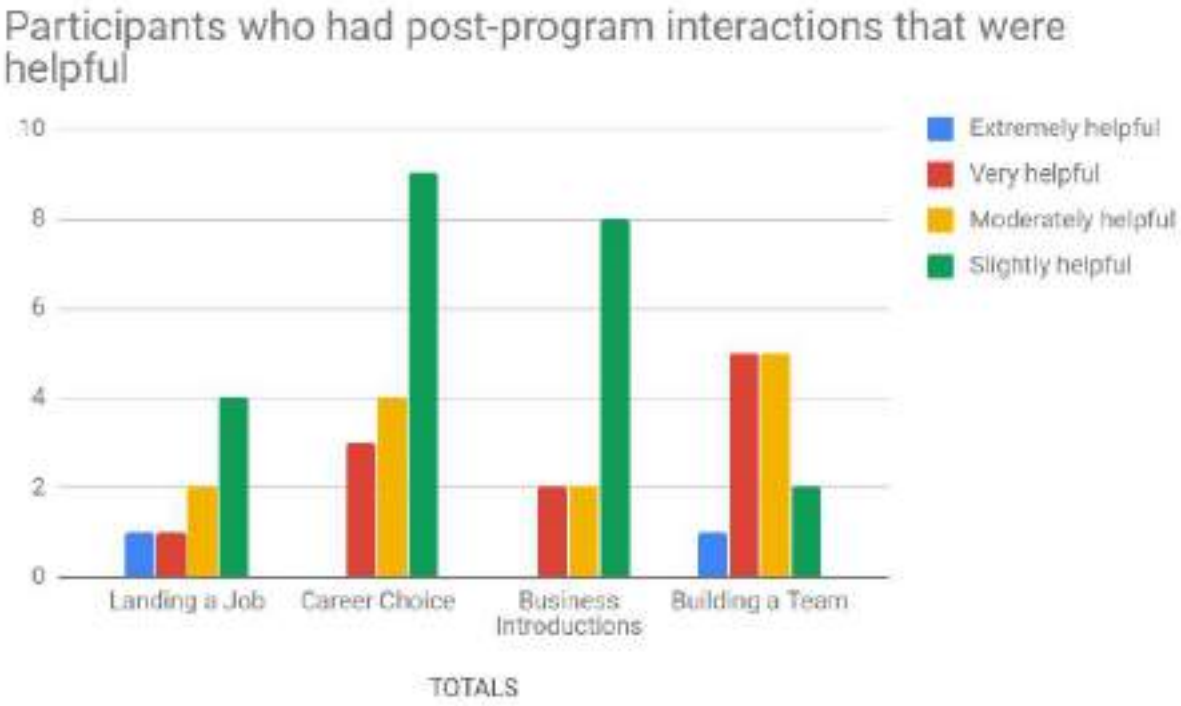
The following graph outlines connections made by students from different colleges, giving the authors an indicator as to the diversity of connections developed.



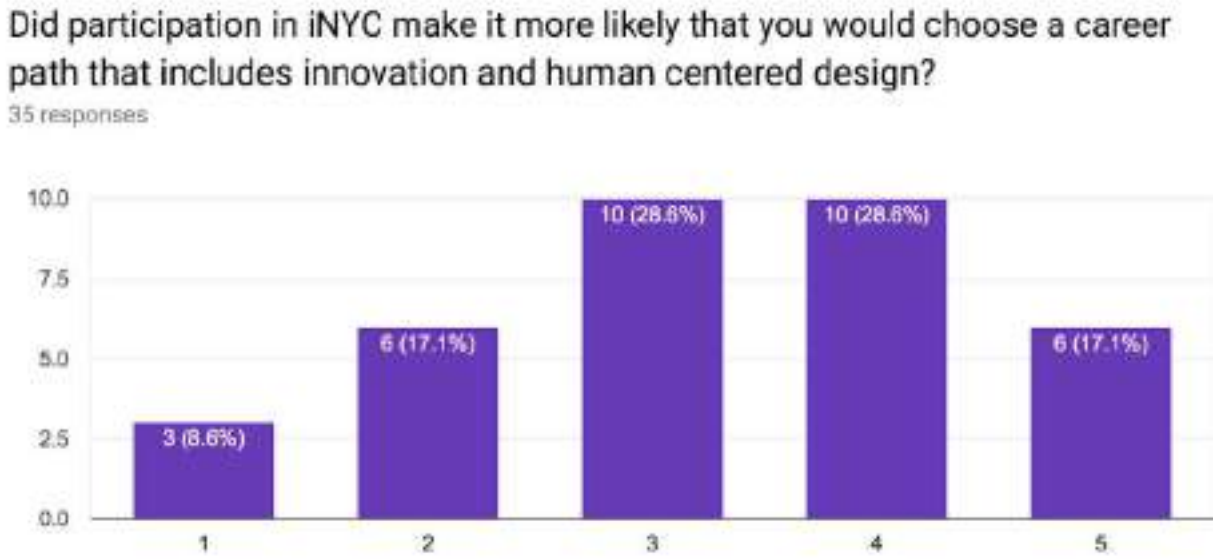
Participants connected with former participants across a range of digital media, however the most popular were Instagram, email and WhatsApp.



Asked whether any post-program interactions were helpful for their career, 16 said that they were at least slightly helpful in terms of career choices, and 12 found them at least slightly helpful for business introductions.

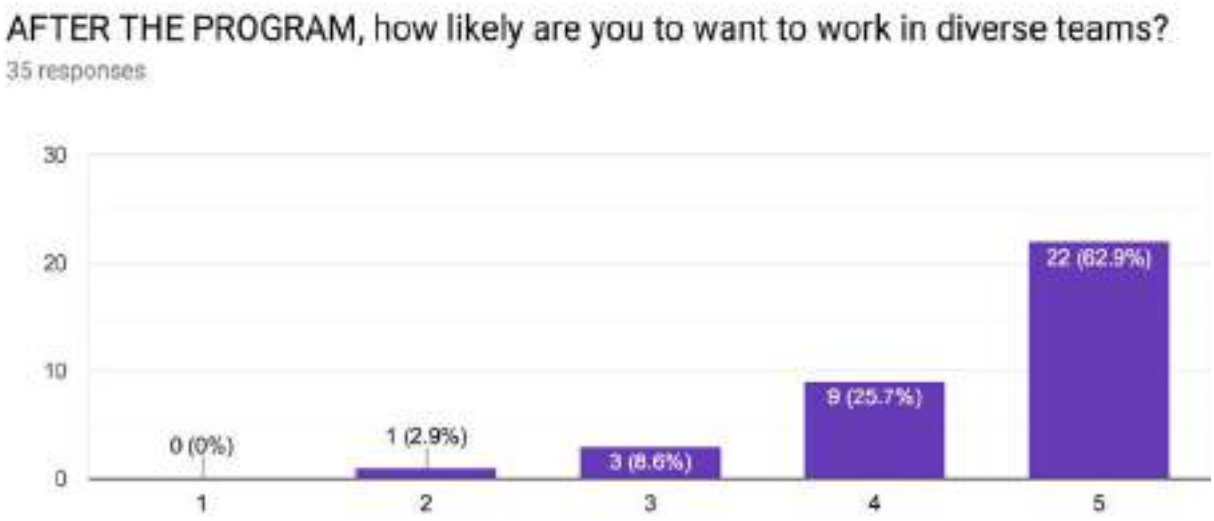


Participants felt that iNYC made them more likely to choose a career path that includes innovation and human centred design. They were asked to select a score using a five point likert scale, which resulted in a mean response of 3.3.



Over 80% of responding participants also believe it to be likely or very likely they will use business innovation, HCD or lean methods in their career. Less than 3% (or one participant) say it's not likely they will use HCD in their career.

In response to a question about propensity to want to work in diverse teams, respondents overwhelmingly agreed that after iNYC they are very likely to want to work in diverse teams, post-program - receiving a mean score of 4.5 (from a five point likert scale)



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Research Perspectives IN THE ERA OF Transformations

Towards an interdisciplinary knowledge exchange model: Uniandes design school help to transform Avianca into a design driven company in the flight industry

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Universities and corporates, in Europe and the United States, have come to a win-win relationship to accomplish goals that serve research and industry. However, this is not a common situation in Latin America. Knowledge exchange and the co-creation of new projects by applying academic research to solve company problems does not happen naturally.
To bridge this gap, the Design School of Universidad de los Andes, together with Avianca, are exploring new formats to understand the knowledge transfer impact in an open innovation network aiming to create fluid channels between different stakeholders. The primary goal was to help Avianca to strengthen their innovation department by apply design methodologies. First, allowing design students to proposed novel solutions for the traveller experience. Then, engaging Avianca employees to learn the design process. These explorations gave the opportunity to the university to apply design research and academic findings in a professional and commercial environment.
After one year of collaboration and ten prototypes tested at the airport, we can say that Avianca's innovation mindset has evolved by implementing a user-centric perspective in the customer experience touch points, building prototypes and quickly iterate. Furthermore, this partnership helped Avianca's employees to experience a design environment in which they were actively interacting in the innovation process.

Keywords: collaboration, university, industry, design methodologies, innovation

From traditional development to Open innovation collaboration

More universities and corporations in Europe and the United States, have come to establish a win-win relationship to accomplish goals that serve research and industry in terms of innovation. Cases like Stanford or MIT that uses academic research to propose novel solutions to company problems, or TU Delft and DTU who use participatory methodologies to exchange of knowledge between professionals and practitioners are a common and valuable practice. However, this is not the case for the Latin American context, in which companies prefer external consultancy as their first option, underestimating the universities input.

That was the case of Avianca. In the Colombian context, Avianca is the market leader in flight services in Latin America with 27.000 employees and 97 years of experience in the industry. A couple of years ago, they were struggling in a severe crisis that ended with a new CEO, Hernán Rincón, former president of Microsoft Latam. The decision to appoint a tech leader was to promote the transformation of Avianca into a digital company that operates flight services.

To pursue this quest, the new CEO established drastic changes to the organization model. One of them was to open an innovation department. The primary objective of that was to build an open network of partners who could add cross-disciplinary knowledge to the company to develop cutting edge projects for the aviation industry. By these initiatives, Avianca's new vision aimed to foster a new organizational culture within the internal teams by promoting new ways of working through agile processes, rapid prototyping, and experimentation.

As a consequence of this initiative, the Design School of Universidad de los Andes was the first partner to explore new formats to understand the impact of knowledge transfer in an open innovation network aiming to create fluid channels between different stakeholders in order to build innovative service propositions (Gardien, Deckers & Christiaansen, 2014). The proposal consisted of a model called Pilot to scale, to define a medium-term vision for the collaboration. This model considers three steps to foster Avianca to become a design-driven organization: Seed, Grow and Spread (Figure 1).

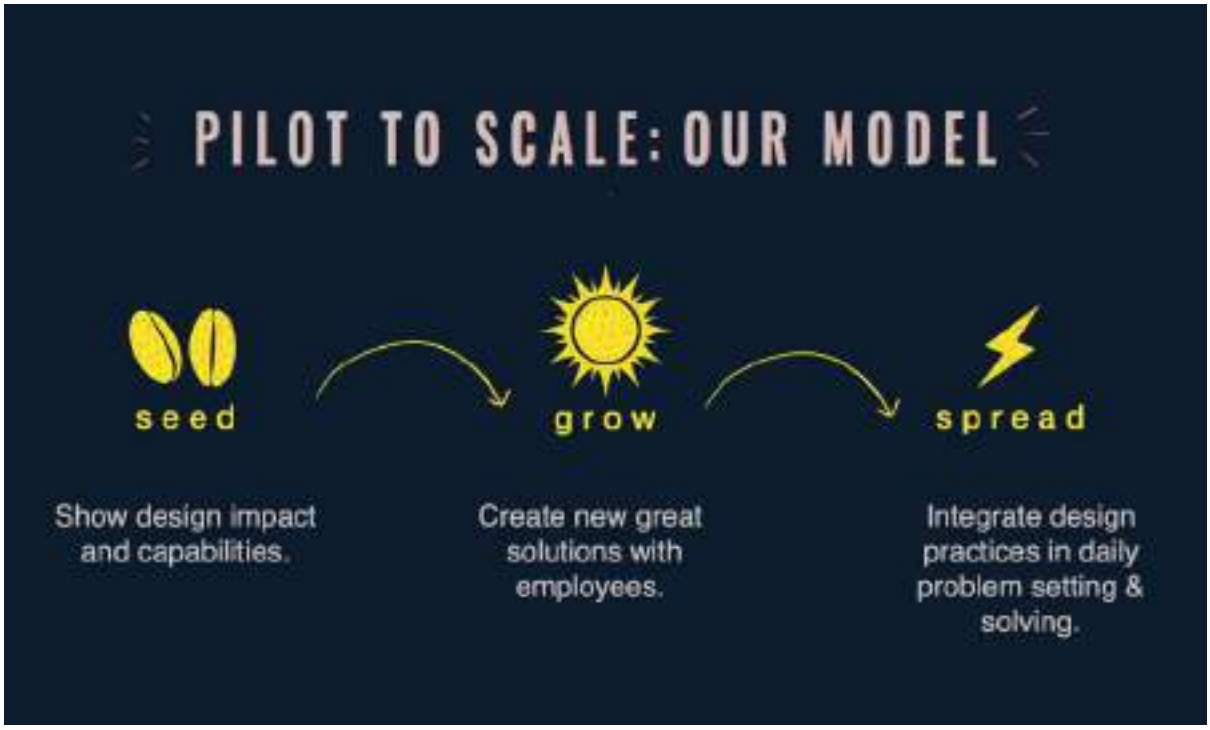

Figure 1 Pilot to scale model

Ready for take off

The first collaborative pilot proposed by the Design School was to use a Service Design course as a platform to explore eight user experience challenges proposed by Avianca. The course was offered in the bachelor program to last year students that were going to work with the assessment and guidance of two design professors, experts in service design (Figure 2).

Twenty-seven students enrolled for the course and were divided in eight groups, one group per challenge. Their task was to perform an extensive design research, visualize and generate new opportunities of interventions, and validate and implement those solutions (Beckman & Barry, 2007). They had to work together with the land and flight experience department of Avianca to enhance the customer's travel experience from top to bottom.

As proposed by Owen (1998) in any innovation process, the observation phase requires in-depth field research. In order to do that, the design teams needed access to some restricted areas to understand how the operational decisions were taken, how the front desk services were presented to customers, and how the overall perception of the experience was. The support, collaborations, and participation of Avianca employees were crucial for uncovering new opportunity areas in the front stage of the experience based on the research results.

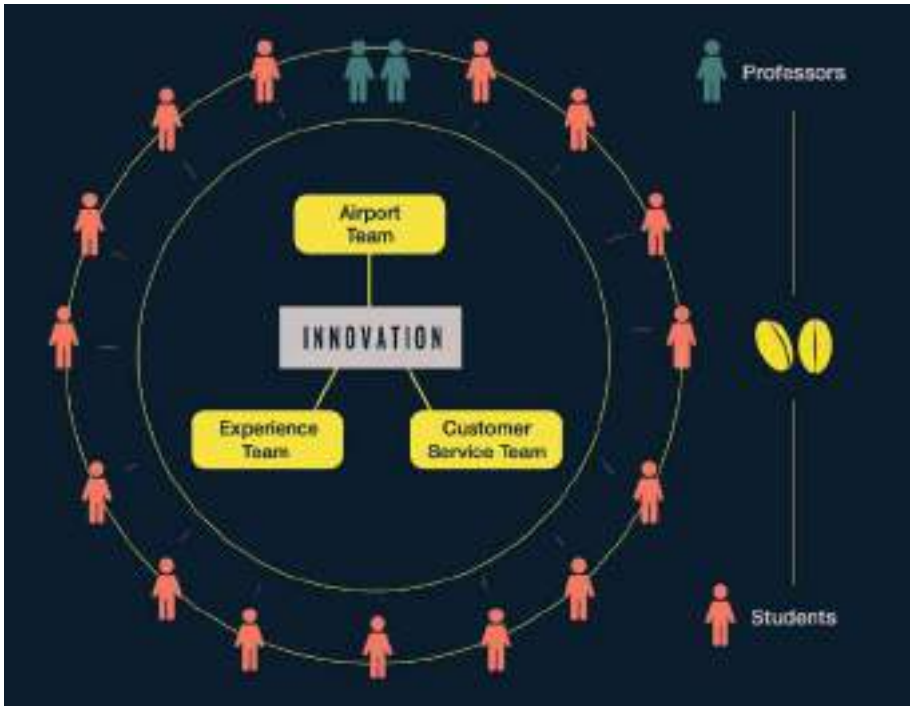

Figure 2 Seed phase. Bachelor design course

Those opportunities were translated into solutions and validated by prototyping them in the real context. Every team launched a minimum viable product at the airport considering the insights and user needs uncovered in the research phase (Table 1). For Avianca this was entirely new. In most cases, the launch of a new product or service waited until the process was completed and there was no window for validations or iterations.

Table 1 Solutions and concept descriptions of the MVP.

Name of the Challenge	Solution	Concept description
Improve the check in experience	CHILLOUT	CHILLOUT is based on Colombian families' habits of waiting for their relatives at the other side of the barrier while they are checking in. This moment of waiting was perceived as a waste of time and was emotionally painful. CHILLOUT takes the customer place in the check-in queue and allows the traveller to spend the previous moments before the flight with his family in a cosy space. Once CHILLOUT arrives at the front desk, the customer is called to continue with the check-in process.
Improve the experience in the waiting areas	Complaining was never easier	A testimony booth located at the waiting area where passengers could talk about any topic, situation or problem. There is an immediate response to make the visitor to feel confident. Moreover, Avianca will collect all complain to apply the suggestions to make improvements in the services.
Improve the experience in the VIP areas	VIP on the go	Partnerships between Avianca and companies located at the airport to let Diamond VIP passengers enjoy their benefits even when they do not enter the VIP area. They will have access to this service from Avianca's app.
Improve the boarding process	Colouring your day (Figure 3)	A boarding system that combines the current letter categorization with a colour code in the boarding pass. A lighting panel at the gate warns the passengers about their boarding moment. If the passenger

		boards in the wrong turn, the red light will represent it is an incorrect order.
Build a memorable experience during the flight	The perfect moment	The in-flight experience takes advantage of the aerial sightseeing and the amazing destinations passed by to use the window to connect the passenger with positive emotions providing a memorable experience.
Cope with 1-4 hours delay flights	The best host	A system to identify the interests and preferences of the passengers to deliver a more personalized and meaningful experience during a delayed flight. This system contains a direct channel of communication in the passenger's smartphone to be updated about flight information. The passenger can choose the type of compensation that she prefers from a variety of services (food, book, hairdressers, massage…)
Deliver a satisfactory flight connection experience	Carla, closer to you	An artificial intelligence system embedded in Avianca's app that helps passengers to get precise information through an augmented reality avatar who delivers a more personalized and familiar interaction.
Improve the luggage claiming process	Friendly luggage	It is a loyalty program with luggage based on values such as friendship, reciprocity, and support. The program provides luggage benefits to the users who apply best practices in the airport processes. The luggage would exit first at the destination, and it would be handled carefully in transportation.

Figure 3 Colour-coding boarding process MVP at the gate

These solutions were presented in a closing event to the Avianca staff team composed by two vice presidents, and several directors, including the director of El Dorado Airport in Bogotá. The design teams experienced how to showcase their work and how to respond to an audience of experts. Further implementations of these solutions are still in the project pipeline, but its development requires further internal ownership that was not in the scope of the objectives of the course.

Due to the success of this collaboration and the value output generated, Avianca's innovation team and their Vice president of experience decided to roll out a new course. However, and taking into account the idea to

give continuity to the projects, they required the course to have specific characteristics. First, the process should provide more engagement from the Avianca team, more like a partnership relation rather than a commercial relationship. Second, the application of the methodologies should develop a installed capacity that would increase the innovation culture to the inside of the company. Finally, to validate the impact of the new knowledge, the brief was aimed to tackle organizational challenges.

For the Design School, this meant that the new course was embedded in the second stage of the Pilot to scale model: Grow. This time, Avianca was more interested in acquiring design thinking skills, rather than receiving solutions for their problems. They wanted to be part of the process and allow the people from the different departments to experience the design research approach. For the second pilot, we proposed Avianca to enroll four of their employees in one of the master courses of the Design School. The master cohort for that year was multidisciplinary and had little experience with design research methodologies, so at certain point, all were even. The idea was to have the employees to be part of the team, share the feedback, experience the phases of the project and ideate solutions for the challenges presented by their departments (Figure 4).

As suggested by Avianca, the main goal of this second collaboration was to generate process of knowledge exchange, rather than providing solutions to identified problems. Nevertheless, the design teams, including the Avianca employees, would have to propose novel solutions for the challenges. In one hand Avianca's employees were engaged to learn the design process and apply it in practice; and on the other hand, master design students were able to face how design methodologies could be applied to systemic approaches. Moreover, undertaking these projects gave the opportunity to the Design School to apply academic research findings in a professional and commercial environment.

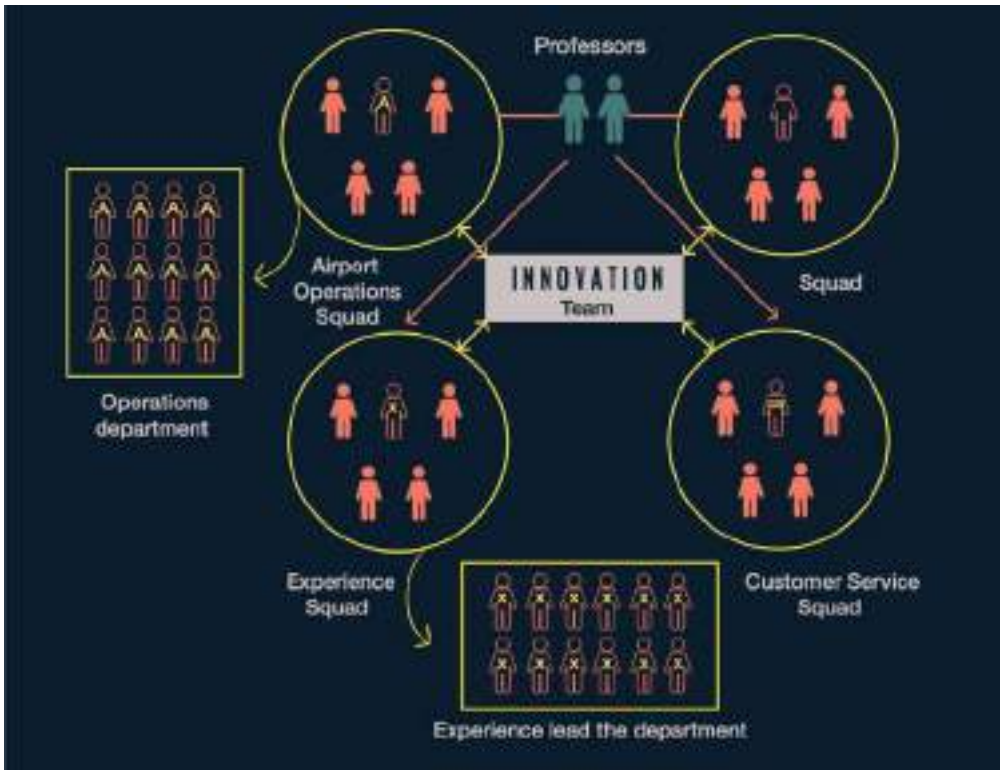

Figure 4 Grow phase. Master design course

Each Avianca employee was in charge of one of challenges selected for the course. Moreover, and as part of the design team, they had to perform certain design activities to move forward in the project. The design teams had to defined a research plan, deciding to use and apply different tools for data collecting, such as cultural probes (Gaver, Dunne & Pacenti, 1999), generative sessions (Sanders & Stappers, 2014) and participatory mappings (Buur & Matthews, 2008). After designing their collecting data tools (Table 2), the teams had to analyze the information that they gathered, in order to identify opportunities to intervene. Then, and as part of the course, we emphasize in the idea generation process (Figure 5). Usually for non-designers,

and sometimes for designers, that is the most frustrating phase. Finally, the teams had to validate their ideas in the real context.

Table 2 Solutions and concept descriptions of the MVP.

Challenge	*Concept description*	*Design tools used*
Opportune information: How can we transfer the operational information through all relevant areas in a convenient and clear way to be available in every passenger touch point?	AICS: An electronic message system customized for travellers that contains information related to the flights irregularities and allows the traveller to be updated in real time. The system will centralize all the information and will help travellers to know what to do in case of a delay. Irregularities backstage: A centralized multi directional communication channel visible for all the information chain that improves the decision-making of the personal in charge of the flight services.	Drawing activities in interviews. Actor-interaction maps. Value proposition canvas. Role-play. Jumping obstacles (creative session). Emotional metrics. Technological probes.
Assistance services: How can we improve the passenger experience while delivering the assistance services (food, hotel and transport) in a operational irregularity?	Mobile bookstore: Entertainment system for waiting rooms that provides the traveller with options to kill some time while waits for the irregularities to be solved. Additionally, it is present to show the traveller that Avianca cares Self management app: New menu for the Avianca app that allows the user to choose the best options related to his interests, pleasures and time availability once an irregularity or cancelation is presented.	Cultural probes. Generative sessions. Scenarios. Pain matrix. Personas. What if (ideation session). 10+10 (ideation session). Prototype. Paper prototype. Mockups
Cabin crew structure: How can we improve the current management and leadership model for the cabin crew?	CaroBot: A virtual assistant that provides useful information to the cabin crew about requirements, requests, and administrative processes. Support Troop: This support group's main activity is to visit the cabin crew, according to a schedule to give them support and answer questions that are not part of the standard procedures or require a more delicate handling.	Empathy maps. Ideal leader activity. Technological probes. Wizard of oz. Video scenario.
Effective communication: How can we improve the communication between Avianca and its cabin crew?	Moodbox: Set of cards to improve the communication between coordination and crewmembers to smooth things. There are two types of cards: practical tips and motivational reflections.	Technological probes. 5+5 (ideation session). What if (ideation session). Prototypes. Card sorting.

Figure 5. Master students and Avianca employees working together during the data collection phase.

The exercise was intended to be very practical, more than novel. We wanted to teach the course participants to learn by doing and experimenting. All the teams we exposed and force to create and implement their design tools and ideas. After each phase of the process, we came back to the key learning's and how the teams overcame the difficulties. It was important that every member of the team experienced how to contribute by applying their previous knowledge combined with the new methodologies that were presented. For the Avianca employees the course was an eye-opener to alternative approaches to complex problems. For the master students was a challenge to manage the client expectations with the developments of the project. In the end, this processes required new time and dedication, planting the seed implied to mingle with relevant actors inside the company. Again, and as the first course, the validation of the solutions gave insightful information to Avianca and hopefully a new perspective to manage future projects.

Crew prepared for landing

The results of theses collaboration gave us insights towards the way to collaborate with a corporation from the academic side. From doing user research in site to prototyping and validating ideas, the learning that both organizations got were important to keep projecting the future alliance. This alliance is building a solid ground for the open innovation network to be developed further with new partners who could add different types of value to the aviation industry and help Avianca to maintain its leading position.

One primary element was the collaboration between employees and students. Employees were able to provide the inside view of the business experience and enlighten the students to come up with fresh perspectives and build new and reachable services. Also, having the employees enrolled in the design course helped the methodologies and new perspectives to sink in the company's processes. Moreover, the role of Avianca's employees in the corporate hierarchy helped to reach the right people to move faster in the design process. However, the directors did not have the time outside the lectures to contribute and generate a fluent collaboration with the squad. Therefore, the selection of intermediate roles to lead the squad would have been more appropriate to ensure a more successful team dynamic.

Another key element of the collaboration was the hands on and multidimensional approach (Gardien, Deckers & Christiaansen, 2014). From qualitative research from the airport to the office building, as well as prototyping simple but ready to test solutions, helped Avianca to increase the speed of their innovation process. Normally, we think about design thinking in the front end of the experience. However, this project worked also in the back stage with internal processes of flight irregularities and crew management. Considering several dimensions at the same time helped Avianca to connect the processes with the passenger and crew experiences and envisioning new opportunities of improvement. In case that after testing the solutions Avianca decides to build these ideas, they have the ownership of the low fidelity prototypes. The students signed an agreement to assign the rights of commercial use to Avianca at the beginning of the course.

Our biggest failure during the project was the exclusion of important stakeholders to the open innovation network in the beginning. The owner of El Dorado´s airport in Bogotá, OPAIN, was an obstacle in the process of field research and prototyping in context due to internal regulations. To avoid these problems, it is our responsibility to convince key stakeholders about the value of this kind of projects and the benefits that the

airport could gain from them such higher customer satisfaction, better passenger flow, more efficient processes…

In conclusion, to recreate the success of this initiative, firstly, it is vital to have in place the willingness to experiment with new formats to share knowledge and learn from each other. Secondly, the commitment of every party to the collaboration is essential to reach common goals; for example academia should have a deep service understanding of the clients' highly regulated environment in both backstage and front stage, and the company should be willing to get their hands "dirty" for the low cost and fast iterative prototyping phase. Finally, as a collaboration that involves really young people, it is rather important to give them freedom to create fresh and innovative ideas, but also it is always a challenge to manage their fixation with technological solutions and let them understand the different layers required to design an efficient and memorable service experience.

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Research Perspectives IN THE ERA OF Transformations

"We need an internet connection" – Early exploration of physical/digital spaces for digital transformation

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The case details the application of a systemic, actor-centered design approach to a strategic process of digital transformation in support of industry/research collaboration in one of the administrative regions of southern Sweden. Project mainstays include regional development of "digital leadership", the creation of a digital/physical competence center, and a larger plan to connect these mainstays to an already established, extremely successful computing- and entertainment-centered yearly event in the main city in the region. Structured around the initial problem space identification and formalization aspects, the case specifically discusses the competence center, what it should be and what activities it should facilitate. It describes the process followed and the results obtained in the divergent stages of the project by means of the early engagement of different stakeholder groups through workshop activities. Preliminary conclusions are drawn in respect to what challenges currently hinder big-scale processes for the design of complex digital/physical environments and the experiences they enable; the relative solidity of adaptive or transformative approaches versus blended space approaches for digital/physical environments; the role and relative weight of "digital" in the organizational context of digital transformation processes.

Keywords: Digital transformation, systemic design, multi-actor approach, blended space

Introduction

The case resides within a large-scale project addressing the digital transformation of small-medium enterprises (SMEs) within the Jönköping region in southern Sweden, and it details one of its main subprojects, the creation of a "digital competence center" (DKC, Digitalt Kompetenscentrum). The project emerged from the notion that competence related to digitization that the local university and an established and extremely successful computing and entertainment yearly event attract should remain in the region and help it, culturally and economically, in its digital transformation journey.

The project, running 2018-2020, is funded with EU funds by the Swedish Agency for Economic and Regional Growth, and sees the collaboration of Jönköping University, through its International Business School and its School of Engineering, and of the regional business incubator, Science Park. Coordinated by a steering group comprising staff from all three organizations, the project is formally compartmentalized along organizational lines in terms of outcomes or subprojects: the Business School is in charge of the creation of "digital leadership" expertise; the School of Engineering of the creation of the DKC; and the Science Park of the more diffusive initiatives for connecting these to the planned growth of the annual computing event in the city.

The authors were not involved in either the writing of the proposal, of the project charter, or the initial planning of the activities for the initial exploration and formalization of the DKC. They were called in roughly four months into the project by the steering group to, upon suggestion from one of the members, to help design and implement the DKC, as they had established competence in the creation of similar physical spaces and in digitalization, and were readily available in-house resources.

Digital transformation

The European Commission defines digital transformation as "a fusion of advanced technologies and the integration of physical and digital systems, the predominance of innovative business models and new processes, and the creation of smart products and services", and states that digital transformation "is characterised by a fusion of advanced technologies and the integration of physical and digital systems, the predominance of innovative business models and new processes, and the creation of smart products and services." (European Commission, nd). According to the Commission, the digital transformation of traditional sectors of the industry "presents enormous growth potential for Europe", but currently "EU businesses are not taking full advantage of (...) the collaborative economy" because of disparities across sectors, "between high-tech and more traditional areas", between countries, between regions within the same country, and between large companies and SMEs (European Commission, nd).

While the global indices for "skills and innovation" in Swedish SMEs are above the EU average (Klingspor & Fortkamp, 2010), the push towards "digital transformation" requires novel competences and a change management mindset that these companies do not currently possess or know how to acquire. For this reason, and because of their number and relevance in the socio-economic fabric of the region, the project primarily targets SMEs and family-owned businesses and addresses their transformation processes at both the strategic and the operative levels. Strategic, through the initiatives connected to the "digital leadership" and "event" subprojects; operative, through the DKC subproject. The project charter also secondarily addresses "other actors that are influenced by the digital transformation of SMEs. The education sector, students, entrepreneurs, and other social actors".

The case

The case details the early stages, post project start, of the DKC subproject in the fall / winter of 2018-2019. It provides an overview of how various negotiations around the design process were managed within the context of a large-scale project where public / private co-production is a key element. It describes the friction between proposal-level goals (create a competence center) and operation-level goals that necessarily include exploration before any formalization can happen. It describes how the authors framed the problem and the early engagement of different actor groups in workshop activities directed at shaping the competence center: what it should be and why, what activities it should facilitate and for whom. It documents the results of the workshops, and the decisional processes connected to advancing the project.

Theory and methods

The design process was operatively approached as a co-design activity involving multiple groups of actors (SMEs, researchers, public bodies), and conceptually as a systemic design activity for social change (Stroh, 2005) to be enacted through a digital / physical space (or series of spaces). Organizationally, it was structured via a management-level decision group, not invested with day-to-day operations, a steering group, and the operative DKC group (fig. 2).

The authors introduced the UK Design Council's Double Diamond model (fig. 1) to frame the design and implementation process in all communications within the DKC group and with the steering group, and explicitly anchored the initial activities to the Discover and Define phases in the first diamond, those often referred to in the practice as "do the right thing" (the second diamond being "do the thing right"). The model allowed for easier alignment of the activities and better communication within the groups.

The Discover and Define phases were then specifically implemented as a set of exploratory workshops with attendees from the primary actor group alternated with reflection and discussion meetings with members of the DKC and steering groups. Communication with the decision group was left to the project manager.

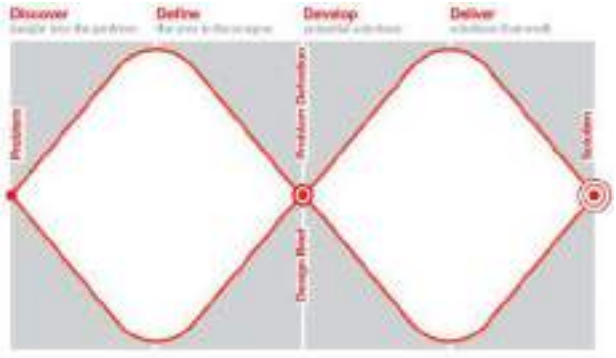

Figure 1 The Double Diamond model, UK Design Council (2005)

Before the workshops, the authors aligned with ongoing conversations and informally captured through one-on-one meetings and mail exchanges the steering group's own views of what the space ought to be. In these meetings the DKC was manifested to the authors as being primarily a "showroom", an exhibit space for "innovative digital products". Together with the requirements provided in the project charter, these views became the foundation of the prescriptive view of the DKC used to inform the October workshop.

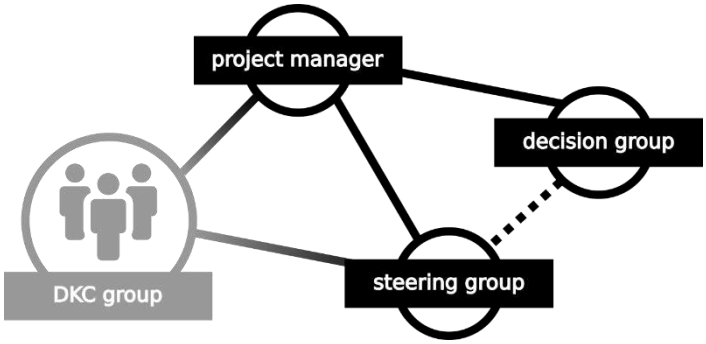

Figure 2 Organizational view of the DKC subproject

As the DKC was described in the charter as a digital / physical environment, the authors resorted to Horan's "digital places" (Horan, 2000) and Benyon's concept of "blended space" (Benyon, 2014) to frame the problem space conceptually.

Horan maintains that digital places are "new leverage points for creating new experiences and relationships that will profoundly redefine our experience of physical space" (p. 23). They "vary in scale and character but share space in both the physical and electronic world". Digital places are not finite artifacts, "stable end-states", but "dynamic settings that evolve over time" and as such are constantly emerging as "a continuum of technological integration". At one end of this continuum, Horan places "unplugged" designs, spaces that manifest little or no digitality. Midway, "adaptive" designs that "modestly incorporate electronic features in physical space". At the other end we have "transformative" designs: spaces where digital and physical commingle and where digital "influences the layout, program, and infrastructure of the place" (p. 9).

Benyon similarly defines a blended space as a space "where a physical space is deliberately integrated in a close-knit way with a digital space" (p. 79) and whose structure and properties emerge from its specific combination of physical and digital. While Horan's continuum explicitly looks at the artifact (the space being considered), the concept of blended spaces is structured around human embodiment and human activity: blended spaces are designed with the purpose of creating first and foremost a novel user experience. They instantiate a different sense of "being present" and lead to new ways of interacting.

The digital competence center

The project charter clearly established that the DKC should be an actual physical environment. The various initial project documents and meeting minutes describe it as a space company representatives travel to in

order to participate in unspecified activities connected to collaboration, dissemination, and networking facilitated by technology.

The overall funding structure, what it allocated for building work, and the requirement that the DKC be maintained and further developed by one of the university subsidiaries after the project has run its course, introduced the primary operative constraints. These pragmatically meant that the DKC be located inside an existing building and repurposed spaces, as opposed to a newly-built construction, and that while no punctual architectural specifications nor a location were determined in the project charter, a position on campus or its proximity was immediately established as highly desirable, for reasons of economic and logistic convenience.

The choice to adapt pre-existing spaces made the physical environment of the DKC a difficult starting point for a design based on actual needs and wants as opposed to organizational satisficing based on availability: consequently, conversations with the DKC and steering groups in preparation for the workshops centered on the concept of what “activities” and “experiences” the DKC should support, rather than what “spaces” it should contain.

In terms of the author’s theoretical framework, the project proposal, funding and setup phases clearly envisioned the DKC as an example of Horan’s “adaptive space”, where an already existing space is augmented with discreet digital interventions: teleconferencing tools, screens, computers. In the course of the initiation stage, before the authors were called in, the DKC started to be described as a transformative space, and attention focused on “activities”. During the workshop stage, coinciding with the authors’ engagement with the project and with the divergent phase of the project, the DKC was cast as a blended space to account for the feedback received and the challenges introduced by external and internal actors. Treating the DKC as an element in a larger, region-wide digital / physical ecosystem allowed the authors to resort to methods and tools they previously applied to the design of the studio spaces for Jönköping University and to the analysis of ambient assisted living solutions (Lindenfalk & Resmini, 2019).

The workshops

Figure 3 Project introduction at the October workshop

The October workshop was held in a separate conference facility on university grounds (fig. 3) in Jönköping. Planned by the authors and facilitated together with two members of the steering group, it registered the presence of 19 attendees from both SMEs and larger private and public organizations operating in the region.

The workshop was conceived as a 2-hour series of hands-on, group activities following a general introduction to the project, to the DKC, and to the goals for the day: explore what activities and what goals the center should support. Attendees were provided a detailed brief. In accordance with the Double Diamond model, the authors identified group exercises focusing on divergent thinking and modified them when necessary to suit the task (Gray et al, 2010). Ideas were to be elicited explicitly and in a way that allowed further subsequent reflection. Informal feedback from attendees was collected after wrap-up.

One of the most immediate concrete results of the workshop was a shift in language, as attendees found the "showroom" concept limiting, and used it sparingly and non-exclusively. This resulted also in a broader focus, with the DKC being diversely characterized as a connecting space, a learning space, and a meeting place.

Workshop attendees identified the DKC with a "space" or "series of spaces" aimed at solving specific problems in these areas, networking, learning, meeting, by providing concrete solutions. Words such as "implement", "survey", "measure", "metric" were used frequently in connection to expected outcomes. A point was made that the DKC should be a "riktningsvisare", a signpost for digital transformation and development in the region, to help local companies "make the journey" to and beyond digital.

Figure 4 The "writestorming" activity at the October workshop

Notes and deliverables were collected at the end of the workshop, analyzed, and informally discussed between the authors. They were then shared with the DKC group and framed in the context of the prescriptive view obtained before. The initial plan for what activities the DKC should support, for whom, and what kind of spaces these implied, emerged from this review (Table 1). A prioritized list of goals and steps to follow was agreed upon and then submitted in report form to the project manager and the steering group, together with a walk-through and recap of the workshop itself that included photos and samples of the deliverables created by attendees.

Table 1 Synthetic view of the characteristics associated with the three main roles of the DKC from the October workshop

Connecting space	Learning space	Meeting place
both a physical space and a digital space		
a place for business	a place where failings lead to successes	a place where to sit and have coffee
a space for showcasing innovative local solutions	a place where to learn unconventional things that open the way	a place where to book meeting or seminar rooms and hosts events
a place that addresses how to work with competition between players	a visible space, locally and globally	
a place where help can be found and ideas shared		
an up-to-date, digital layer that extends the DKC's physical reach		

Communication-wise, the workshop illustrated the digital gap portrayed by the EU Commission in detail. While very clearly discussing and describing a continuous blended space of a/synchronous presence, attendees phrased the DKC in terms of "we need an internet connection" or "I want to see a robot".
Attendees also clearly signaled the importance of directly engaging secondary actor groups, students, instructors, entrepreneurs through the DKC. Nonetheless, it was decided to prioritize the creation of a space that facilitates industry / research collaboration and dissemination, strongly focused on SMEs, to respect the project charter goals. The authors supported the decision as obeying systemic design principles. Focused

intervention on strategically chosen elements within a system, rather than a scattered approach, has proven to be more effective in enacting systemic change (Stroh, 2015).
Based on these outcomes, the authors prepared a preliminary list of desired characteristics that was used as the base input for the subsequent December workshop.

Table 2 Digital competence center: physical and digital elements and characteristics from the October workshop

DKC physical space	DKC digital space
manned space, with expert staff and expert workshop facilitators / leaders	physical presence in the competence center should be "one-click" streamable
reception area	physical presence in the competence center should be "one-click" recordable
flexible exhibit space	curated web presence
cafe corner	curated social media presence
specialized spaces for meetings, workshops, seminars, and teleconferences	interactive display of cutting-edge digital products and services online and offline
restrooms	

The December workshop was held on the grounds of Campus Värnamo, in Värnamo, Jönköping county. The location was chosen to increase the outreach in the region, and attention was paid to enrolling smaller companies from the area. Both authors facilitated the workshop, which ran activities specifically chosen to build on the results of the October one: attendees were given Table 1 and Table 2 as a starting point and asked to identify challenges and opportunities those activities and spaces suggested.

Figure 5 Introducing the December workshop in Campus Värnamo

Attendees primarily saw the DKC as a direct embodiment of abstract practices, a container, with no precise distinction between its physical and digital spaces, with “information” available “inside”: as a stand-in or avatar for a regional network one can “call on” if necessary to easily pull together resources, receive help with a problem, or acquire the necessary operative and strategic expertise to possibly solve it. Physically visiting the competence center was described as an unnecessary hurdle by many.
The October and December workshops were both filmed in their entirety using a two-cameras setup, with the permission of attendees. All deliverables, notes, posters, sketches, were retained by the authors.

Key learnings and preliminary conclusions

Adaptive and transformative spaces v blended spaces

Preliminary key learnings from this phase of the DKC subproject include how adaptive or transformative space approaches do not provide solid foundations for the design and implementation of digital/physical environments such as the competence center. A blended space approach provides a better fit, but with it

comes the need to consider actor-centered processes as the originator of the ecosystem itself (Resmini & Lacerda, 2016). This is currently a problem because of how the decisional process for large-scale project flows, exacerbated by the fact that the inclusive systemic process it implies is part of what digital transformation sets out to enable in the first place.

Role and relative weight of digital

People's experience of day-to-day processes, from education to travel to healthcare, happens across locations, environments, devices, and freely spans the digital and the physical (Resmini & Lacerda, 2016). Transformation is also a process, and a necessarily pervasive one, but decision makers in the setup stages of the project clearly drew a separation between physical and digital assets and outcomes. This separation impacted the way the project was budgeted and this in turn severely constrains transitioning to a blended space approach.

Figure 6 Group activity during the December workshop

Such an idea of digital is marketing-driven and fundamentally static and descriptive: a unidirectional tool to document and report in-project organizational progress, or a mere technological aid such as teleconferencing. This also led to the conceptualization problem codified by the DKC as a "showroom": a largely static if inspirational display of "what's been done".
As trivial as this might seem, the consequences are vast. Budget cannot be re-accommodated to support digital as a dynamic conversational environment that helps shape the culture of the space. Even the DKC web presence has been framed as an execution problem and not as a community building opportunity that needs steering, resources, continuous nurturing, and appropriate governance.

Execution v design disconnect

These issues can be ascribed to a disconnect between the binding constraints introduced at the proposal stages and the reality of a large-scale transformation process. In the case of this project, the disconnect appears to be rooted in a business-centered scaffolding that eschews the socio-technical and systemic complexities of co-creation and of turning ideas into actual structures and artifacts. The EU SPIN document mentioned earlier unwittingly illustrates this approach: "Innovation (...) needs (...) a visionary that has the idea; an entrepreneur that organises to put the idea into practice; a salesman to commercialise the idea; a financer to finance the product development; customers that demand new and innovative solutions" (Klingspor & Fortkamp, 2010). This is a huge misunderstanding of how such processes work. From idea to implementation it is simply "execution": a "vision" needs to be "put into practice" by an entrepreneur, financed, and commercialized, leaving little to no space for any design activities and human-centered reassessments.
Additionally, the use of traditional bottom-up co-creation processes can result pragmatically problematic. Both the steering group and the DKC group insisted on an inclusive, bottom-up co-design process built on a multi-actor perspective. This was partially sidestepped by companies whose decision makers mainly brought themselves into the process and personally attended the two workshops with the aim of bringing management seniority to the conversation. Especially in December, many attendees were "koncernchef", high-level managers with a strategic view, rather than an operative view, of the problem space. This not only

led to some last-minute retooling of the activities, but it conceptually turned a bottom-up conversation (DKC-side) into a top-down conversation (SME-side) (fig. 7).

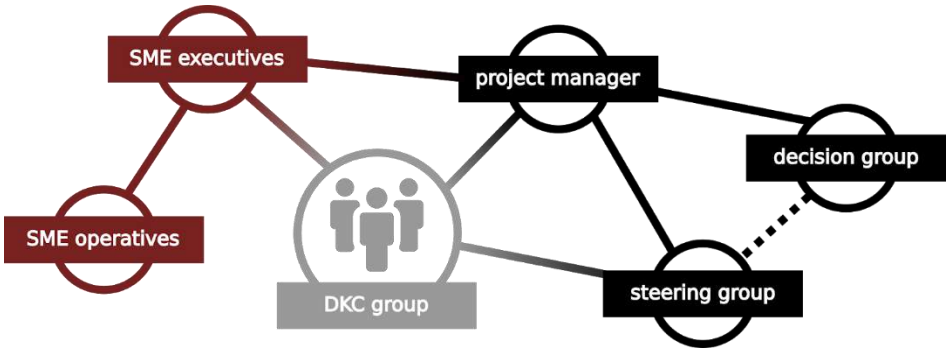

Figure 7 Organizational view shows SME executives introducing an additional top-down loop in the process

This appears to be yet another loop reintroducing the same problem the authors experienced first-hand in the framing of the DKC itself, with the initial top-down process initiating the project assuming pure "execution" and remaining completely unaware of and disconnected from the complexity and uncertainties of design for large-scale socio-technical change.

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A design contribution to the entrepreneurial experience

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In recent history, different design approaches have been entering fields like management and strategy to improve product development and service delivery. Specifically, entrepreneurship has adopted a user-centric mindset in methodologies like the business canvas model and the value proposition canvas which increases the awareness of the users' needs when developing solutions. What happens when a service design approach is used to understand the entrepreneurs' experience through the creation of their startups? Recent literature suggests that entrepreneurial activity and success is conditioned by their local entrepreneurship ecosystem. This study investigates the Entrepreneurship Ecosystem of Medellín, Colombia - an ecosystem in constant growth but that lacks qualitative analysis. The sample consists of 12 entrepreneurs in early-stage phase. The data was gathered with two design research methods: Cultural Probes and Semi-structured interviews. The analysis of the information collected facilitated the development of 4 insights about the entrepreneurs and an experience map to visualise and interpret their journey to create a startup. The results of this study reflected the implications of the ecosystem, the explanation of the users' perceptions and awareness and propose a set of ideas to the local government to improve the experience of undertaking a startup in Medellín.

Keywords: Entrepreneurship ecosystem, Service design, Entrepreneurship, Startup, Design methods

User centred Design in Entrepreneurship

In recent years, there has been an increasing diversification of user centred design approaches, due to the exploration of experiences, products and services as a whole system. This trend could be seen in fields like management and strategy (Martin, 2009); retail, financial services, hospitality and human resources (Reason, Lovlie & Flu, 2016); health management (Lin, Hughes, Katica, Dining-Zuber & Plsek, 2011), social innovation (Anderson, Ostrom, Corus, Fisk, Gallan, Giraldo, Mende, Mulder, Rayburn, Rosenbaum, Shirahada & Williams, 2013) and manufacturing processes (Lighting, 2017). Specifically, entrepreneurship has adopted a user-centric mindset in the development of methodologies like the Business model generation (Osterwalder, Pigneur, Smith & Movement, 2010) and the Value proposition design (Osterwalder, Pigneur, Smith, Bernarda & Papadakos, 2014), which increases the awareness of the users' needs when creating solutions as the core of a business model.

The aforementioned methodologies have flourished as assistance for entrepreneurs in the planning, ideation and implementation of business ideas, in order to create and capture value (Trimi and Berbegal-Mirabent, 2012). This case study undertakes a different perspective and aims to explore the consequences of using a user centric approach to understand the entrepreneurs' experience through the creation of their startups.

Between the different streams of user centric methodologies, this study uses service design as stated for its capacity and methods to investigate and understand people's experiences, interactions and practices as main sources of inspiration for designing better services. (Meroni and Sangiorgi, 2011).

Complemented by Stickdorn, Hormess, Lawrence & Schneider, (2017) perspective about service design, first as a mindset, to help us to determine how to respond to situations; second, as a process, to find an elegant and innovative design driven solution and third, as a toolset, that should be used after understanding the mindset and process.

As some writers (Klaar, 2015; Penin, 2018; Stickdorn et al., 2018) suggest, service design is a holistic approach, which understands that users (or customers) are not only influenced by the core offering but by all the layers around the experience of buying/using, and therefore deliver a suitable solution. Due to this, the exploration of the broader context of entrepreneurship should be taken into consideration.

The systemic support for entrepreneurship

Particularly in the field of entrepreneurship, Fuerlinger, Fandl & Funke (2015) argue that start-ups' survival is conditioned by not just the business itself, but the (Entrepreneurship) Ecosystem. According to Isenberg (2010), the Entrepreneurship ecosystems (EE) are a set of conditions that foster entrepreneurial activity, which involves culture, policies, support, human capital, an open-minded market and that are limited to a metropolitan area.

In order to identify the conditions of EE, The Aspen Institute (2013) reviewed 9 different diagnostic tools for EE, mapping them by the level of complexity (number of indicators) and the geographical analysis (local or national) (See: Image1). This study selected Isenberg's (2010) Six Domains to understand the ecosystem where entrepreneurship moves in cities, for its analysis capabilities based on different aspects on a local and a national level with the same importance. This allowed to acquire contextual data for the analysis of the entrepreneurial support as a system.

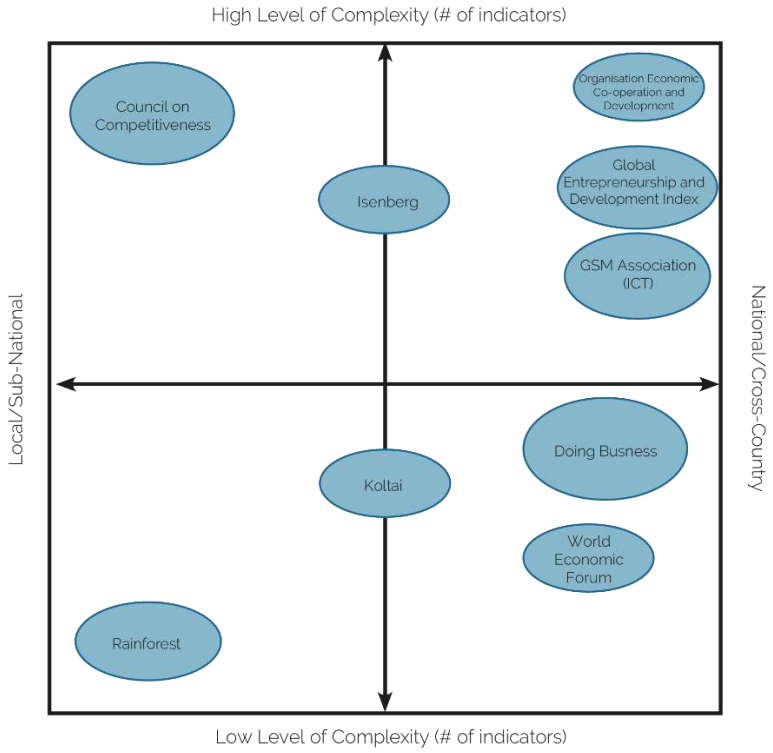

Figure 1: Diagnostic tools. Adapted from The Aspen Institute (2013)

The Entrepreneurial activity in the context

According to the Global Entrepreneurship Monitor (2017), Latin-American Countries has been increasing their entrepreneurial activity and their participation in early-stage entrepreneurship is even higher than in bigger economies. In a regional scale, Colombia is ranked fourth for ease of doing business in Latin-America (Doingbusiness.org, 2017); at a local scale, Medellín is the second largest Colombian city and it concentrates the second industrial centre in Colombia.

The EE of Medellín has been developing across 20 years of cooperation and work (Universidad Nacional de Colombia, 2016), led by the local government, but expanded by the industry. Figure 2, shows the interconnection of the most visible actors around the domains.

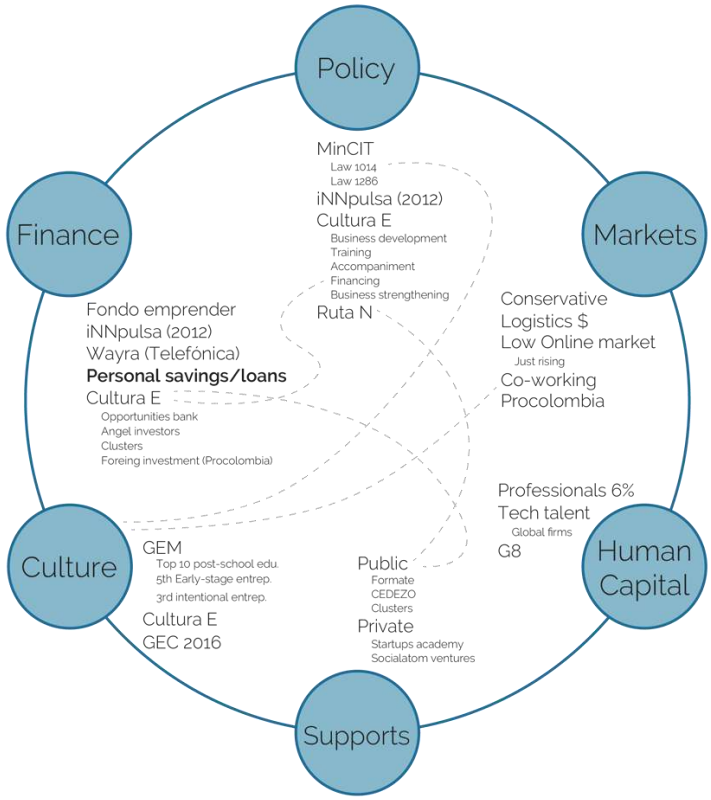

Figure 2: Medellín's domains of entrepreneurship.

From the entrepreneurs' (users) perspective, the ecosystem is compounded by a set of activities, programs or institutions that can support their venture and entrepreneurial development. These activities and programmes are services for entrepreneurs, which could be construed as touchpoints of an entrepreneurial support service (the entrepreneurship ecosystem itself). Figure 3, presents Medellín's inventory of programmes and activities of the EE of Medellín.

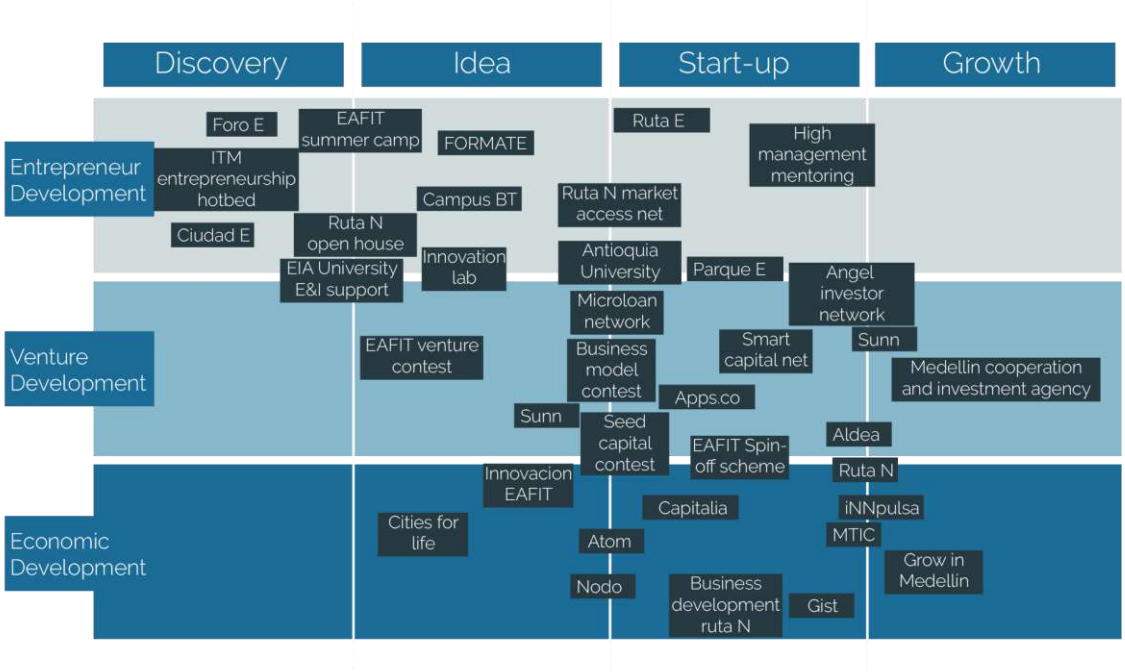

Image 3: EE of Medellín's Inventory. Adapted from Jaramillo, 2018.

Analysing the conditions of the ecosystem through the Isenberg's domains can be perceived that Medellín has a complex system loaded with actors, programmes and activities, but also that it has the characteristics that fosters its entrepreneurial activity. Although this approach explores in deep different characteristics, it leaves on a side the experiences, emotions and personal goals that entrepreneurs have. Based on Lederman, Messina, Pienknagura, & Rigolini (2014), the entrepreneurs are the actors that add value to the EE, therefore they need to be understood.

The research

The research used a sample of 12 entrepreneurs located in Medellín, with a start-up on early-stage development phase, which includes two types of individuals: Nascent entrepreneurs and New business owners (Global Entrepreneurship Monitor, 2017).

The first tool used for data collection is Cultural probes, defined by Gaver, Boucher, Pennington, & Walker (2004), as collections of evocative tasks meant to elicit inspirational responses from people, and also consider as a tool that produces unbiased data collected by participants themselves (Stickdorn et al., 2018). Its appliance consists of the filling of a booklet with a set of activities that participants solved by themselves. Specifically, the activities were designed to inquire about the entrepreneurs' emotions in relation with important events; to investigate, when and how they feel comfortable or challenged; to explore, how they have interacted with the entrepreneurship ecosystem; and how the entrepreneurial experience can be better (from their perspective). Figure 4, presents the booklet sent to the participants. It worth to mention that participants are native in Spanish which is the reason for the language in the booklet.

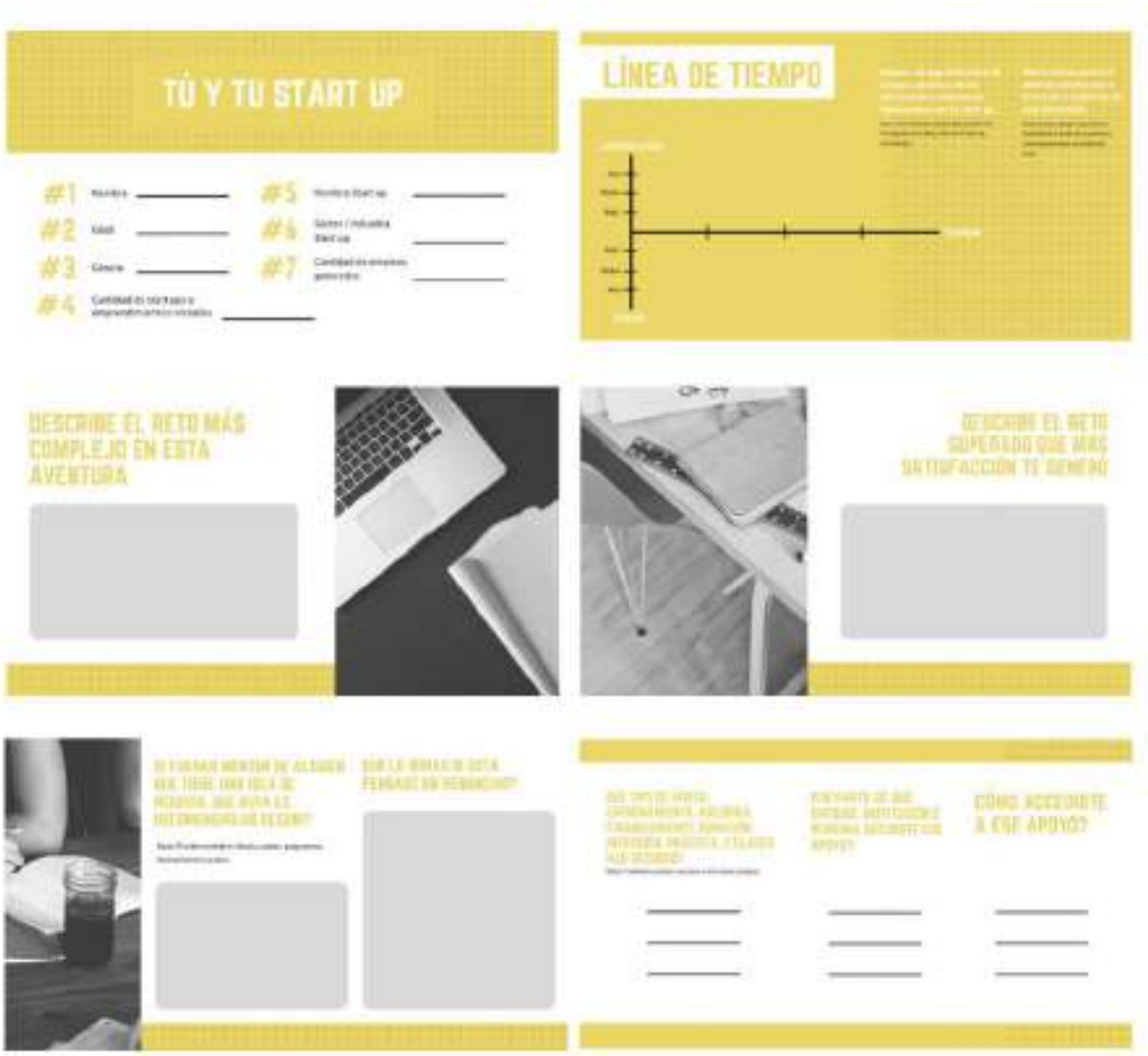

Figure 4: Booklet.

The probes generated a range of diverse messages, storytelling and descriptions that provide an understanding of how entrepreneurs feel and act around the EE, even if they are unaware of what the ecosystem is. For this reason, an initial scan of the responses was undertaken with the objective of identifying keywords in the answers, looking for patterns within opinions and the actions taken by the participants through their own experience. As described by Gaver et al. (2004), participants interpret questions and activities in different forms, and that was reflected in their answers. This required critical analysis of the data to clarify the meaning of the answer given based on the profile of the participants.

The initial keywords scan spotted similarities in perceptions, definitions and attitudes, but it further allowed the division of the participant entrepreneurs into two categories: entrepreneurs who have had access to some of the programmes offered by the entrepreneurship ecosystem, and entrepreneurs who have not had access to any programmes offered by the entrepreneurship ecosystem.

For both cases, the first scan identified missing information in the results. Therefore, a set of follow up questions was developed to be asked in an online semi-structured interview tool, to use with the participants. Yin, (2018) define semi-structured interviews them as a flexible tool that adapts to the situational context with a set of open-ended questions where a conversation guided by the interviewer develop the studied theme. The emerging inquiries allows the understanding of the entrepreneurs' awareness, particularly on what (other) programmes they knew existed to support entrepreneurs or ventures in the city; how they knew about those programmes; and why they did not access them.

Key Results and interpretation

Based on the answers in the probes in relation to the entrepreneurs' experience and complemented by the online semi-structured interviews, the data was separate as follows:

- Satisfactory events
- Stressful events
- Complex challenges
- Overcoming challenges
- Support and resources
- Mentoring advice
- Knowledge about programmes
- Programmes' communication
- And reasons to avoid participation

The key findings reveal valuable data about entrepreneurs in Medellín, their experiences, values and perceptions. The amount of data and its relevance requires deep analysis to interpret it properly. The following mindmap shown in Figure 5, presents a summarised viewpoint from the probes and interviews, and facilitated the definition of insights following Dalton's (2016) suggestion. The context sets a place, one activity and one condition that the entrepreneurs have in common; the dilemma is divided into two categories perceived by the entrepreneurs, and analysed by the researcher after transcribing the data; each item from the dilemma is related to a why, which would present possible reasons that produces the gaps in the ecosystem operation; the motivations are divided in motivations to be an entrepreneur and motivations to not interact with the ecosystem, the last motivation may not be related to all the entrepreneurs but aims to suggest what they think based on their comments; and ideal, presents optimal conditions for the different entrepreneurs when interacting with the ecosystem.

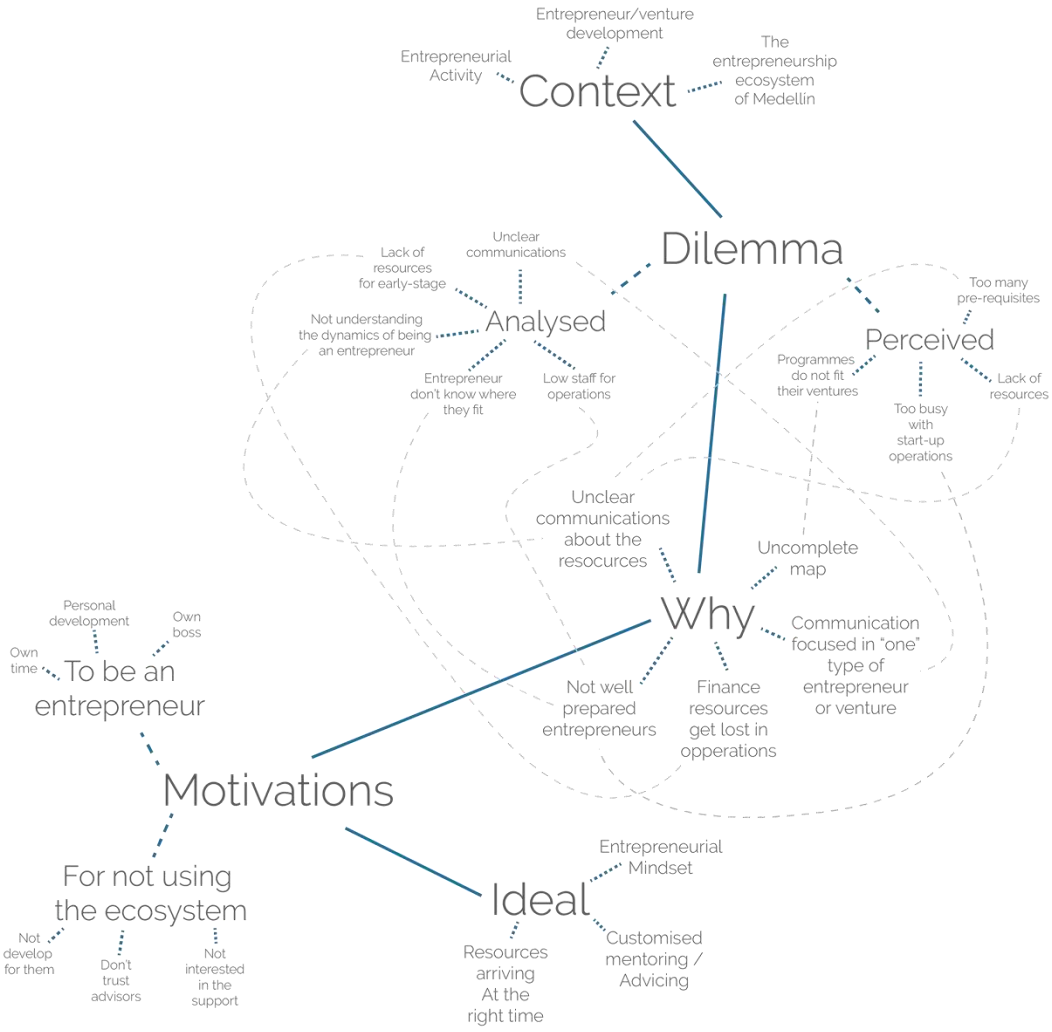

Figure 5: Mindmap.

After identifying the five characteristics around the theme, Dalton (2016) also recommends to state the insights by three sentences: the first one to describe a situation for a user's behaviour; second, to define the dilemma; and third, to describe an ideal situation. As a result, the following insights were developed:

> *"I decided to start my own business in Medellín because I will be working for something I feel passionate about. I've seen institutions that offer courses or contest for start-ups but I don't know which type of help they provide or where to look for it. If there was a source that briefly described the opportunities, I would give it a chance."*
>
> *"I have been working for a year on my start-up and I am really busy trying to do everything, I am feeling tired and I don't have time to look for courses or advice, I don't even know what they can provide me. If someone had told me about the challenges and difficulties of setting a start-up, I would have thought more about it"*
>
> *"I have my own business with a partner. We know Medellín supports entrepreneurs through advertisements and marketing, but that is just for technology-based ventures. I would like to see successful entrepreneurs outside of the technology fields."*
>
> *"I had participated in contest and courses for entrepreneurs before, all of them are the same, they are too general: business model canvas; but nothing on growth strategies, finance or staff management. I wish I could find offered valuable mentorship in specifics areas by people with real experience and not by junior advisors."*

The insights created aim to represent a variety of entrepreneurs' voices about their journey in venture development in Medellín, collecting different thoughts and opinions. Emulating diverse entrepreneurs, the first one was an entrepreneur that had chosen not to interact with the ecosystem; the second is an entrepreneur without any type of training in entrepreneurship, that started empirically and had experienced a difficult path; the third voice represents entrepreneurs that had encountered different sources and types of support but was meant for a different type of entrepreneur, which made them lose interest; and the last one is an entrepreneur that does not trust the ecosystem, someone that has experienced it and is tired of the redundant offers.

The entrepreneurs' experience in the EE of Medellín

One of the service design characteristics is the facilitation to visualise an experience through graphic maps that allows revealing different issues within the service. This research uses a method presented by Kalbach (2016), the experience map, which targets the observation of human behaviour and how the organisation fits in the user's aim.

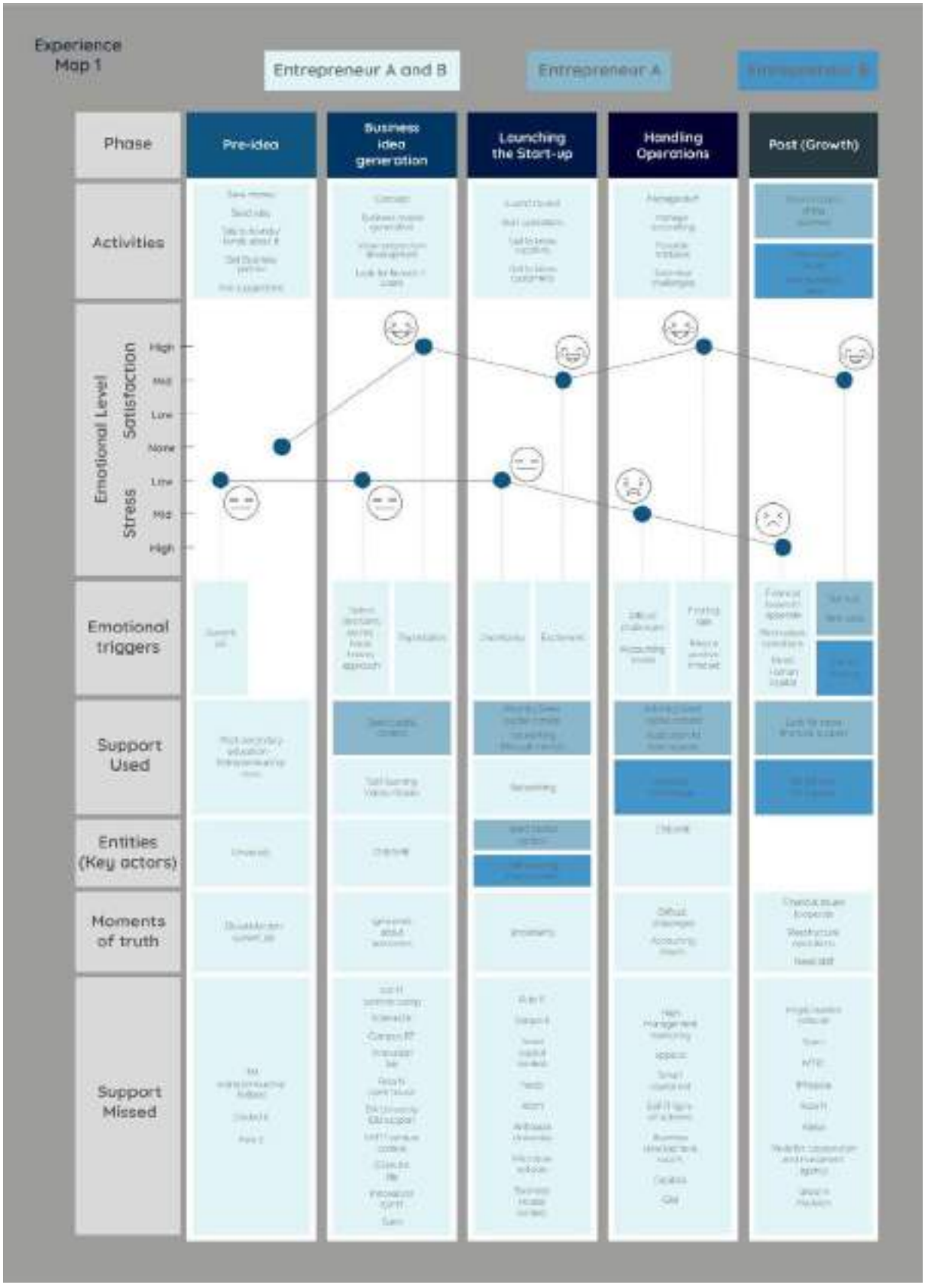

Figure 6: Experience map "As-Is".

Figure 6, shows an experience map chronologically divided into phases: Pre-Idea, Business idea generation, Launching the start-up, Handling operations, and (Post) Growth. Each phase is described by a set of

characteristics divided into two sections. The first section includes: the activities, what entrepreneurs develop and focus their efforts on in that time-set; their satisfaction and stress level at each moment; followed by the triggers of those feelings and their corresponding level. The second section contains: the support, which is subdivided into two types of entrepreneurs. Character one, represents an entrepreneur who chose to interact with the entrepreneurship ecosystem in order to receive support for each of the phases; Character two, illustrates an entrepreneur who had chosen not to interact with the ecosystem by choice or acknowledge anything about it; following the support is the entities section, institutions or organisations that provided the support mentioned in the previous characteristic; support missed, mentions programmes that could be used by the entrepreneurs but did not; and the final characteristic is the Moments of truth, the characteristic of the reflexive statement realised by the entrepreneur in that phase, which may affect its future interactions. It needs to be highlighted that this map may not represent the whole spectrum of entrepreneurs in the city but aims to simulate how some of the entrepreneurs' experience interact with the EE.

What else can Service Design offer to entrepreneurship?

By visualising Figure 6 and the identified insights from the entrepreneurs' experience, the needs of the users and the limits or conditions of service providers are clear. An idea generation stage can be used now to propose how to improve the service experience. Starting with a divergent step, where all the possible solutions to the ecosystem issues are explored; followed by the clustering and filtering of ideas based on cost, current facilities available of the ecosystem and easiness of development; to finish with a convergent step, by the selection and adaptation of the best options for the context.

This process results in a set of ideas implemented in Figure 10, an Experience Map "To be", that represents an ideal experience for an entrepreneur.

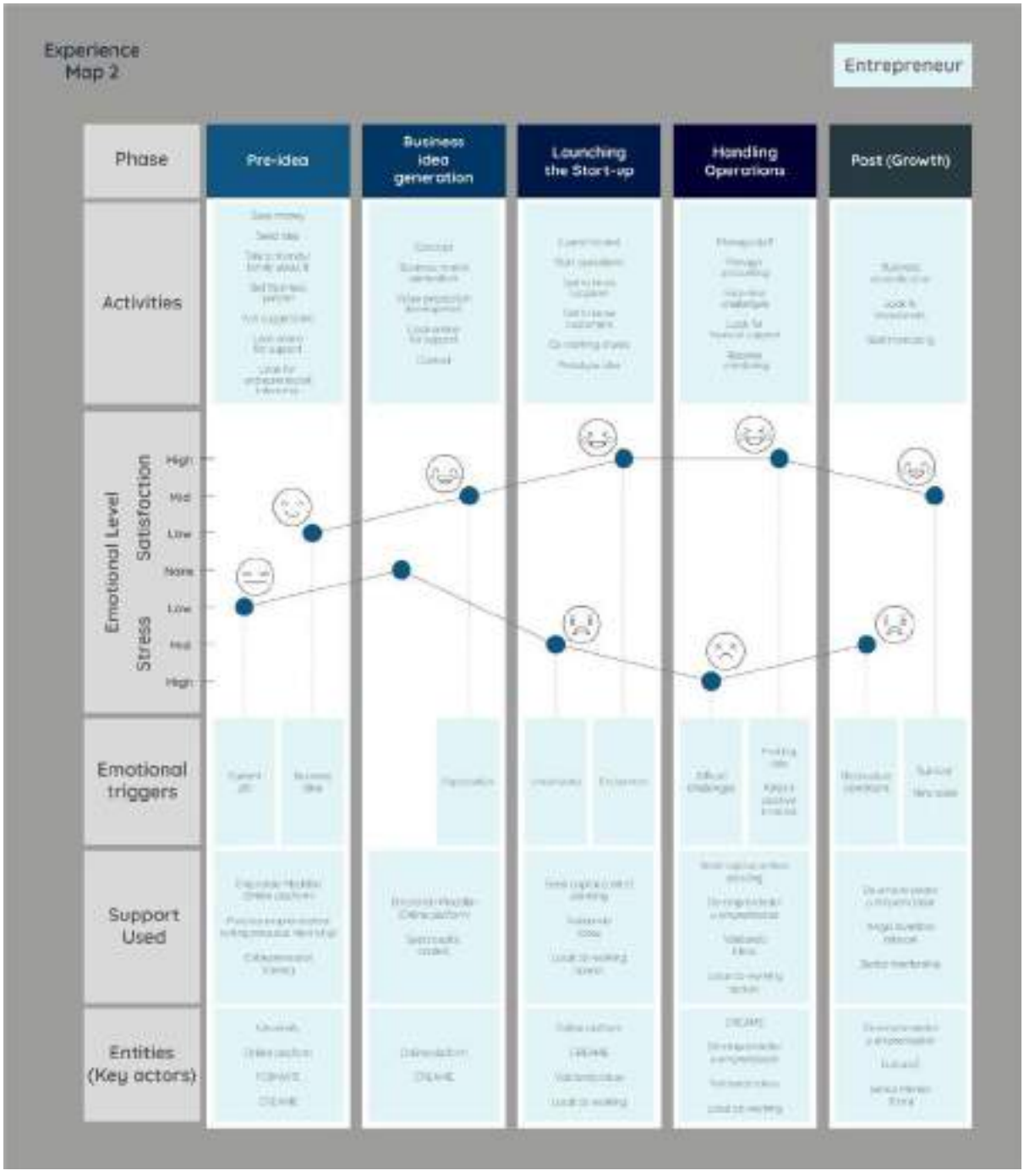

Figure 7: Experience map "To-be".

The previous map presents some similarities with Figure 6 (The Experience Map "As-Is"), in its composition. It is divided into the same five phases; as well as the activities entrepreneurs realise, the levels of stress and satisfaction with their triggers. The difference lies in the support received, this experience map represents one journey, not two as Experience Map "As is", and the legend that highlight the new programmes. The ideas implemented in this map, aim to make suggestions that can be useful in Medellín and are described in the following paragraphs.

The first Service/Idea proposed is an online platform named Emprende Medellín (Medellín Undertakes), where through an easy interaction, entrepreneurs will find programmes available in the city according to the development stage. This is a database that includes a basic description of the programme, the provider and the deadline to apply. Also, the type of development for each stage will be described to guide the entrepreneurs in their self-identification.

The internships programme Práctica emprendedora is the second idea, which will allow university students to have internships in start-ups and live the entrepreneur experience in order to understand the commitment this requires, this programme can be implemented as a tax reduction for start-ups that receive potential entrepreneurs.

The third proposal, are local co-working spaces. This initiative needs to be supported by the local government to allow the usage and synchronisation of public spaces available to the community as libraries, to generate a network compound by entrepreneurs encouraging the inter-disciplinary work which facilitates venture development and problem-solving.

The fourth idea is Validando ideas, a program that facilitates entrepreneurs to meet users and test their product or service, as mentioned before, Colombians are no early-adopters and that limits entrepreneurial products and services, this programme can be undertaken by Cultura E (the lead local initiative for entrepreneurship).

The last idea applied on the map, De emprendedor a emprendedor (From entrepreneurs to entrepreneurs), aims to use entrepreneurs that gained previous support from the ecosystem, to share one-on-one with new entrepreneurs the knowledge they earned through their initial experience, this programme is proposed to share successful experiences and motivational support that influence the entrepreneurial culture of the city.

What has been the service design contribution?

This study has used service design in two perspectives, as a mindset and as a toolkit (Stickdorm et al., 2018). In this case, it has helped to analyse the context, understanding it as a complex system (Sangiorgi and Prendiville, 2017). It also had been used for its research tools that represent a medium to acquire the information gathered from the entrepreneurs. Which helps to realise not just their awareness but the qualities and characteristics of the challenges the entrepreneurs face, but also their behaviours and values. Combining it through a holistic view and realising organisations' structure and resources, to be able to make suggestions (Junginger and Sangiorgi, 2009). Additionally, it has facilitated the discovery of hidden information and the visualisation of those in order to stimulate the idea generation for the issues previously found.

Furthermore, it has allowed us to raise the question about the effectiveness of the implementation of programmes to foster entrepreneurship in the city. It challenges the different design approaches to keep the exploration in new fields different than retail and services for massive consumption.

Suggestions and future research directions

Literature in entrepreneurial activity, entrepreneurship ecosystems and design approaches need to be explored in depth to strengthen the framework of information in particular for Medellín as the context, as well as the secondary sources to verify and track the number of programmes developed along with their impact.

From the methodological perspective, a larger and more distributed sample will increase the opportunities and approaches taken based on the different needs of the entrepreneurs, depending on their venture development stage and the local government's needs within the projections for the ecosystem and possible impacts. Using service design thinking, this issue can be undertaken by the tool personas to fulfil this categorisation and its understanding of users (entrepreneurs of Medellín), including an experience map for each entrepreneur profile if the differences in communication (strategy) and entrepreneurial needs require it.

Likewise, in the methodological approach, the tool 'Cultural probes' provided a large amount of data about the experience of being an entrepreneur (in Medellín), and also developed a reflective process in some of the participants who revealed that in the complementary interviews. Although the tool provides partial information in some cases as Gaver et al. (2004) explained because of the engagement of the participant variate, it produced a high value for the research and this study highlights its potential to use for other qualitative research studies.

The prototype stage needs to be considered in order to test the ideas proposed. This is a key stage for service design in order to iterate the ideas by test and improving them.

Another possible approach for future research identified in this study is the multiple case study within efficiency-driven economies. As highlighted by the Global Entrepreneurship Monitor (2017), particularly in Latin-America and Africa, they present similarities and are highly active in early-stage entrepreneurship. This

quantitative current approach needs to explore and confirm from the qualitative perspective in order to reveal new knowledge and patterns hidden in the experiences of the entrepreneurs.

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Business as Unusual: Creative industries, international trade and Brexit

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UK government statistics maintain that only 18 per cent of creative industries firms engage in international trade. The UK's *Industrial Strategy: Creative Industries Sector Deal* aims to increase UK creative industry exports by 50% within 5 years, arguing there is a "great deal of untapped potential in the sector." It also identifies small company size as a barrier to creative industry exports. Our research, however, challenges these assumptions. At least one creative industries hub is already deeply entwined in global trade. In Liverpool's creative and digital hub Baltic Creative, 69 per cent of tenants export. Furthermore, these exporters are highly dependent on their overseas income. Over one-third of exporters earn more than 50 per cent of their annual income from exports. Our research also finds that small company size was not a deterrent to international trade. Rather company owners report concerns about access to global markets after Brexit, which had already resulted in significant financial losses for some. Our study reveals that even the smallest micro-enterprises are exporting not by way of strained or concerted efforts, but simply because they are operating in an open, digital, global environment where international trade is integral to their business.

Keywords: Creative industries, design policy, international trade, Brexit, creative hubs

Introduction

Creative industries are growing at nearly twice the rate of the rest of the UK economy (Department for Business, Energy & Industrial Strategy, 28 November 2018). In 2015, they accounted for 6 per cent of UK jobs and an impressive 9.4 per cent of total services exports from the UK (Department for Business, Energy & Industrial Strategy, 26 July 2017).

Nevertheless, policy-makers are concerned that the creative industries are not sufficiently engaged in global markets. The government*'s* 2018 *Creative Industries Sector Deal* aims to increase exports by 50 per cent before 2023 because the sector still offers a lot of "untapped potential" with many businesses not yet exporting at all (Department for Business, Energy & Industrial Strategy, 2018). The Department for Digital, Culture, Media & Sport (DCMS) maintains that only 18 per cent of creative industries firms are engaged in international trade (DCMS, 14 February 2018).

Creative firms are seen as having industry-specific barriers to international trade, in particular small company size (Department for Business, Energy & Industrial Strategy, 2018). The average creative company size is 3.3 full-time employees (FTE) and 34 per cent of creative sector workers are self-employed, which is more than double the UK average (Bazalgette, 2017). The *Creative Industries Sector Deal* states that micro-companies lack the "absorptive capacity" to undertake extra export duties such as identifying and assimilating useful information and using it to commercial ends (Department for Business, Energy & Industrial Strategy, 2018).

Our case study calls many of those assertions into question. In at least one creative industry hub – at Baltic Creative in Liverpool – even small one-man-bands are already deeply engaged in the global economy. Creative industry firms in this cluster are exporting at much higher rates and with more economic impact than official figures suggest. Small company size does not appear affect their ability to export. Are small, local creative industries more global than we think?

International Trade at Baltic Creative, Liverpool

Baltic Creative in Liverpool provides commercial space specifically designed for creative and digital industries, housing almost 100 SMEs (small and medium sized enterprises) and dozens of freelancers. In the UK, the creative industries comprise advertising, architecture, arts, crafts, design, film and TV, IT and software, museums, music and publishing – including both goods and services in these fields (Department for Business, Energy & Industrial Strategy, 2018).

In May 2018, we asked freelancers and company owners all based out of Baltic Creative to complete an online questionnaire about their international reach. This "International Trade Survey" consisted of 16 quantitative and qualitative questions. It was sent to 75 tenants, of which 59 responded. Each question in the online survey left room for a supplementary, open-ended reply. Many respondents used this space to clarify their responses. All of our statistics about company imports and exports are derived from this survey. In July 2018, we also conducted almost a dozen semi-structured, personal interviews.

In addition, we cross-referenced the 2018 International Trade Survey with data from Baltic Creative's 2018 Business Owners Output Survey. Here, each year Baltic Creative's tenants are asked to provide key figures including questions on annual turnover, annual growth and expected growth. In 2018, 71 company owners responded to this survey. We used this data to arrive at figures such as median company size, annual turnover, and per-employee GVA of both exporters and non-exporters. Combing responses from both surveys, we have data from 89 SMEs or freelancers.

Since the sample size of 89 is relatively small, we have used the median rather than the average when discussing the results. A very small number of firms at Baltic Creative have turnovers well in excess of £1m and employ over 50 workers, which would significantly distort the average of a small sample. By using the mean we have arrived a more accurate snapshot of the "average" firm based at Baltic Creative.

Although "international trade" should normally refer to both imports and exports, we will use the term synonymously with "exports" for two reasons. First of all, the documents that we are interrogating – the *Industrial Strategy* and the *Creative Industries Sector Deal* – almost exclusively refer to international trade in the form of exports. *The Industrial Strategy* mentions imports only once and the *Creative Industries Sector Deal* never mentions imports. Secondly, of our 59 respondents, only one firm imported a small amount without exporting. In all other cases, tenants who engaged in importing also exported. Conversely some exporters did not import. Further details will be discussed in our results, below.

Results

SMEs and freelancers based at Baltic Creative are highly engaged in international trade, with 69 per cent of tenants exporting. Of the 31 per cent who do not trade internationally, one-third would like to start exporting in the near future (Figure 1).

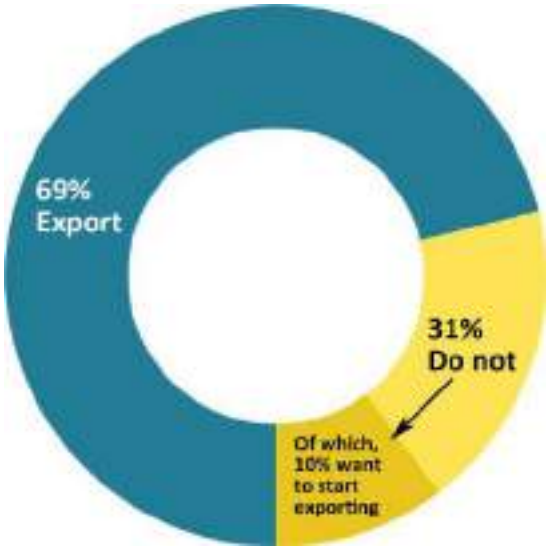

Figure 1 Proportion of Baltic Creative tenants that export

Isolating the exporting firms from the whole of Baltic Creative, henceforth "exporters," we find that most are trading in services with 70 per cent trading only in services, another 15 per cent trading in goods and services, and the final 15 per cent trading in goods only. Exporters reported that their primary concern around trade was Brexit. Europe is their main trade partner with 90 percent of companies exporting to the EU; 63 percent exporting to North America; and 51 percent trading with Asia.

Baltic Creative's exporters make a significant share of their income from overseas: 35 per cent of firms make over 50 per cent of their total income abroad, 37 per cent make between 10 and 50 per cent of their total income abroad, and 29 per cent make between one and 10 per cent of their total income abroad (Figure 2).

Figure 2 Baltic Creative's exporters rely heavily on their international income

Exporting is only half of the story. Exporters also import goods and services from abroad. While 21 per cent spent no money abroad, 38 per cent spent up to 10 per cent of their total expenditure abroad, 22 per cent spent between 10 and 25 per cent abroad, and the final 19 per cent spent over 25 per cent of their expenditure abroad. These last two groups of importers were hit by Sterling's sharp devaluation after the Brexit referendum in 2016. One business owner revealed that, because of sudden exchange rate fluctuations, his company lost £13,000 on the day of Brexit and more since then because of on-going international commitments.

Both exporters and non-exporters perceived the same major barriers to international trade: finding clients, access to knowledge and skills related to international trade, language and cultural issues. Interestingly, one would expect seasoned exporters to be less anxious, but instead exporters are more worried about customs procedures, delivery, tariffs and duties than non-exporters (Figure 3).

Figure 3 Perceived international trade barriers

Brexit then is a substantial concern for exporters at Baltic Creative because, at the time of writing, it is unclear whether tariffs and duties will be applied to goods and services entering the EU. Of all the companies we surveyed and interviewed, only two had managed to profit from Brexit. One business owner told us, “So far, Brexit has been good to us because the pound has weakened to the dollar and 65 per cent of our income is in US dollars. We've consciously spent more aggressively to acquire more US customers while the pound is weaker.” The rest of the companies were either apprehensive about the effect of Brexit on their future business or had already faced significant losses since the June 2016 Brexit referendum.

Although 85 per cent of the surveyed companies trade in services and therefore do not face the prospect of direct taxes on goods, company owners (and European clients) still worry what the new trading environment will mean for permits, insurance and other compliance standards. As one photographer said, “I need a work visa for any shoots I do in the United States. I can’t just enter on a tourist visa. My insurance would be void if I didn't get a work visa for the U.S. In Europe, I can just get up and go. I worry how Brexit will affect my work in Europe.” His turnover is highly dependent on exports with 30 percent of his income coming from international work, of which 85 per cent is in Europe. Another SME owner admitted, “We are retrenching all international business and making teams redundant to increase productivity. Because of Brexit, we've lost 7 major contracts in the last 12 months, a risk we cannot afford to make again.”

With 95 per cent of creative industry firms employing fewer than ten people (Frontier Economics, 2016), the *Creative Industries Sector Deal* identifies company size as a particular challenge to exports. Again, we have not found this to be true in our case study. Baltic Creative houses a selection of freelancers, micro-companies with under 10 employees, a few companies employing between 10 and 50 people, and only one firm employing more than 50 people. The mean company size of all tenants at Baltic Creative in 2018 was 2.5 full-time employees (FTE), with exporters slightly higher at 3.2 FTE. This is in line with, but slightly below, the national UK Creative company average size of 3.3 FTE (Bazalgette, 2017).

Discussion

The 2018 *Creative Industries Sector Deal*[1] contends that the micro-enterprises lack the "absorptive" capacity to increase exports. It does not, however, look deeply enough at the digital economy, which has – in less than two decades – dramatically reduced trade barriers for both large and small creative industries firms. According to the Centre for Economics and Business Research (Cebr), "We live in an era where the methods we currently use to trace trade flows are losing their relevance and ability to depict an accurate picture of trading realities," (Cebr, Creative Industries Council & Creative Industries Federation, 2018).

For an increasing number of creative industries firms, international business is not extra business: it's just business. One micro-enterprise owner told us, "We never set out to export. It's just the nature of the Internet to unlock that kind of potential without thinking you're starting a global business." This business creates YouTube content and over 75 per cent of its income is earned through overseas viewers and the associated advertising sales. The owner started the YouTube channel as a side project and now the firm employs 4 staff and 15 freelancers.

Another business owner told us, "In 2005…Google came up with this thing called Adsense. Overnight [my website] went from just [sitting on] the Internet somewhere to making more money than I made working full-time in the NHS." Using a website as their marketing tool, their company sold home-study DVDs. In 2013, they switched from selling DVDs to selling courses purely online, which only increased their international sales. The company currently makes 70 per cent of its annual income from exports and spends between 25 to 50 percent of its expenditure abroad. In 10 short years, the Internet transformed this micro-entrepreneur's career and business. The owner concluded, "If you are an online business and you are selling digital products, I think it's fairly standard that you are more of an exporter than…a domestic company because the cost of delivery is not there and the cost of fulfilment doesn't exist."

It's not only creative service providers that benefit from this borderless, digital global trading environment. Goods also have witnessed dramatic reductions in barriers to trade. "When we launch a product, we press release it [around the world]" another micro-enterprise owner told us. "As a result, it gets picked up by press and blogs in the US, UK and Europe. Our products are about film, music or literature…popular culture…that's why our customer base is so international." This micro-enterprise employs 4 full-time employees and earns between 50 and 75 per cent of income is from foreign sales.

The *Creative Industries Sector Deal* asserts that its priority for the creative sector is scaling-up: "helping the SMEs and entrepreneurs that overwhelmingly make up the sector to grow, in order to raise productivity," (Department for Business, Energy & Industrial Strategy, 2018). Interestingly, the two following examples of increased productivity resulted – not from scaling-up – but rather from clustering micro-enterprises into one shared location. One Baltic Creative company owner and exporter told us, "I recently hired a Google ads expert. I looked all over the Web to find somebody and there's plenty of companies or agencies that will do it…but in the end, I found a Google ads expert at Base Camp [a co-working space within Baltic Creative]. He is a real specialist and he sits next door. When you're in this online business everything is done by e-mail and it is a refreshing change to speak to somebody and express what you need in person instead of doing it backwards and forwards through e-mail…The first thing I do now is look to Base Camp." The company owner employs only 3 other people and earns between 50 and 75 per cent of its total income from exports. Rather than hiring a full-time employee to do the job, this micro-enterprise hired a neighbouring freelancer to increase exports. A second micro-enterprise owner told us, "We co-habit [our office] with another company, and they asked, "Why don't you claim for R&D tax credits? We do." The micro-enterprise owner had been unaware of the UK's Research & Development Tax Credit scheme. His unplanned, serendipitous conversation ended up saving his

[1]This includes the reports they reference: Peter Bazalgette's 2017 *Independent Review of the Creative Industries* and Frontier Economics' 2016 *Absorptive Capacity: Boosting Productivity in the Creative Industries*.

company thousands of pounds, which were then reinvested into the firm. Serendipity is an important benefit of clustering and it's countless opportunities for face-to-face contact (Storper and Venables, 2004).

No interviewees saw a direct positive impact of clustering on their exports, but the benefits of clustering at Baltic Creative may be increasing their productivity, which would result in expanding their ability to export (Marrewijk). Clustering micro-enterprises may be a more economically viable and efficient way of helping SMEs "scale-up" – by expanding the network and knowledge base – without actually having to increase employee numbers.

Besides, scaling up does not always have advantages. At least one company owner cited worries about increased risks with scaling-up. Hiring more full-time staff required certainty of increased turnover. In an era of instability marked by Brexit, this micro-enterprise owner was unwilling presently to take that risk and preferred to hire freelancers on a case-by-case basis. Some economists point to clustering flops such as business parks where many similar firms share larger premises, but no interaction between tenants results (Wadha, 2011). This may be true, but clustering micro-SMEs and freelancers may produce different results from clustering larger companies. Businesses employing more than 10 people may indeed not require the serendipity and peer support that clusters offer because, as they grow, they hire specialised staff members and develop their own internal logic. But micro-enterprises and freelancers may benefit from the spill-over effects, networking and peer support that clusters such as Baltic Creative offer. Creative industries firms in 2007 were 15 per cent larger than in 2014 (Bazalgette, 2017) demonstrating a clear trend towards decreasing company size. Trying to force the industry in a direction that it is not naturally heading may be counter-productive. Instead, supporting creative clusters may be a more effective policy for increasing the productivity and exports of micro-SMEs and freelancers in the creative industries.

Our research is based on a small, geographically isolated sample of companies and cannot claim to represent a broader snapshot of creative industries in the UK. Indeed, economics research has found that the differences between individual firms are so astoundingly large, so-called "firm heterogeneity," that they call into question the viability of generalising from case studies (Marrewijk, 2017). We are indeed undertaking further research in four more creative industries hubs in England's North West to see if the trends extend to other digital and creative hubs. Moreover, we will revisit Baltic Creative in 2019 and 2020 to assess the impact of Brexit on tenants' international trade.

Key Insights

Our research suggests that official statistics may be understating the true value of exports to the creative industries. More refined and accurate data gives policy-makers better tools for designing effective strategies and efficiently allocating public funds.

The government's 2018 *Creative Industries Sector Deal* focuses efforts on helping creative industries firms to scale-up in order to increase exports. Our findings, however, show that small size is not hindering the exports of micro-companies based at Baltic Creative. Furthermore, these small companies are already highly dependent on their exports for total annual income.

Our findings are important because undervaluing current exports underestimates the possible negative effects of a significant break with the UK's hitherto successful international trading environment. If creative businesses are as financially reliant on exports as this study suggests, shocks such as a no-deal Brexit – or even the uncertainty caused by prolonged Brexit negotiations – are potentially far more wide-ranging on this set of businesses. A key factor in their export success has been the global, open, digital economy where international trade is integral to their business. The policy focus, then, should rather be on maintaining seamless – or at least consistent – access to global markets.

Should this prove to not be possible, gearing policy efforts towards providing affordable, not-for-profit creative industry hubs – and in underserved locations – may be a wiser allocation of public funds. Our preliminary research suggests that many creative industry firms do not want to scale-up, preferring to stay small and agile. Locating in a creative hub where they can temporarily employ the talent they need on a project-by-project basis, and possibly taking advantage of knowledge spill-over within the hub, may provide small creative firms safe harbour while they navigate the vagaries of Brexit.

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Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

Design innovation practices in a global supply chain: a Fung Group case study

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Whereas the contribution of design thinking has already been appreciated both in academic literature and practice in the West, there have been little serious and comprehensive studies focusing on Hong Kong and China. This case study paper, therefore, reports about the design innovation practice in Fung Group, a Hong Kong-based company whose core businesses operate across the global supply chain for consumer goods including sourcing, logistics, distribution and retailing. The analysis (1) identifies and describes design practices that the company initiated to support service innovation (including new products, processes and business models) (2) identifies challenges in adopting and institutionalising such practices. The results show that the company supports both externally and internally oriented design practices – and loosens the boundary between the two – through the activities in the Fung Academy and a new innovation hub, Explorium, with a particular focus on utilising digital technologies. Specifically, the study demonstrates how the company empowers and involves a variety of stakeholders (individuals, groups, and organisations) in value co-creating practices involving absorptive, collaborative, and adaptive practices that aim to challenge or disrupt current practices. The study uncovers that some of the major challenges in such aspirations lie in the adaptation of design thinking organising logic and mindset to specifics of the Chinese socio-cultural context.

Keywords: innovation, supply chain, design thinking, digital technologies

Introduction

Over the recent decades, within business and management communities, design thinking (DT) became a portal for the whole design area to contribute to innovation, especially well-suited for complex, "wicked" challenges facing contemporary service organisations (Buchanan, 1992; Gustafsson et al., 2016). Fung Group,[1] a Hong Kong-based multinational group with subsidiaries in trading, logistics, distribution and retailing, and a renown pioneering Asian innovator, has been on a similar path for several years now; Victor Fung, the chairman, has decided to rebuild a culture of innovation by adopting DT and hired an experienced designer from IDEO to be the innovation catalyst who would lead the change.

[1] It was founded in 1906 in southern China by Fung Yiu-Hing, an entrepreneur, and Li To-Ming, a merchant; today it is chaired by Victor Fung, Fung Yiu-Hing`s grandchild.

Whereas a number of researchers have outlined cases for design-based innovation (e.g. Leavy, 2010), relatively few studies (e.g. Ge and Maisch, 2016) have provided empirical insight into what kind of design practices companies in non-Western contexts adopt and what are the specific challenges in these contexts. This study attempts to shed some light on this issue. Hong Kong is a particularly interesting context to study since its development is driven by the service economy, with service sector dominating its gross domestic product (in 2016, 92.7 per cent of its GDP, of which trading and logistics equal 21.7 per cent, according to www.gov.hk). Looking ahead, the 2018-19 Hong Kong government budget plan assigned additional $6,4 billion to supporting innovation and technology, focusing on the first phase of the Hong Kong-Shenzhen Innovation and Technology Park. Moreover, Hong Kong serves as a bridge between the influences of Confucius China and the West, especially considering its legacy of British rule. As it will be shown below, this unique position creates conditions that posit some challenges to adopting and implementing design practices.

This study has an exploratory character; its purpose was to grasp the personal views, experiences and understanding (Kvale, 1996) of the practitioners involved in design practices in support of service innovation in the Fung Group. We have combined the interview data with document analysis and our own observations. The two-hour long interview with the innovation catalyst Richard, and a one and a half hour long group interview with Richard and two design-thinking practitioners and innovation specialists working within the innovation team—Peter and Mara[2]—were open and had little structure. They focused on certain themes, such as the key design practices which support service innovation (including products, processes, and business models), structural enablement, project examples, and the challenges encountered. Since the questions were aimed at drawing on personal experiences, and sometimes lead to narrative-like responses, this research could also, at least partially, be qualified as experience-centred narrative research (Bold, 2012).[3]

Fung Group: network orchestrator in the era of digitalisation

Fung Group is known for being a disrupter in the supply chain business, particularly with its innovative approach to knowledge management, such as taking and deconstructing orders, its problem-solving capability, and getting factories to learn from each other. To compete in a flat world, rather than relying on a bundle of assets, IPs and capabilities that would enable the company to compete in a closed market, the focus of the Fung Group became to integrate and connect to resources and competencies in the network through the so-called "network orchestration" competency (Fung et al., 2007).

In today`s digital and networked economy, Fung Group strives to create new business models, where fewer resources are used, which create entrepreneurship and growth in markets, create better products that last longer and enable people to live better. The present three-year plan (2017-2019) states: "Our goal is to create the supply chain of the future to help our customers navigate the digital economy and to improve the lives of one billion people in the supply chain." "That's our challenge," says Richard, and "there are not that many other companies around which can be a platform for doing something like that." The plan further emphasizes the role of digitalization in supporting network orchestration, which involves the development of the "digital platform that includes all [our] ecosystem partners and enables them to benefit from the convening power of a network that reaches over US$2 trillion of retail sales."

Due to the importance that is put on the role of digitalisation, across the whole Fung Group, experiments are conducted with different forms of technology, including AI. The future of supply chain, however, all the interviewees agree, will be much more open source, more networked and it will not rely solely on technology. It is more about enabling people in the business, whether it means going through short processes or finding ways to spot opportunities. The current roles will be disrupted as well, says Richard: "So the supply chain may be run by two kids in a garage, versus by a large multinational."

While reflecting on the question what the future of supply chain that Fung Group envisions is, Peter says that "it is less about what it is and more about how we prepare ourselves through the journey, it's about adapting yourself to any new situation." He stresses: "If we think that we have to define what the future supply chain is and that we're going to invent it, we have already lost because that's not going to happen."

[2] These are not their real names.

[3] The particular characteristic of this case study – and perhaps its limitation – is that it is largely based on the personal observations and views of the interviewees – non Chinese people - involved in the Fung Group work, which sets it up as an observational case study with inherent potential biases.

Striving for ambidexterity

Structural enablement of innovation

The innovation model that Fung Group is attempting to build is relatable to the concept of an ambidextrous organization, with capabilities of both exploring and exploiting, and hosting multiple structures, with different cultures and practices (Tushman and O'Reilly III, 1996). That is to say, apart from its core business, it boasts a portfolio of innovation, day-to-day incremental changes, and some disruptivity. The distribution of these depends on where the company is in its business cycle, however, if the core business makes up 80% of what the company does, it can be assumed that they are not doing enough and there is a threat that someone will disrupt them. The trap that the company wants to avoid, which often happens with large organizations, is to transition from being small, and wanting to grow, to being large and wanting to optimize, protect, and control, i.e., to fall into the trap of an exploitative culture. Furthermore, organizations expect data to generate new revenue models, but they are not generating any data in the first place because "they are not doing a digital thing. People in Excel, folders, all the day," says Richard. Business needs to become leaner and fitter, he argues: "If we had $100, we would need to put $20 on the crazy new ideas, and $80 on digitally transitioning the organization. There's a process around this new stuff, creating new value and in new ways, true innovation. And, 80% of the block and tackle change, change, change."

Figure 1 Three structural units within Fung Group

Within the Fung Group organizational structure, there are three interconnected units which, interdependently, aim to create ambidexterity—business unit(s) (BU), Fung Academy, and Explorium, a new innovation hub. Structurally, Explorium is incubated within the innovation team of the Academy and the talent that it leverages largely comes from the Academy. That is, the Explorium team (which consists of eight people) is a small subset of the innovation team, which is a small subset of the Academy (consisting of 40 people).

Explorium Hong Kong started with the same branded name as the "original" Explorium Shanghai[4] in May 2018, as a part of the headquarters, in the context of "less space and less startups, less all that stuff happening," explains Peter, and currently has a setup of a fuzzy front-end–a stage where value proposition and business model canvas are being iteratively defined.

The dominant roles of the Academy and Explorium are to be the explorative part of the organizational ambidexterity, which performs design practices, while the BUs are mostly responsible for the exploitative part, which performs routine work. However, innovation occurs when the institutionalized, routine practices in a BU change, as we will demonstrate in the following paragraphs.

[4] Explorium has been around as an innovation hub for three years; it started in Shanghai, where it has gone through three different phases. In the first, experimentation phase, it was focused at trying new retail formats and inviting customers and businesses to test how they might work. The second phase revolved around developing an experience centre where the Group wanted to closely examine what the business of the Group is, so that people can engage in it and understand it better. The third, current phase is about engaging the startup ecosystem in Shanghai, the community of providers exploring new technologies and new ways of doing things, testing new technologies and business models.

Operationalization of ambidexterity through design practices

The examples we will provide in the following sections show how Fung Academy and Explorium, through various design practices, identify the needs of the BUs, influence and transform the BUs to take a risk in exploratory (including digital) innovations and change routinised, institutionalised practices.

The Academy is ahead of BUs in the sense that it enables by building the core capability of business–it develops and provides talent (i.e. creates entrepreneurial learners or DT-based institutional entrepreneurs), whereas the BUs builds on the "wave" of these entrepreneurs and more or less incrementally changes some of its routine practices (its inherently exploitative nature). Located within, but at the same time on the edge of Fung Academy as an autonomous, small unit, Explorium has more freedom to experiment and open to new opportunities in the ecosystem. Through its flexible structure and decentralised decision making, it acts as a connecting point via DT-based innovation via conveying needs, providing direction and connecting relevant stakeholders – internal and external, such as startups, enterprises, universities, and AI labs. In this sense, Explorium acts as a sort of gatekeeper which enables open innovation (Hafkesbrink & Schroll, 2010).

Within this model (see *Figure 2*), the business provides the challenges and the assets; Fung Academy and Explorium provide know-how processes and talent. Getting business put their skin in the game, with specifying some barriers, is an important factor in the model. Richard explains: "The question is if it's going to take us $10 to go do a new thing, maybe business can put in $5, and we put in $5. Or, you put in $2. Or, maybe, your $2 is your two people for three weeks, full time, and then, if the business doesn't use the work, the innovation team has to pay back the money that was invested."

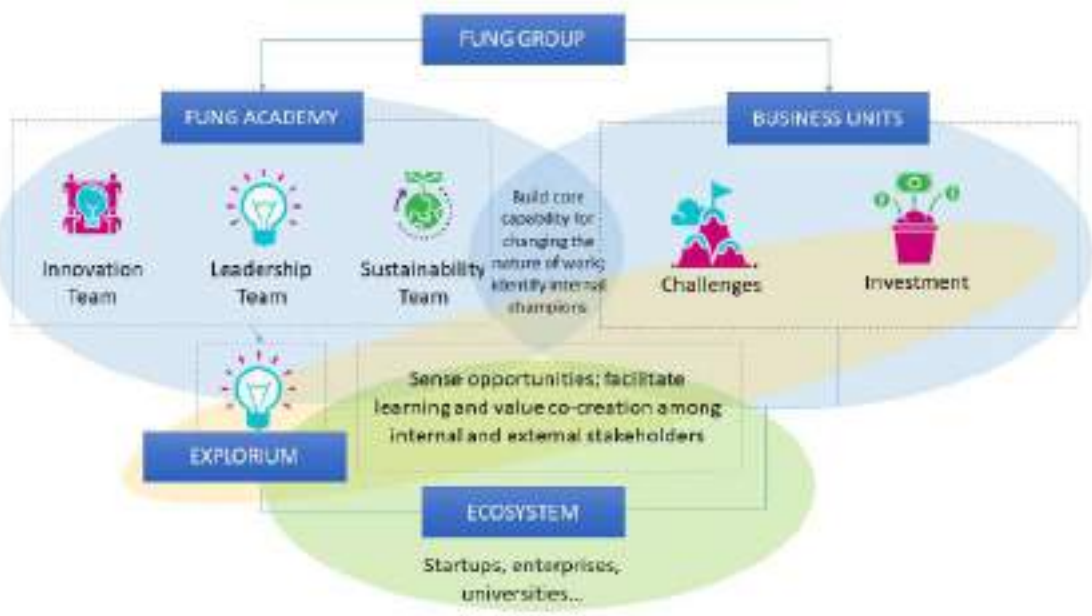

Figure 2 Operationalization of design-based innovation and ambidexterity

We further propose the trilogy of interrelated design practices which might be called absorptive, collaborative, and adaptive practices to depict the explorative work in the synergy of different units (cf. Lusch et al., 2007) (see Table 1). Then, we describe some examples of the practices within Fung Academy and Explorium.

Table 1: Roles and actors within various units in explorative part of organizational ambidexterity in Fung Group

Relevant unit	*Main actor*	*Role*
Business unit	Internal champion	*Collaborative practices*–co-creates with external champions (e.g. from startups); *adaptive practices*– implements a change of current practices to carry out the project and

		implement new solutions, support changes locally via internal champions.
Fung Academy	Innovation, leadership and sustainability team; innovation catalyst	*Collaborative practices*–empowers and enables employees by means of three pillars: innovation, leadership and sustainability; identifies and develops the champions/DT-based institutional entrepreneurs; *adaptive practices*–builds the core capability according to new knowledge and needs, implements the change in behaviour within the BU
Explorium	Part of innovation team; innovation catalyst	*Absorptive practices*–identifies the "below the iceberg" hidden needs of BUs and customers; senses opportunities in the environment (technology, partners, ideas in form of startups…); *collaborative practices*–creates opportunities for mutual learning and collaboration among relevant internal and external actors through workshops, showcases, hackathons etc.; facilitates value co-creation via DT practices that pilot new services, business models, etc.; e.g. via the Idea to scale DT practice
Startups, enterprises, universities, AI labs	External champion	*Absorptive practices*-provides new ideas; *collaborative practices*–collaborates with BUs and addresses their needs

The role of Fung Academy - building creative confidence and nurturing DT-based institutional entrepreneurs

Fung Group`s assumption is that in a network-orchestrated world, the network that learns fastest wins. In an asset-light business model, instead of capital, the assets are people. With its three pillars – leadership, innovation, sustainability–the Fung Academy poses questions such as: "What does it mean to be a leader in a global world? How to make Asian leaders feel really global?"

"It becomes less about doing innovation work and more about redesigning people's jobs to enable them to get the work done and act as innovators. It is about pushing new behaviours into business", says Mara. Ultimately, it is about building autonomy into the process and building people`s creative confidence, which DT can greatly contribute to (Kelley & Kelley, 2013). As the business grew, the Fung group hired T-shaped, IDEO like people, everyone from data analysts to graphic designers, who would support this mission. Along with this journey, Richard stresses, they gathered more and more people, and slowly, over time "you are building this army of, an army of, these sort of, communities of passion."

"Unless you lead through those people, they're just serving the system versus they're making the system," says Richard. And this is hard to do if the "base is low, if people are all sitting in cubes, doing stamp work, and answering phones. That's not the kind of work we need to do in the future", he notes.

Figure 3 Empowerment through Fung Academy

Over the years, after hundreds of individuals going through the programmes, workshops, internal competitions, and lots of conversations about DT, people started to realize that they could come to the Academy, and through different ways of thinking, they could come out with different things. For example, the Academy partially launched one leadership programme in collaboration with MIT and Stanford University. One unique quality of the company is that it has grown its business by acquiring small businesses, the majority of which were owner-operators, entrepreneurs. Today, these people are entrepreneurs within the company, "'little John Waynes', people who would, metaphorically speaking say: 'I'm, like, sheriff of my town, and I am the P&L owner,"–"very entrepreneurial," says Richard (cf. Fung et al., 2007). And there are thousands of P&L owners only in one part of the business. However, most of them have never attended university, because they have been building their business from a very early age. Having been presented with an opportunity to enrol in MIT leadership programmes, they came in tears because they went through this, Richard recalls, as if they were saying: "Oh, you think I'm good enough, so that you're going to send me to Boston for two weeks, to MIT?" These people are very engaged and still adopt some of the frameworks they have learned. And then, there are those high-flyers who started to embrace self-learning, they call them "entrepreneurial learners", people who are now constantly curious, learning all the time.

The role of Explorium – connecting between the needs of BUs and knowledge in the network

The primary role of Explorium is to be the *connector* between the needs of different BUs (the challenges that they are going through, as well as the challenges of their customers) and the knowledge residing in the network in order to enable growth through collaboration. Peter explains that the question becomes "How do we bring in and have access to a community of innovators, other corporates around Hong Kong to help us handle the challenges as they get thrown at us, and if they`re really good at that, then they can be part of the future of supply chain?"

The hypothesis is that if Explorium can persuade other people from the outside, such as startups, enterprises, universities, to work with them, they can show the people inside the BUs that it is feasible for them to try the same things. "So it can be as simple as say 'okay well you have that pain point, we know 10 Chabot companies over here, that's what we're doing we're building community, let's bring you guys together and facilitate you working together", says Peter. In a large organisation, in particular, the problem can be a lack of coordination of communication among the BUs, which might lead to not knowing what the units are doing; the role of Explorium is to connect these through DT practices.

Among internal (within the BUs) and external collaborators (within the community), the critical issue becomes finding the ones "that are highly engaging, the ones that are returning back, the ones who are constantly in the loop of what we want to do", these are the ones "on their way to become champions", explains Mara. A lot of their work, she says, is then revolving around how to convene some less comfortable ideas, benefits of it, and convince them that the team will provide support to their efforts to bring about projects locally. It is about instilling in these champions autonomy and a sense of ownership of the change.

Figure 4 "Idea to scale" framework

To find and bring together potential internal (BUs) and external collaborators, the team organises and participates in various community events (e.g. the TechCrunch event in Shenzhen), organises showcases with startups and runs experiments—from running workshops (both internally and in other companies) to hackathons. Explorium particularly aims at collaborating with startups. It is assumed that the Group needs new ideas to grow. And since ideas nowadays often come in the form of startups, the goal becomes to utilize this potential through collaboration.

"Idea to scale" is one of the key design thinking practices in Explorium which addresses this problem, which follows a collaboration framework that facilitates business experimentation and learning through piloting new products, processes and business models in collaboration with external partners. It comprises a series of sub-practices which starts from the human and business "below the iceberg" needs identification and analysis, which the team helps to identify in conversations and interactions with relevant stakeholders through interviews, design thinking workshops and other activities (see *Figure 4* for the different phases of the framework and *Figure 5* for different roles).

Figure 5 Different roles within the "Idea to Scale"

Cultural aspects of adopting design practices

Projects example: Changing company culture through experimentation

The conversations within the Fung Group revolve how they can begin to redesign how the core business actually operates, how to start to redesign the nature of the work by changing underlying values, norms, and assumptions, components of organizational culture according to Schein (2010). At Fung Group, design thinking (DT) is viewed both as a philosophy (mindset) and a set of practices. It is a frame of reference for the world and it is seen as powerful because it is pulling lean, customer experience and similar topics into the "overarching thing". However, there is an implicit notion that there is not much sense in "banging" about using the DT. The point is not to talk about it, but to do it, argue the interviewees and, then communicate the value of its output. The existing DT frameworks are seen as helpful in terms of how they codify simple steps, but it is not as important which one is used. Giving people a terminology, however, can have an effect that lighthouse projects have. DT is in GE and in IBM and other big companies, which enables people to say "Yeah, we're adopting design thinking." "Oh, we're part of cool kids!" says Richard. Thus, what really matters is what gives people confidence that they can do something different.

In their research into the link between design thinking and organizational culture, Elsbach & Stigliani (2018) have discovered that there is a recursive relationship between the use of design thinking tools and the development of cultural values, norms, and assumptions. Such a reciprocal relationship is also evidenced by the example of the early rapid 3D printing retail experiment, the project which brought some awareness to the organisation that "There's this team of people who can take a crazy idea, go and make it happen." That is, early attempts at changing organisational practices started in the company with experimentation and prototyping.

Picture 6. 3D printing experiment for Toys "R" Us

In 2013, Victor Fung, chairman of the Group, wanted Richard and his team to start with 3D printing and soon an opportunity to do something meaningful arose in 2013 when a gigantic yellow inflatable duck was about to dock in Victoria Harbour, a floating sculpture designed by the Dutch artist Florentijn Hofman. The team created awareness in the organization that there is an event which brings "crazy bunch in town" and that they can do something about it, that they can respond by creating new product and experience before the duck leaves the harbour in four weeks.

They reacted quickly, they assembled a small team that created (prototyped and iterated) customized 3D-printed toys in a super-fast way and brought a toy duck to retailer Toys "R" Us. They. This project did not only show the people in the organization what is possible, but also enabled them to do three more 3D printing projects, and started the conversations around questions such as "What does digital manufacturing mean?" "What is AI?" "What do robotics and automation do?" "What does mass customization do?" In other words, the project has served as a catalyst for numerous other projects that would have never happened without that first project. Projects like these are often called lighthouse projects because their aim is to enable people in the

organization to point to it and say “We can be innovative! Oh, we can do that!”, and in that way build innovation confidence and trust in the organization.
Over time, the use of DT tools helped to build more customer and user-centric focused culture, more open to experimentation and adoption of new ideas. Overall, the group’s capability for innovation and change has increased, according to the observation of interviewees. Following this experiment, DT tools, such as rapid prototyping (from digital MVPs to role-playing to discovering service prototypes), started to become an integral part of the company culture. More recently, the operating groups have established “voice of the customer” KPIs (which had not been in place before). Richard and his team are as well refocusing back on “brainstorming” and on developing tools around re-framing and H(ow)M(ight)W(e).

Picture 2 AI-powered smart checkout machines (Image Fung Retailing Group)

One recent important project (which created a new value) came out of “Idea to scale” practice is the partnership between retailing giant JD’s AI lab and the Fung Retailing Group to create AI-driven retail system with embedded AI-image recognition technology to enable checkout processing across Circle-K stores. The aim of the project is to develop a new retail format for China and Asia that would utilise AI-based technology innovations and integrated platforms. The project is continuing the path of building the culture of experimentation and user-centricity, with a specific aim to allow consumers to try out Hong Kong’s first check-out experience based on AI-recognition and provide their feedback.

Challenges in adopting design practices

Cultural factors

Some challenges stem from social and cultural factors such as having permission and saving face, related to Confucian culture. On a practical level, however, simple things can be done, as going local in adopting DT. People should not be forced to run a brainstorm in English if they are more comfortable to do it in Mandarin. As well, instead of making a competition of writing post-its, a better approach would be to write ten post-its, put them up on the board and talk about them. It is necessary to understand, that the natural Western way of “I wanna share everything I’ve got about myself, it’s just not an Asian thing," Richard stresses. However, bodystorming and prototyping are on the other hand easy to do here. Chinese people like a notion of play, which explains why karaoke is so popular here. He explains: "you get people to play a different role" and people will be like, “Oki, we`ll play that.”

Further on, the particular non-disruptive notion of how things are done in Hong Kong, according to interviewees, influences how the problems should be approached. For example, trying to get people to start from a lean experiment about something completely disruptive would result in the answer "What's that got to do with our business?". In contrast, starting from a different place, like “Here’s where we are. We've got ten choices. How do you prototype those?" would make them feel "Oh, we can do that!" Essentially, it is about how to find different ways of doing things that are actually the same.

In the Asian culture the disruption of balance, yin and yang of life, is not something which is often welcomed, says Richard. For this reason, Chinese innovations are often incremental and not disruptive. Richard explains, "That is why when you look at China, who is really disruptive?" Their natural inclination, he explains, is to take on a task, work on it and let the solution develop over time: "If you write in Chinese, right, you get little square blocks, and you do hours of characters. And, over time, your style comes out. But, it's emulating after 20,000 times doing the same thing. And, so, the natural idea of doing something completely new is hard. (…) “it is difficult to innovate here in an "IDEO kind of way" because people think that that's not their business.

Organizational structure and mindset

The hardest thing for most people is figuring out what the value is in various design practices in support of the innovation and how to make money out of them, because “What is the value created, it's not so visible and we need to make that invisible to come to the surface,” says Richard. One of the keys is not so much to talk about innovation but always about growth. "And, that's the point, right?", says Richard, "both design thinking and innovation are just useless words. You talk about growth and changing the value, and that’s all you do.”

People are as well incentivised based on the year targets and not on how portfolio growth might look for the next ten years, which is what innovation is essentially about. The interviewees point out that employees are sometimes caught up in traditional, industrial logic-based thinking or too focused on a daily business and immediate concerns. Often BU “adhere very strongly to ‘this is how we do this,’”; especially in Hong Kong, says Peter, and training that muscle to be more flexible is the goal of his team. “Which brings those champions back in into the room, how to build on those champions that we know will be more open to ideas like this than the ones who won't,” he says.

One other challenge is to work with “different customers, vendors, teams, cultures, time zones, which requires navigating through all these”; “what makes our job more exciting (…) is to constantly be with people, understand their pain points, apply the DT, and then see how we can customize for each customer,” says Mara.

Discussion and learnings

To be competitive, service organisations such as Fung Group need to be able to create (radical) knowledge continuously (cf. Ahmed and Wang, 2003); in this case, with the aim of satisfying the needs of their business units, customers and partners. The present three-year plan (2017-2019) emphasizes the Fung Group efforts in embedding an institutionalized mechanism for the reinvention of their business as a way to “anticipate changes and have a system of governance and management that facilitates this.” The establishment of Explorium and practices facilitated both by Explorium and Fung Academy can be seen as such mechanisms, with internal and external stakeholders becoming resource integrators in value co-creation.

Whereas the role of Fung Academy is internally driven–its main focus is to build the core capability of the BUs, to support learning and to empower the employees, Explorium is on the edge of the organisation, “where the skin is the thinnest”, with the role of sensing the opportunities in the environment and tackling the hidden, “under the iceberg” problems of the organisation (absorptive practices) through collaboration with partners within the ecosystem and pilots (e.g. through the “Idea to Scale” practice) (collaborative practices). In the feedback loop, the learning facilitated by Explorium is fed back to the Fung Academy and business units (adaptive practices).

The critical role is played by the actors who are likely to act as champions when they need to implement the changes that break with institutionalized practices. Champions can help to implement the changes locally, in specific business units (internal champions) and in the community (external champions). These champions might be seen as institutional entrepreneurs, i.e. individuals on whom the company might rely to initiate and carry out the necessary changes (cf. Battilana, 2006). The company encourages a culture of autonomy–

continuous learning, taking risks and experimenting particularly with the help of these champions and entrepreneurial learners.

The design practices within Explorium and Fung Academy act as an integral part of the larger value ecosystem. Through absorptive, collaborative and adaptive practices, knowledge is continuously co-created with all the participating actors in the network and fed back into the sub-systems such as business units, and at the same time to the partners in the community within the ecosystem. For example, the knowledge and capabilities that start-ups gain through collaboration with the company can help in solving a BU's (and its customers') specific problems, but can also support its own growth and, in the long term, affect other stakeholders. In this sense, design practices are boundaryless (ecosystemic) and interdependent with the wider social and cultural contexts.

By looking into the identified practices and experiences in this paper, and recognizing the complex relationship between design practices on the one hand and the social and cultural structure within the organisation and the broader ecosystem, on the other hand, managers can find some inspiration for managing change. Since change involves breaking with the current institutionalised practices, managers are invited to recognise that it is necessary that the social structures or institutions support change. For example, incentivising the champions (institutional entrepreneurs) who support change locally and develop the value of "intrinsic 'I want to help the world, I want to help my partners' versus extrinsic 'I`m going to win a competition'", notes Richard.

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Causing a Stir: Co-creating a Crowd-voted Grants Platform for Creative Entrepreneurs

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Stir was a crowd-voted grants platform aimed at supporting creative youth in the early stages of an entrepreneurial journey. Developed through an in-depth, collaborative design process, between 2015 and 2018 it received close to two hundred projects and distributed over fifty grants to emerging creatives and became one of the most impactful programs aimed at increasing entrepreneurial activity in Canberra, Australia. The following case study will provide an overview of the methodology and process used by the design team in conceiving and developing this platform, highlighting how the community's interests and competencies were embedded in the project itself. The case provides insights for people leading collaborative design processes, with specific emphasis on some of the characteristics on programs targeting creative youth.

Keywords: Co-creation, Collaborative Design, Community Building, Creative Entrepreneurship

Introduction

In late 2014, the Canberra Innovation Network was founded as a partnership between local government, academic institutions and the private sector, with the purpose of supporting entrepreneurial activity in the Australian Capital Territory. Their leadership soon realised that both youth groups and the creative industries had not been accounted for in their original plan. Using an in-depth co-creation process, facilitated by a team of design professionals, an initiative aimed at supporting the development of entrepreneurial intentions and behaviours among young creatives was born.

The initiative, named Stir, established a crowd-voted grants platform that ran between 2015 and 2018, received close to 200 project applications, delivered over fifty micro-grants, contributed to entrepreneurial competencies among young creatives, and built a community of over twelve thousand people.

This case study highlights the value of co-creation as a methodology that enables the simultaneous development of product, user engagement and word-of-mouth marketing. Additionally, it highlighted the shortcomings of pure design teams and the difficulties of attracting young creatives to the entrepreneurial ecosystem.

The case study will provide practical insights and guidelines for people leading co-creation processes, while surfacing some of the limitations present in a design-led team when building programs aimed at supporting entrepreneurial activity.

Part 1: The Context and the Opportunity

In November, 2014, the government of the Australian Capital Territory, in collaboration with local universities, research institutions, and the private sector, founded the Canberra Innovation Network (Canberra Innovation

Network, 2018). With the motto “Connect. Promote. Accelerate.” (Canberra Innovation Network, 2014), this new institution (CBRIN) aimed to provide cross-sector support for entrepreneurial activity in the region. It was in early November, shortly before the official launch of the initiative that the founding CEO recognised that the CBRIN lacked a way to engage youth and the creatives industries with the entrepreneurial ecosystem.

To address this, she contacted an interdisciplinary design team who had a track record of designing entrepreneurship education programs. The team was led by an industrial designer with experience in the development of student communities, interdisciplinary learning, game design and innovation education programs; a mathematician with experience in higher education, innovation research and small business management; and an undergraduate graphic design and marketing student with strong ties to local youth leaders and the creative community.

Her goal was to identify how entrepreneurship could be made attractive to a younger demographic. The initial brief was to design and deliver a one-day “hackathon”, where young people would attend, describe what they wanted from CBRIN, and have their ideas compete for some form of material reward.

To gauge interest, the team quickly drew upon their personal networks in the intended audience. After engaging with different youth groups, it became clear that success would require the project not be perceived as a “token gesture” or “photo opportunity”. Although a reward could provide extrinsic motivation for young creatives, the risk was that they would not feel represented or desire to connect with entrepreneurship in the longer term. It also became apparent that, through an in-depth co-design process, CBRIN had the opportunity to develop something novel and meaningful to young creatives, even if this would require a longer timeframe and better resourcing.

This was a daunting proposition for an organisation predominantly led by the public and academic sectors. The design team, interested in seeing what would come from said co-creation process, decided to show their commitment by halving their fees. This led to a mutual leap of faith and approval of the co-design approach for what was then known as the “Youth Innovation Initiative”.

This marked the beginning of a four-year project aimed at determining a way to engage youth and people from the creative industries with the entrepreneurship ecosystem. The following section will provide an overview of the design of the project, how it was implemented and some of the impacts it had throughout its lifespan.

Part 2: The Narrative

Tackling the question of how to involve young creatives in the entrepreneurial ecosystem was a complex issue, in particular due to the fact that “youth” is in itself a poorly defined concept, representing a broad demographic with diverse needs and interests that could be better understood as a mindset than an age bracket. This situation suggested that the best approach to addressing this question would be through a co-creation process (Prahalad & Ramaswamy, 2004).

The co-creation process used was comprised of three stages. The first stage focused on establishing relationships with local youth leaders. The second stage focused on engaging these youth leaders in a workshop aimed at discovering their needs and how these could be served. The final stage drew on the outcomes of previous two to collaboratively develop a solution.

Stage 1: The Secret Brand

The first stage of the process required engaging representatives of local youth communities. The challenge here was that these communities were diverse, exclusive, and often reticent to participate in programs run by “the establishment”. As one person eloquently put it “A government Youth Innovation Initiative is about as attractive as a poster that encourages me to get tested for a sexually transmitted illness”.

To overcome this, the team took steps to develop a community that could help to execute the project. This process began by attending a CBRIN event and capturing a photo that evidenced the lack of young creatives present within the organisation’s decision-making structures. The second part of building a community was developing a “secret brand”. This concept was inspired by William Gibson’s (2010) novel “Zero History”. Given that a key aspect of the community would be its focus on developing a tangible solution, the brand should emphasise practice, work, innovation and unexplored perspectives. The team arrived at the concept of “shift”, defined in the Oxford Dictionaries (Shift, n.d.) as:

Shift (n)
1. "A slight change in position, direction, or tendency"
2. "Each of two or more recurring periods in which different groups of workers do the same jobs in relay"

Figure 1: Logo for the secret brand.

The secret brand became "SHIFT ONE". The team designed a simple logo (see figure 1) and began building the community for the co-design process. Starting with their own networks, the team showed the aforementioned photo to representatives of the project's target audience, accompanying it with the following statement:

> *The local government is about to decide how to support young people's participation in entrepreneurship. These are the people making the decision. Want to have a say? Join the SHIFT ONE Crew.*

The team connected with approximately twenty people who were influential among specific youth or creative communities. They ranged between the ages of eighteen and thirty-five, with the majority in their early twenties. They were invited to a workshop on a Saturday, 22nd of November, 2014. To build upon the intrigue established by the secret brand, the email included a Google maps geo pin and a street view image with the message "entrance is behind the white van". This due to there being a vehicle parked directly in front of the doors to the venue.

Stage 2: The Co-creation Workshop

To make the most of the diverse group that had been recruited, the team designed a co-creation workshop that could help gain a better understanding of what they needed from a program aimed at encouraging them to engage with entrepreneurship. The process of designing the workshop began with a set of clear objectives from which the team designed a series of gamified activities that provided the structure for the workshop. These activities aimed to be playful and fun, allowing people to feel confident expressing what they really needed in a trusting and comfortable environment. The objectives and diagrams used to describe these activities can be seen in figure 2.

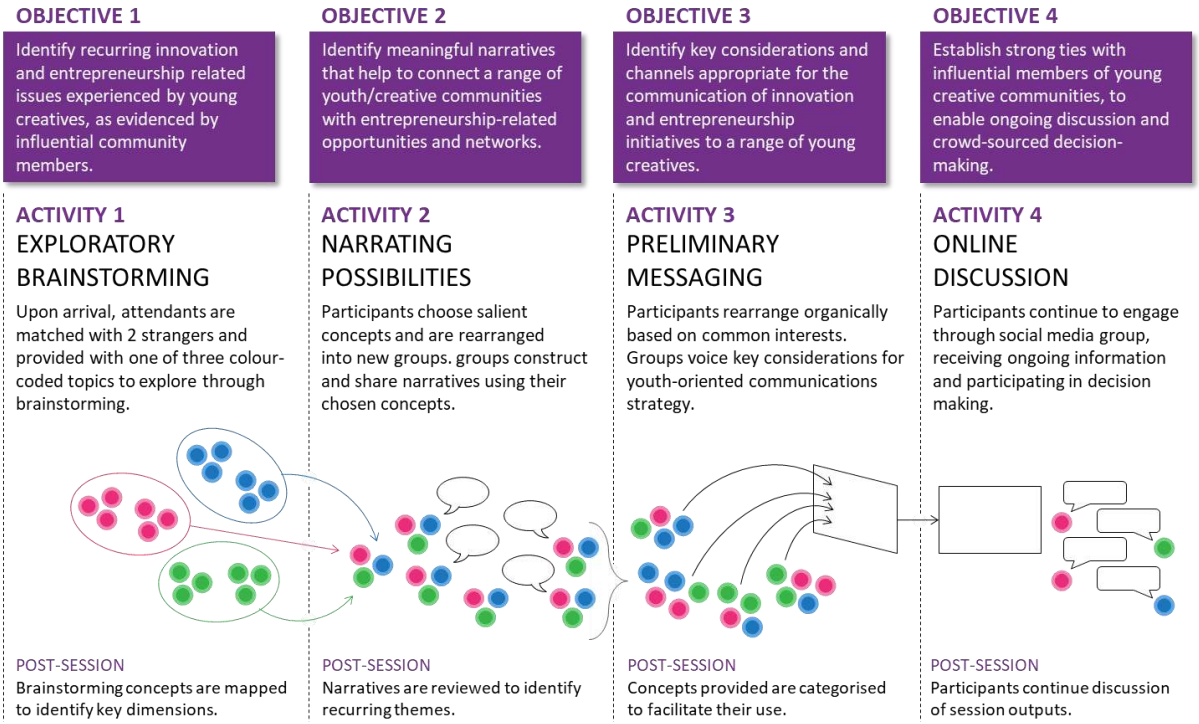

Figure 2: Objectives and activities for a co-creation workshop

Once the day arrived, they set up the room in the early morning and got ready to begin. There was an aura of nervousness amongst the team due to the short promotion cycle and the early, Saturday morning start, but when the time came, twenty-three people arrived. Attendees included people who had their own independent record labels, film-makers, event organisers, designers, game developers, photographers and visual artists. It also included café managers, appliance technicians, bicycle repair people and educators (see figure 3).

Figure 3: A gathering of diverse young creatives

As attendees were a diverse crowd, it was important that everyone, no matter their background, gender, age or experience, have their contributions received as equally important by others. For this purpose, the team introduced all participants and stated "*Now that we know who we all are, we can leave our egos at the door and focus on the needs of the thousand people we each represent*". At this point, the workshop began. It was divided into four activities which are briefly described below.

Activity 1 – Exploratory Brainstorming

People formed groups of three with others that they had not met before. Each group received one of three colour-coded questions (see figure 4) The questions were aimed at eliciting concepts related to what participants thought would be necessary for an entrepreneurship program looking to benefit them.

How would you like to see CBR described in the future?

Which opportunities would help young and creative people?

Which networks are required for young and creative people to flourish?

Figure 4: Questions to elicit concept generation.

Data generated through this exercise was analysed to detect key themes. These themes became the two axes of a conceptual map. Snippets of the resultant maps are provided in figures 5 through 7.

Figure 5: "How would you like to see CBR described in the future?"

Figure 6: "Which opportunities would help young and creative people?"

Figure 7: "Which networks are required for young and creative people to flourish?"

Activity 2 – Narrative Possibilities

Participants were asked to choose the concepts that seemed the most meaningful to them, forming a new group with people who had been given the two other questions. Their task was to draw on their previous discussion, constructing a narrative of how what they were envisioning could be made a reality. Three key narratives emerged from this activity – "Easy Start"; "Staged Learning"; and "Seasonal Innovation". These are described in figure 8.

THEME 1:

EASY START

A desire for Canberra to become the most favourable context for start-up activity in the country.

Opportunity to develop an easier start-up process, in terms of support structures and lowered regulatory burdens.

In addition, the hope was raised for a financial structure that provides support to low-cost ideas through "micro-grants".

THEME 2:

STAGED LEARNING

Recognise the unique educational needs of creative youth and their relative business knowledge and experience.

Emphasis was placed on the need for training to be delivered through a staged approach.

This extends to providing knowledge and experience of entrepreneurship as a viable career choice.

THEME 3:

SEASONAL INNOVATION

Incorporating natural themes into innovation. Participants expressed interest for creative-focused innovation festivals, exhibitions, and conferences occurring cyclically throughout the year.

Planning innovation activities in alignment with the city's distinct seasons, which recognising that innovation projects have a birth, or Spring, but also experience Winter, or closure.

Figure 8: Narratives to engage young creatives with entrepreneurship.

Activity 3 – Preliminary Messaging

The following activity was a group conversation aimed at determining how to best communicate these narratives to the members of the many communities represented in the room. The goal for this activity was to ensure that support of entrepreneurship among young creatives be perceived as relevant, desirable and accessible. There were four broad aspects discussed – "Considerations" or desirable outcomes; "Content" that messaging should include; "Tone" or nature of the relationship with the audience; and "Channels" or the means used to deliver the message (see figure 9).

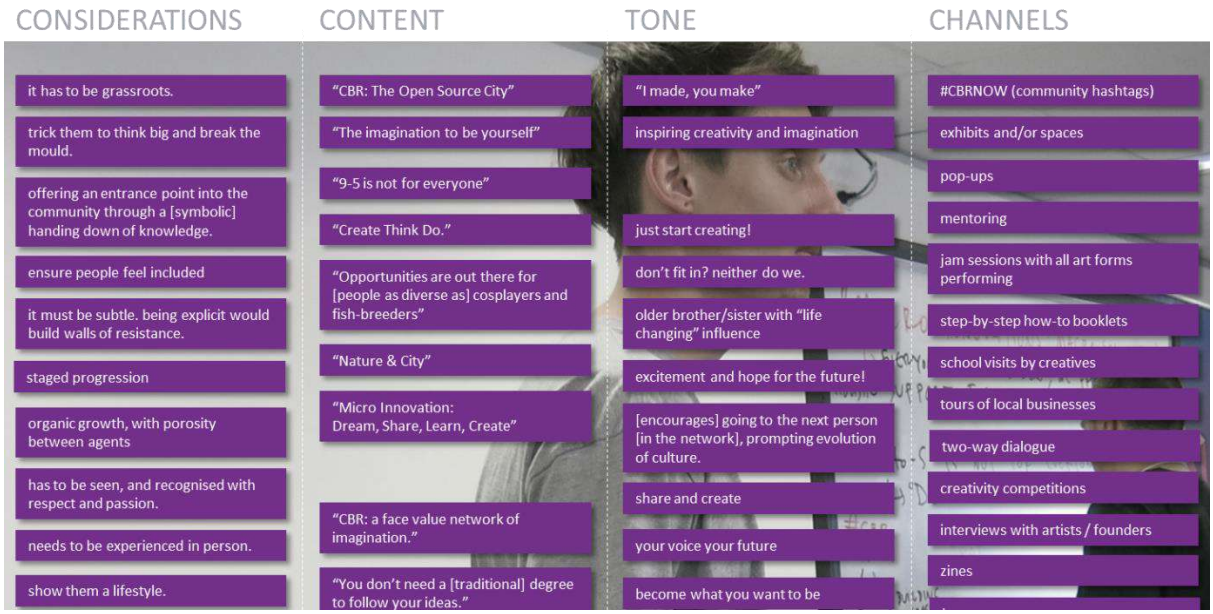

Figure 9: Narratives to engage young creatives with entrepreneurship.

Activity 4 – Online Community

The final activity set out to establish a way to continue the discussion after the workshop was over. This was not just to keep people informed, but also to present findings and involve them in development of the potential solution. The channel chosen for this purpose was a secret Facebook group. Community members were given the ability to nominate potential members. Once a nomination received a certain number of "likes", the person would be invited to join the "SHIFT ONE Crew".

Stage 3: Co-Designing a Solution

After transcribing hundreds of post-it notes, organising the data, and uploaded the results to the SHIFT ONE group, several interesting insights emerged. The most important were:

1. Young creatives are often very entrepreneurial. They do not, however, identify as such, and do not feel catered for by existing support initiatives provided by government or academia;
2. More than monetary support, many were interested in empowerment and personal development through education. They also wanted mentoring and business coaching for their projects; and
3. There was less interest in a "mass market" than there was in being part of one or more emerging "micro-collectives". Each of these represents a unique community with specific interests, which provides the validation and sense of purpose to the individual's work.

To begin developing a solution, the design team invited the SHIFT ONE Crew to participate in defining how these needs could be addressed. Proposed ideas were put up for a vote by members of the community. One member of the group asked:

> *"What if people could upload an idea, and if it gets a number of votes, then they get some money to make it happen?"*

This resonated with the design team lead, as it reminded them of "LEGO CUUSOO" (CUUSOO, 2014), now known as "LEGO Ideas" (LEGO, 2019), which they had encountered while in Japan in mid-2014. It led to an interesting series of questions, including: What does an incubator for young creatives look like? Does it have to look like every other incubator? Can it be something completely different? Could it be completely online?

These questions led to the following concept:

> *"An online incubator that could guide the young and creative through stages of learning, developing an entrepreneurial mindset and helping*

them to structure and present a business concept.

Projects submitted would be evaluated and voted upon by the public, incentivising a positive attitude towards sales and encouraging the project creator to obtain feedback from their target audience.

At the end of a season, projects with the strongest crowd response would receive a microgrant to help with their execution. After the season, grant recipients could share their stories and motivate the next generation of project creators.

This concept was presented to the CEO of CBRIN, receiving support and resources for execution. The concept was presented to the SHIFT ONE community, who were invited to participate in development of an "Online Micro-Grants Incubator for Creative Youth". The design team reserved some of the budget to remunerate those that chose to remain involved in the form of "consulting fees". Four project teams were formed, working interdependently on specific aspects of the solution. The project lasted seven weeks. Below are brief descriptions of each team and some of their key findings.

[Ed] Education Team: "Make it easy to understand"

This team included people with skills and experience in education. They worked on translating concepts from the Business Model Canvas (Osterwalder & Pigneur, 2010), with the goal of making the framework accessible to people non-business backgrounds.

[Ev] – Events Team: "Make a splash at existing events"

This team counted with the participation of people with experience managing venues and events. The key takeaway from this team was to leverage existing events in the city. This led to a presence at Art, Not Apart (Art, Not Apart, 2019), exposure to thousands and a social media following of over 750 people in one day.

[Ux] – User Experience Team: "Make a clear story that people can follow"

This team brought together people from the worlds of code, design, information systems and game development. Although their role seemed technical, the team included a film-maker who focused their efforts on establishing a clear narrative for the different user groups - project creators; voters, sponsors, etc.

[Br] – Branding Team: "Why don't we call it Stir?"

This team drew people from design and marketing backgrounds and was the last to meet. This ensured that they included the insights from the other teams. The name emerged as a perfect description of what the platform was looking to achieve: To mix things ups, to awaken people from slumber, and to create a murmur among the crowd.

The findings from these teams set the requirements for what would become the Stir platform. Although it evolved over time, figure 10 describes the platform's core functions at the peak of its lifecycle.

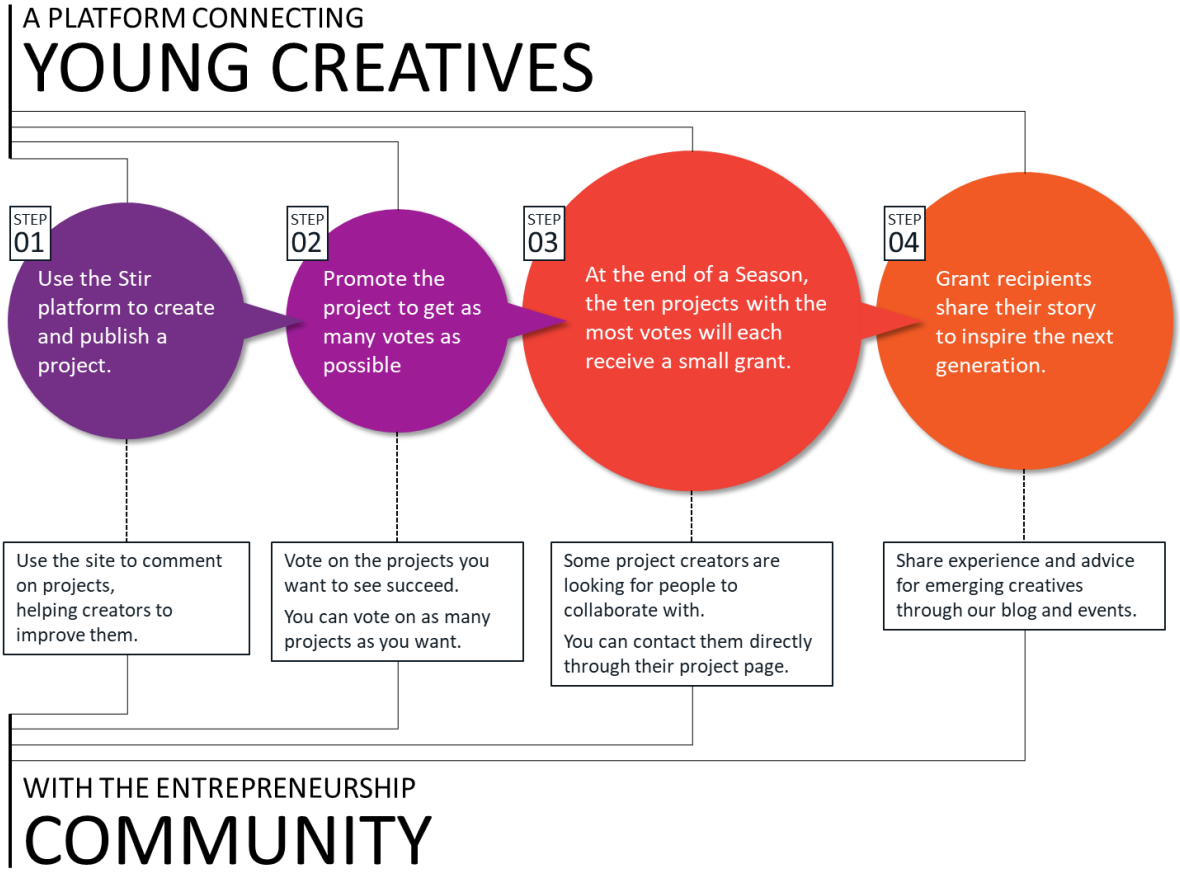

Figure 10: Overview of the Stir process at the beginning of Season 3.

Between launching on the 26th of March, 2015, and the close of Season 4 in early June, 2018, Stir ran 6 grant seasons. These included four major seasons and 2 shorter summer seasons. Seasons lasted approximately 50 days. During this time, over 13000 people registered to the platform, uploading close to 200 projects and submitting 12629 votes that determined who would receive a micro-grant. 57 individual grants were delivered, totalling AUD51000. The platform was visited 82747 times, with over 250000 pageviews. These numbers, although not large by global standards, were significant when taken in the context of the 403000 people that live in Canberra, Australia (Population Australia, 2019).

Although now defunct, Stir represented a shift in the scope of what was achievable by entrepreneurship programs in the Australian Capital Territory. Its reach was larger than the standard set by other local initiatives. Although it did not support high-tech, high-growth start-ups, it provided an avenue for underrepresented communities to feel their work was important and their passions were worth pursuing. Figure 11 includes some of the logos of the projects Stir supported. While many of the projects have since been discontinued, people who participated in its initiatives have now become embedded in the local ecosystem as founders, consultants, contractors, support service providers and community managers. It was a platform that, like its name, caused a stir.

Figure 11: Logos of some of the projects that Stir supported throughout the years.

Part 3: The Key Learnings

The process of engaging with the local community in the definition and development of the "crowd-voted grants platform" provided several key insights and lessons for a collaborative design process.

These lessons are specific to a context where the team was working towards establishing a common ground between two groups with very distinct values, goals and accountabilities. In this case a government agency and representatives from multiple creative youth communities, with the purpose of supporting increased participation of an underrepresented communities in a growing entrepreneurial ecosystem

There were many lessons derived throughout the project's four-year lifespan. Most of these were incremental and happened on a daily basis. It would be hard to capture all of these lessons in writing here, but it was possible to derive some themes that encompass these learnings. This section will outline some of those lessons and highlight some considerations for co-creation. It will also include personal observations and challenges derived from the experiences of the team executing the project.

Lesson 1. The Common Struggle

Engaging underrepresented communities in a collaborative design process requires an authentic understanding of their "common struggle", or the challenges they perceive themselves to have faced throughout their careers. In the case of creative youth, many expressed feelings of having been exploited by the business world, either through low wages, poor treatment or working for "exposure". For the Stir project, it was important not to trivialise these experiences. With a background in the creative industries, the team shared some of these experiences. This common ground between the team and the community that was emerging from the project led to strong ties and commitment between the two groups, which increased mutual respect, trust and willingness to contribute to the project. When deciding to undertake a collaborative design process, it seems that an important factor for success would be a genuine connection between the facilitating team and the target community. This will avoid tokenising the audience and could increase their sense of ownership as they see themselves reflected in the team that is supporting the process.

Lesson 2. Choose a Side, Start a Movement.

Without having experienced the aforementioned "common struggle", it was difficult for the parent organisation to understand the interests and concerns of the community of creative youth that were participating. Although they provided significant support and had a genuine desire to connect with the

creative youth community, they did not fully understand some of their challenges or aspirations. Some of this stemmed from a deep misalignment of values between the Canberra Innovation Network, a government entity set up in collaboration with academic institutions and private entrepreneurship support services – whose goals were associated with stimulating economic activity – and a community of creative youth, many of whom were interested in personal achievements such as exploration, expression, and recognition. To ensure the support provided was genuine, the team had to take a stand for the community on numerous occasions, articulating their interests and avoiding these becoming second to the institution. When undertaking a collaborative design process, it would seem that an important first step is to surface the values and principles of the community that is participating. It would be important to recognise which of these are non-negotiable and why, discussing these with both the community and any funding or supporting organisations early in the project. Establishing the central values of the community can help in ensuring that the parent organisation does not inadvertently make statements or take actions that could compromise the relationships that are being constructed.

Lesson 3. In Collaboration, Design can be the Mediator

Although the team strongly advocated for the interests of creative community to the parent organisation, it was equally important to advocate for the interests of the parent organisation. The team acted as facilitators and mediators between the two stakeholder groups, highlighting that the funding parties did not have an ulterior motive that played into the young creatives concerns about exploitation. For this purpose, the team also invited members of the parent organisation to participate in events and activities organised by the members of the creative community. The leadership of the organisation responded admirably, attending these activities with their families, enacting the support and earning the trust of those they were aiming to support. Eventually, this led to members of the community having the confidence to have their own conversations with the upper management of the Canberra Innovation Network. A key aspect of collaborative design processes would therefore be to not only involve the target audience, but also encourage the participation of “upstream stakeholders”. They should not just be seen as funding parties to be reported to, but where possible, involved as equals and get directly involved in developing the solution.

Lesson 4. Recognise the Value Inherent in your Target Audience

A surprising lesson learnt by the team and the parent organisation was that many young creatives had experience in many business functions, including accounting and sales, due to the self-reliance which is prevalent in their industries. A clear example of this were members of the community who were independent musicians. This observation made it clear that much of the messaging targeting these groups and encouraging them to get involved in business-related activities was inadvertently both condescending and not relevant to their stage of development and experience. Thinking of them as “at risk” will not benefit either party. The creatives did not just want to “start-up”, they wanted to grow, learn and develop the capabilities they already possessed. When developing a program for an underreported community, it would seem important that the offerings, language and messaging begin by recognising the existing achievements of the community they are intended for. In the case of young creatives, they will be entrepreneurial with or without the support of the existing ecosystem. Rather than framing support as a “handout”, it could be more effective to frame it as an invitation to collaborate and an exchange, where the target community is bringing their valuable existing knowledge and expertise to a context that will also benefit.

Lesson 5. Meritocratic Cultures may be Less Democratic

Distributing corporate funding to young creatives is difficult. They do not seem to be motivated by the funding itself, but rather what the funding enables them to achieve, and what obtaining said funding signals to their peers. Making it easily accessible through a democratic method such as “crowd-voting” does not make it more attractive. They seem to prefer the sense of accomplishment that comes from being selected for a grant. For this purpose, it may be beneficial to identify people whose opinions the community respects and invite them to be part of the decision-making process. Offering these individuals some form of “weighted votes” could have assisted in attracting the more meritocratic members of the creative community.

Lesson 6. Designers are Great Innovators, but may be Mediocre Administrators

The hardest lesson learnt by the design team was that they were uncapable of managing all of the functions required to achieve economic and institutional sustainability for the project. The collaborative design process itself was simple, and the team were comfortable with many aspects of an innovation process – identification of the opportunity; setting a vision; recruiting the community; generating excitement; developing the product; obtaining traction; and presenting clear value propositions to potential funding parties. However, it was not long before basic administrative duties became a burden. Accounting and other simple business activities were less familiar than dealing with uncertainty, leading to high levels of stress and animosity within the team. It would seem that increasing the chances for sustainability of the project would require a more diverse, multidisciplinary team that includes specialists in basic business functions. The challenge is in recognising one's own limits and ensuring that they can be overcome through collaboration with either the parent organisation or the community itself, as these two groups are the ones with the greatest potential to benefit from the longevity of the project.

We hope that these six themes can provide some guidance for people conducting similar collaborative design projects. Our greatest hope, however, is that people are inspired to contribute to increasing the number of creatives participating in the global entrepreneurship ecosystem. In a world of growing "gig economies", the arts will be needed to ensure that these gigs are humane.

Acknowledgments

The authors would like to thank Dr Sarah Pearson and Petr Adamek, leaders of the Canberra Innovation Network, for their unwavering support in seeing this project become a reality. They stood up to boards of directors for it to receive funding, and that is something that few people in their position do. They would also like to thank the Canberra Innovation Network team and the broader Canberra ecosystem for their enthusiasm and participation. Most of all, they would like to thank the SHIFT ONE Crew and all of the creatives who contributed to the platform, uploaded a project, and/or voted to support others. You inspire us.

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Research Perspectives IN THE ERA OF Transformations

System Design for People Dealing with the Liminal Space: Case Study: Family member that Take Care of Terminally Ill Family Member in Israel

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A 23% increase in the number of family members that find themselves as care providers has been documented throughout the last decade. In 2017, more than 1.6 Million people in Israel (18%) are defined as 'caregivers' to family member.[1] In Israel, approximately 70% of yearly death cases are from terminal illness (Elizera, 2018).Accompanied is a family member who accompanies any terminal ill family member at some time during their illness.[2] This project examines a system-design solution for the helplessness and obstacles that the Accompanied experiences. This project combines qualitative methods and human-based design. Based on the findings, three prototypes were developed using a participative graphic experience map and the co-design of illustrated storyboards.[3] These prototypes were presented to senior caregivers in healthcare system and to a nursing manager of one of the biggest hospitals in Israel. This project found that the most efficient service for alleviating the Accompanied's helplessness is a Case Facilitator (CF) who has expert knowledge of the health bureaucratic system and Interpersonal skills. The CF will escort the Accompanied during all critical situations throughout the process. This system-design solution could also solve similar problems for any person who find themselves dealing with liminal bureaucratic spaces.

Keywords: Death, Service design, System design, Liminal space, Palliative care

[1] Israel Central Bureau of Statistics, 2016
[2] Accompanied was the chosen terminology to differentiate from 'care givers' which is the professional terminology of someone that get paid for doing this including changing diapers for example. The accompany family member usually choose the tasks they are able to do, sometimes changing diapers are not included in it and there is an addition professional care giver that get paid to do it.
[3] A storyboard is a series of simple illustrations that demonstrates an idea through visualization; if needed, some words are added.

Figure 1 Accompanied's feelings expressed visually

Introduction

The aim of this project is to make things easier for the Accompanied. In this project, I use Accompanied to refer to a family member who accompanies any terminal ill family member at some time during their illness.

My motivation is based on personal experience. During 2017, I accompanied two terminally ill, family members. Unfortunately, caretaking duties will reach us all. This research can apply to terminally ill individuals, elderly parents, or children with disabilities. In this project, I focused on families with a terminally ill family member. There is a lack of research on the influence of the imposed responsibility on the Accompanied.

We repress end of life issues. We are afraid of "the impossibility of further possibility" (Yalom, 2008, p. 59).[4] This is one of the reasons why there are no answers for end-of-life challenges. There was an art still life trend, *memento mori*,[5] the purpose of which was to remind us not to forget that one day, we are going to die. Knowing about death will help us deal with it when it arrives and will help us to live better lives.[6]

Caring for family members has several aspects. There are psychological aspects, including the fear of death, medical aspects include palliative care, and taking care of patients' pain and suffering when the "battle against illness is ended" (EE).[7] Along the many aspects of end of life process, families face ethical and legal limitations, together with social, spatial and cultural considerations. There are bureaucratic systems to be dealt with, which include duplicate services for the Accompanied in many organizations. Finally, we must consider what happens to the Accompanied and their support system after the death of a terminal ill family member.

This research utilized qualitative methods, including 20 interviews[8], three observations[9], two conferences, and self-documentation. The literature review included[10] 24 articles, 26 websites, 19 media resources, 23 blogs and journals, and four books.

One of the Accompanied duties is to ensure the quality of life of the terminally ill family member, despite their limited life expectancy. CF's purpose is to allow Accompany to do it. One of the CF's functions is being with Accompanied in the obscure liminal space where there is no clear responsible service provider. The liminal space is "when you are between …if you are not trained … how to live with ambiguity…" Richard Rohr (Barron, 2013). CF recognizes liminal space potential and with this knowledge, the CF will be able to provide the most accurate and holistic service that the Accompanied needs. The CF will help the Accompany "…tolerate the anxiety and develop the faith that things will take shape" (Barron, 2013).

[4] Yalom quotes Heidegger
[5] Some examples in Appendix A
[6] From Tibetans wisdom chapters
[7] See Informants layout Appendix B
[8] See Informants layout Appendix B
[9] See Observation layout Appendix C
[10] Right for July 2018

This potential solution could help the Accompanied during and after the accompany process. This solution has been tested and approved with Accompanied, end of life social workers, palliative care nurses, and hospital manager. Nevertheless, actual pilot program is still to be conducted.

The CF system design solution, may be found useful not only in this case of Accompanied terminal ill family member, but also in many scenarios in which people find themselves lost in liminal space, such as parents of disabled children, the unemployed, migrants, and children to elderly parents.

Literature Review

The purpose of palliative care is to maintain the quality of life and prevent suffering for terminally ill patients. Today's updated palliative care field is meant to maintain the quality of life and prevent suffering for all patients.

This project can be included under the third sustainable development health care goal of UNA 2015-2030 ((UNA) The Sustainable Development Goals 2015 – 2030, n.d.), to "ensure healthy lives and promote well-being for all at all ages." It could be also included under 2018 trends, such as "precision treatment " (PSFK Future of Health 2018 Webinar, 2017), to create the most accurate personal treatment to suit each patient's lifestyle.

The 2018 trends relate directly to the patient. They show the beginning of the understanding that patient treatment is complicated and requires additional involvement besides the medical professional team. The unprofessional caregiver, Accompanied, is missing from these trends. In Israel, "the patient is not hospitalized alone;" (LW) the family members tend to stay in the hospital during the hospitalization time.

This literature review contains academic articles, media resources such as TED and YouTube videos, documentaries, and family radio programs debating end of life issues. It also includes information from participation in two conferences—one about palliative care, and the other about end of life ethics issues.

This chapter will review the main issues that were found in the literature review. These are:

1. Making death a dignified end of life
2. Legislation
3. Palliative care
4. Place of death
5. Contact with the bureaucracy system
6. Multiple non-profit organizations
7. Family physician status
8. The joy of professional caregivers

1. Making death a dignified end of life

According Epicurus, suffering is the continuous fear of death (Yalom, 2008). Physicians are not trained to stop searching for healing options for their patient (Gawande, 2014). Hospitals are designed for diseases, not patients. In the video *What Really Matters at the End of Life* (What Really Matters at the End of Life | BJ Miller, 2015), BJ Miller proposes "to invite design thinking to this subject (end of life)," as there is a lack of attention to the design of palliative care medicine. Some physicians are not exposed to this field during their studies. BJ Miller is a palliative care physician who criticized hospital design and invite designers to redesign hospitals based on the thought of how they would like to die.

Palliative care nurses find that death is a process, like birth (What Hospice Nurses Know: Dying and Afterlife Questions and Answers with panel, 2014), and not an event. So, how might we turn death to a dignified end of life (LiLach, 2017)? How should we prepare for death, as eventually all of us are going to die, and there is no second chance to be prepared to die (Every one will die once so we have to get it right, the first time, dying at home - The Feed, 2016)? Based on the literature, palliative care nurses have the tools and abilities to turn death into a dignified end of life.

2. Legislation

The definition of terminally ill in this project was any patient that will die from their disease. For example, this project includes the Accompanied of patients with chronic diseases (Kol Zechut, n.d.), different stages of

cancer,[11] and ALS[12]. The definition of terminally ill is flexible and depends on medical development. During the 80s, HIV was defined as a terminal illness (al, Volume 14, 2002 - Issue 5, Pages 587-598) until the development of medical treatment.

During 2017-18, some laws were updated in Israel, including benefits for the Accompanied, but most of the Accompanied are not aware of laws existence (RL).

3. Palliative care

Palliative care, as one nurse said, is "specialized with the dying" (Nurses on Death and Dying, 2016). Professional palliative care accompanies the patient by guaranteeing their quality of life as much as possible until their death. Professional palliative care uses different tools, such as listening (Starkman, You do not have to hospitalize: the doctor who brought treatment to home, 2018), guiding family through the process of forgiveness, observing the patient without judgement (What Hospice Nurses Know: Dying and Afterlife Questions and Answers with panel, 2014), accompaniment rather than treatment, preventing patient loneliness, and servicing patient needs—"we just travel him" (Dying at home - The Feed, 2016). These tools can also be used by the Accompanied. The support volume of palliative care will be based on the patient's disease stage, including after patient death.

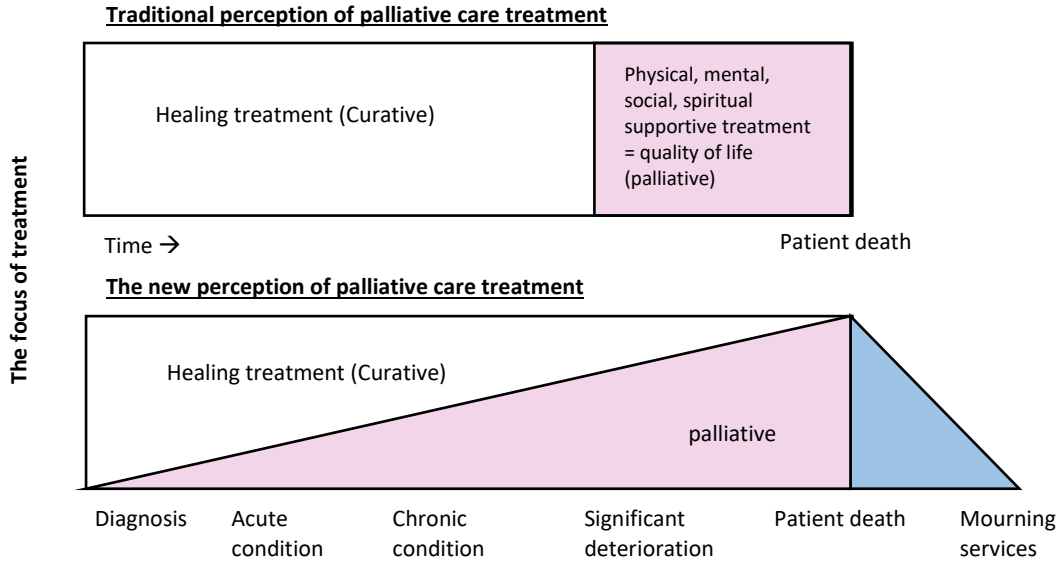


Figure 2 Traditional perception of palliative care treatment (top) versus new perception (bottom (Bentur, 2005))

[11] Only cancer stage four is defined as terminal.

4. Place of death

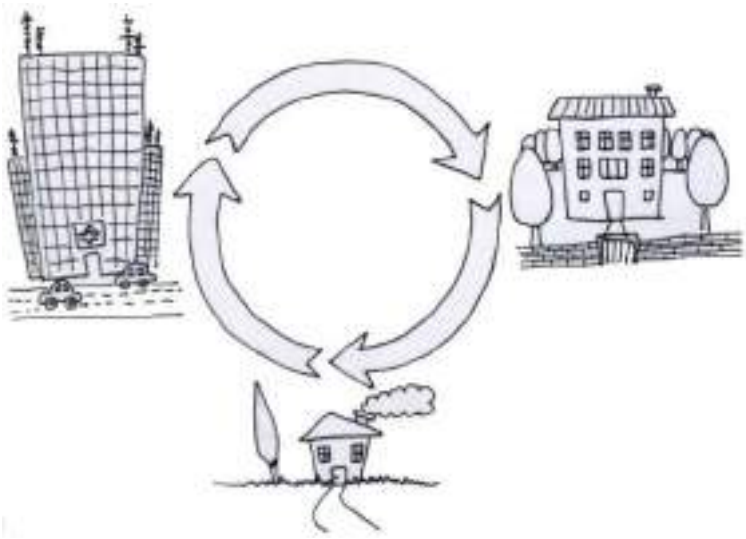


Figure 3 The place of death circle of changes: from home, to the hospital, to the hospice, back to home

In the past, the whole circle of life occurred at home. The exposure to death was extremely high (Molloy, 2015). Today, most people die at hospitals, although some choose otherwise.[13] When death is not easily visible, the exposure to it is low. This is one of the reasons that people are afraid of death.

5. Contact with the bureaucracy system

Caring for a terminally ill family member requires involving several authorities such as: healthcare, social systems, municipal services, religion, and medicine. There is a lot of paperwork required to coordinate between these functions. The services needed by the Accompanied are located in the liminal space created between the responsibilities of all authorities' services providers. There is no sole entity that has budget and staff to provide the holistic accurate need of the Accompanied. Instead of working effectively with the Accompanied, when the healthcare system and the authorities are most needed, they are adding difficulties.

Daniel Blake's (Loach, 2017) neighbor told him that the system will kill you. Does the system aim to kill patients more quickly, or is doing paperwork an escape option for the Accompanied?

6. Multiple non-profit organizations

Many organizations aim to support patients and their families, yet many organizations provide similar services.[14]

The Accompanied has various organizations that can help them. Duplicate organizations, however, can cause a waste of resources on both sides. One organization supplies multiple services that can be supplied by other organizations, instead of providing a unique service.[15] The Accompanied wastes precious time figuring out the differences between identical services supplied by different organizations.

7. Family physician status

Why should not the family physicians be their patients case manager? The family physicians will accompany the patient from the first news of terminal illness until the end. Family physicians are familiar with their patient's medical history. The family physician can connect different authorities and healthcare system

[13] For example, in Australia, 70% of patients choose to die at home (Dying at home - The Feed, 2016), while only 14% actually died at home; more than half of patient are dying in hospitals. In the USA (Gawande, 2014) only 27% of patients died at home, which is high, because most of these patients did not have time to reach the hospital.

[14] For example, one organization was established in 1990 to help cancer patients between the ages 0-25 and their families. Another organization was established in 2009 with exactly the same purpose.

[15] Multiple organizations→multiple services→resource waste→missing knowledge

information. “Incidents are not usually caused by a single decision or action… it is caused by dynamic interactions between people, tasks, technology and working conditions… management, policy, regulation…” (SystemsThinking - A New Direction in Healthcare Incident Investigation, 2017). Healthcare incidents are the third cause of death in world (Mozer, 2018). “In a perfect world, family physicians should manage patient cases and needs” (Levi, 2018). Family physicians connections will prevent incidents and help provide better service to the patient and the Accompanied (Reznik, 2017).

8. The joy of professional caregivers

Professionals palliative caregivers, although their professions expose them to death with great frequency, were found to be satisfied and happy people. “I think I am one of the happiest physicians in the world” (Nir, 2013); “we are all happy” (Steinmatz, 2016).This happiness was found to exist across the field; every professional caregiver I spoke with expressed their satisfaction despite the difficulties.

Research layout

This research used human-centered design management tools to find how the Accompanied can use their limited resources to improve the quality of their lives. The field research was based on qualitive tools such as interviews, observations, and seminars.

1. Informants

Professional informants were chosen for research. These included social workers, psychologists, physicians, and palliative care nurses. Nonprofessional informants included the Accompanied, volunteers in an organization that transfers information to elderly patients, researchers in this field, and company/application founders. Informants layout include 20 interviews.[16]

2. Observations

Three observations[17]of an up-to-date medical information center, a medical center oncological day care center, and a hospice were done. All observations included interviews.

3. Research Limitations

I could not interview the Accompanied mainly from ethical reasons. In addition, the Accompanied denied any connection to terminal illness. As long as the patients were alive, they maintained a hope that it was not terminal. Further research needs to be conducted to evaluate the proposed solution viability and integration with local systems.

4. Stakeholders

Hospitals, workplaces, health insurance and healthcare systems are the project’s central stakeholders.

5. Prototype

Mapping[18] and analysis of overall research findings suggested that the following five insights are the most critical for the Accompanied:

1. Diagnosis of terminal illness
2. Overwhelming information
3. Confronting bureaucracy
4. Release from hospital crisis
5. The kick (IR), 17 days on average (Nir, 2013), before death

[16] For Informants layout table see Appendix B
[17] See Observation layout Appendix C
[18] See Appendix D

At the last point, when the physicians announced there was nothing else they could do, they had the patient choose between hospital hospice and home hospice. Time limitations forced the Accompanied to use their resources efficiently.

Focusing on this point shows that many changes are required for patient home care. A two-room apartment was drawn and shown to the Accompanied. They[19] were asked to state which changes needed to be done to make the apartment suitable for home hospice. It was found that:

1. Home hospice is not available for all and required a special setting
2. Part of the information on how to prepare for home hospice was known retrospectively
3. The kick can be softened by advance preparations
4. Getting the sketch done by a professional made it possible for the Accompanied to prepare their home

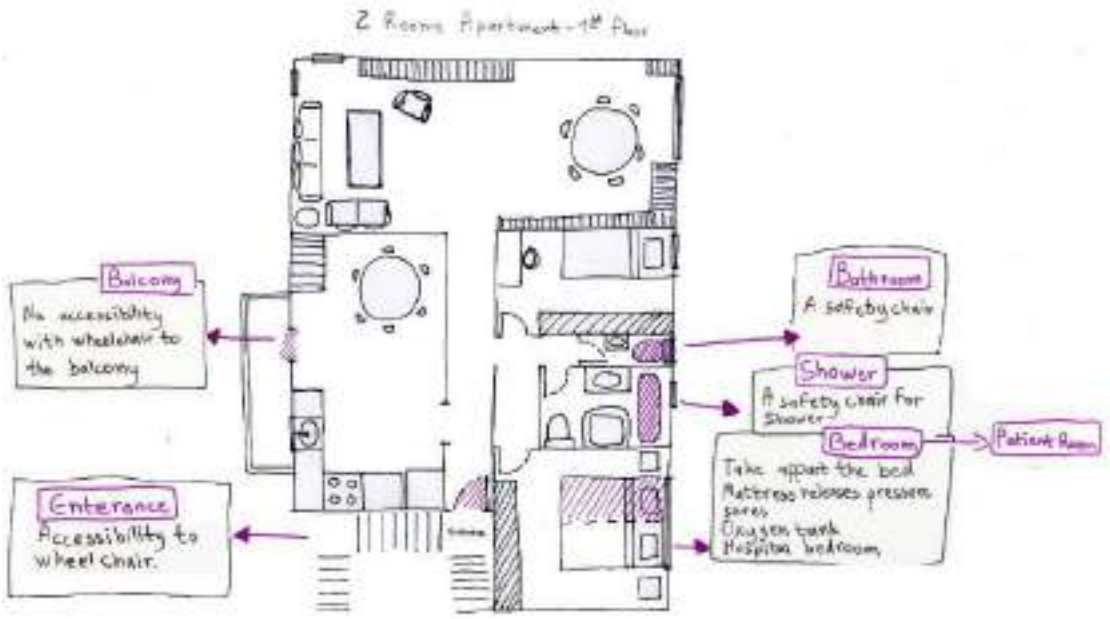


Figure 4 Prototype apartment sketch based on field research

[19] They already finished being Accompanied due to the research limitations mention above.

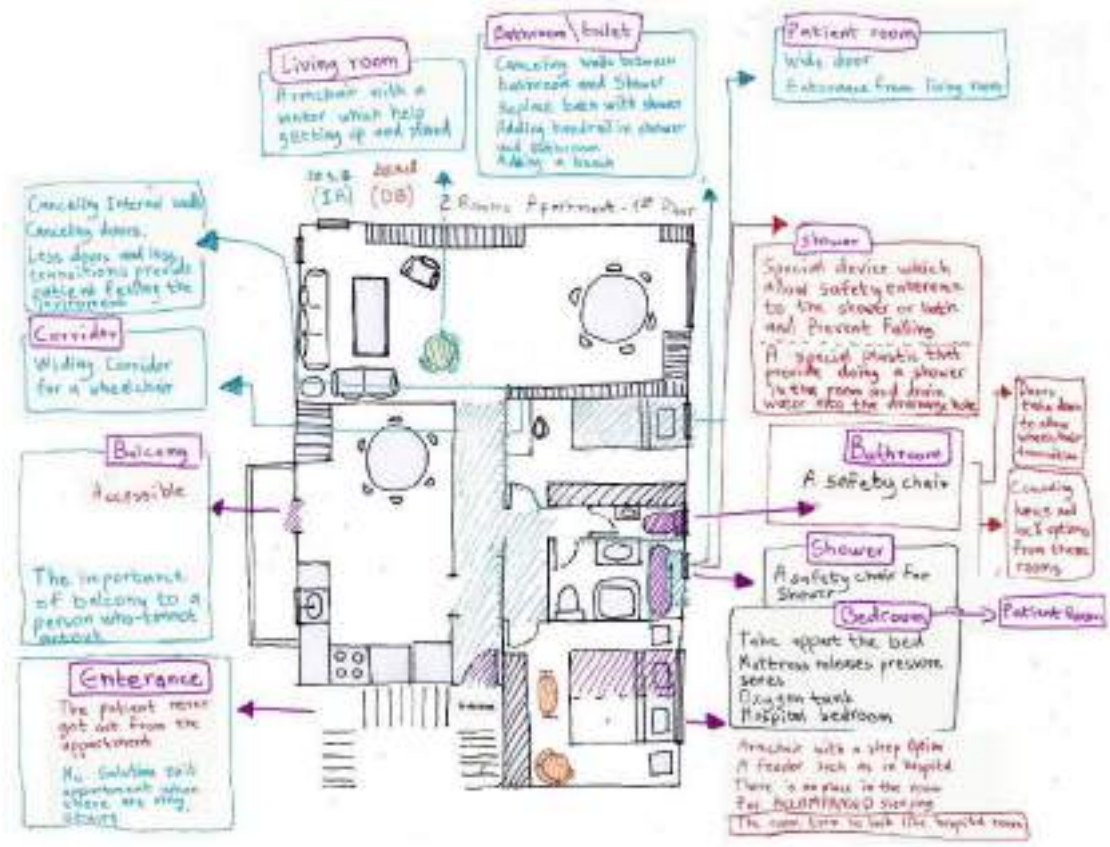


Figure 5 Prototype apartment sketch with Accompanied notes

Three different prototypes were made during this project. Two of them are detailed above.[20] The last prototype was multiple storyboards strips[21] which were presented to the informants. The methodology behind the storyboards is the visualization of informants in a familiar situation, which allowed them to freely express their thoughts, which created deep insights.

Five storyboard strips were presented to the informants. Each of them showed one critical pain point. These storyboards were presented based on a chronological experience map. They were presented to five informants in four interviews.

Selected Research Findings

1. Caregivers make up a quarter of the labor market in Israel (RL)

The term caregiver refers to any family member that takes care of the elderly, ill, or disabled. This project refers only to the Accompanied.

25% of employees are caregivers (RL). 60% of them hide the fact they are caregivers. 3.7% of them quit their job. “Based on USA data, caregiver employees cost $3,000 to the workplace because of absent work days, quitting their job, recruiting, and training new employees” (Saragusti, 2017). Most caregivers are around 45 years old, the peak of productivity (Saragusti, 2017). In the last decade, caregiver numbers rose by 23%.[22]

The Accompanied reported that they were occupied with patient care during work hours. “Being a caregiver is an additional career” (Saragusti, 2017). There are two ways to help the Accompanied:

1. Supply formal services, such a professional daily caregiver.
2. Supply services such as money or mental support.

[20] Experience map and apartment sketches
[21] See Appendix E
[22] Israel Central Bureau of Statistics

2. The Accompanied's status in the system

Being an Accompanied has emotional, health, economical, and social costs. It is not a role people choose. Most of the time, the Accompanied was given this role without any qualification or preparations.

There is no "one adjusted rule" for Accompanied (Reznitsky, 2015). Therefore, it is challenging to find one service that fits all Accompanied. "It is time to develop ethical rules to help the Accompanied to take their place in the medical decisions of their family patient. These rules should be adapted to state, community, and family values" (Reznitsky, 2015).

World trends recognize the special status of the Accompanied. In 1999, the UK declared a national strategy regarding the Accompanied (Brodsky, Reznitsky, & Citron, 2011). Role recognition opens an opportunity to provide holistic and accurate services. An example of how "a little service can support the Accompanied" (RL) is the Hertz pilot service.[23]

3. The liminal space between authorities add difficulties to the Accompanied

Hospital prescriptions do not contain enough medicine (IR); this is one of the issues with the system. There is no synchronization between different systems and authorities in the liminal space, such as hospitals and community healthcare systems (IR). The Accompanied spends a lot of their time filing papers and chasing signatures (OB). There is a danger that charlatans might use the system's weaknesses to gain unfair advantage or commit fraud.

4*. Family physician as a case manager*

The patient is surrounded by a professional team and the Accompanied. There is a need for holistically, effectively adjusted management. Family physicians are the most familiar with the patient and are able to minimize incidents during treatment. The system does not define the family physician as a case manager, but some family physicians act as case managers, despite not having the resources to do so (palliative seminar, 2017).

Due to the missing case manager function in the system, the Accompanied find themselves acting as case managers (ID). The Accompanied should not be case managers, since they do not have the required knowledge, experience, or understanding. The Accompanied should focus on accompanying their family member and not managing their case. The family physician should be the case manager. Israel Medical schools should include improved content about terminal patient care, including the Accompanied (DS).

5. Post mortem opportunities

After the death of the terminally ill, the Accompanied still need support (ID). Suddenly,[24] the Accompanied find themselves unoccupied. After death, they would use their free time to do good for future Accompanied. For example, developing an application with information for cancer patients (ID), providing information by volunteering (HB), and establishing organizations to supply caregivers' needs (RL).

These research findings supplied many opportunities. The challenge was to choose the best opportunity to fulfill most Accompanied's needs.

Project product

The case facilitator (CF) is a new professional. The CF will accompany the Accompanied from terminally ill diagnosis, through the liminal space between different authorities, up to and after death.

The CF will assist the Accompanied in using their limited resources in the most efficient way and will minimize the Accompanied's helplessness, especially when time is critical.

Goals

1. Maximize the accessibility of relevant information in the liminal space.

[23] Hertz drivers volunteer to transport disabled patients to their hospital treatment and back home. This service gives the Accompanied some breathing space.
[24] It will always be sudden, no matter how much you prepare for death

2. Minimize wasting time and money for the Accompanied and the system, especially when there is overlap because of duplicate organizations and services.

Mission

Israel healthcare system recognizes the importance of continuous treatment, but such treatment does not exist. There is a lack of hospital beds (RR), but it is forbidden to release patients from the hospital to home if their home is not adjusted for the patient's condition. The nurses are in a conflicting situation—if they release patients from the hospital, the hospital will save money, but they are not allowed release patients to non-suitable homes. It is not surprising when the current patient-nurse standardization is based on data from 22 years ago (RR).

Figure 6 Example of patient complexity (left to right): a man reaches to his 90th birthday; he may develop diabetes, walking issues, or/and damaged hearing, or/and be diagnosed with cancer

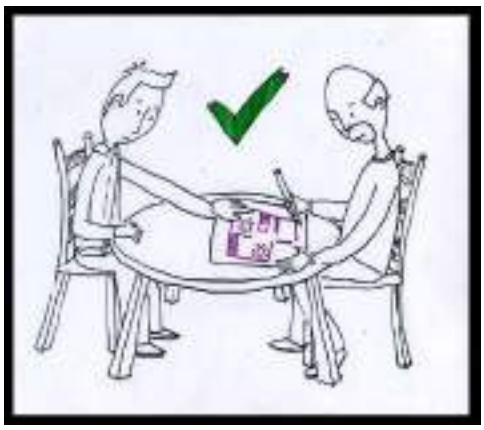
The solution

The Case Facilitator (CF) solution can help solve the complexity of Accompanied process.

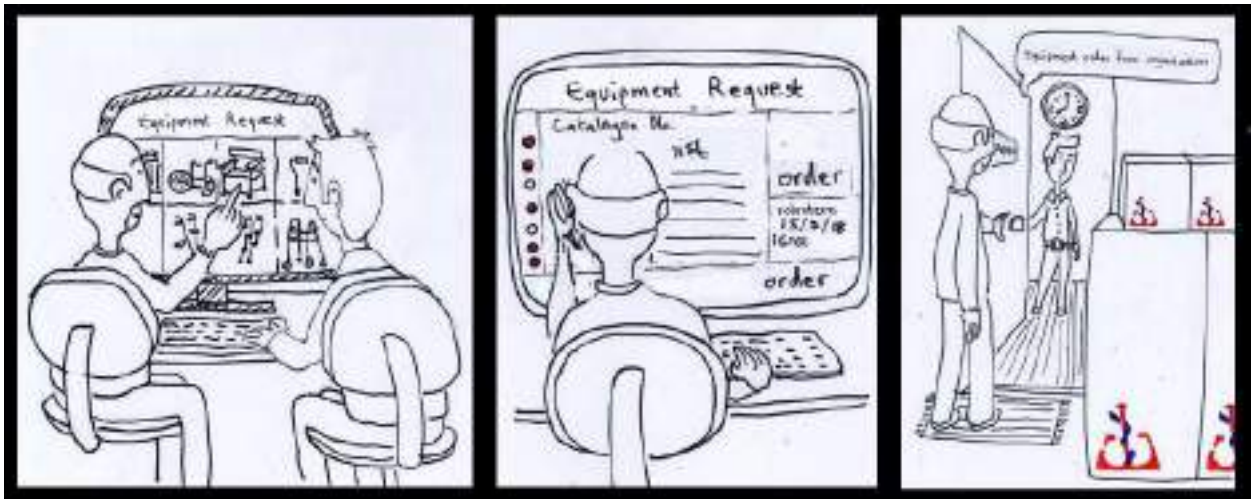
The CF is with the terminally ill patient family members from diagnosis. The solution will be presented by the following storyboard prototype. Let's join the CF, who is already familiar with terminally ill patient and family, during the 17 days (Nir, 2013) before patient death. The CF knows that this family could, with some arrangements, handle home hospice. The CF presents the two solutions, hospital hospice and home hospice, with their advantages and disadvantages.

As part of this presentation, the CF takes the family to visit a hospice and answers their questions.

In addition, the CF explains the home arrangements they need to make, based on CF familiarity with their home. The family chooses home hospice.



In coordination with the family, the CF orders equipment to make their apartment into a home hospice. The family receives the equipment order at home.



The CF checks the physician's prescription before releasing the patient. The CF is able to adapt the prescription with the physician and adjust the next 17 days. [25] This CF service prevents pharmacy visits by the Accompanied and lessens patient suffering. The CF collects the medicines.

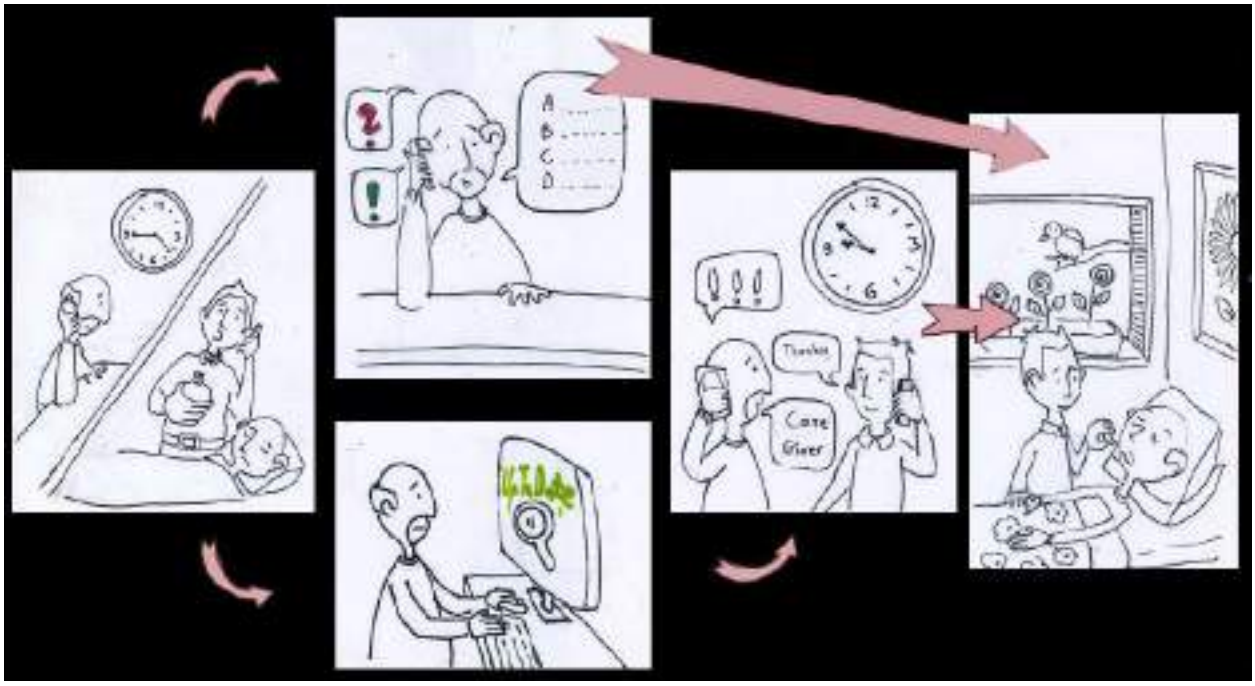
[25] 17 days on average (Nir, 2013), before death

The patient arrives at home. The CF guides the family in connecting the patient to their equipment. The CF leaves, reminding family that they are available for them around the clock.

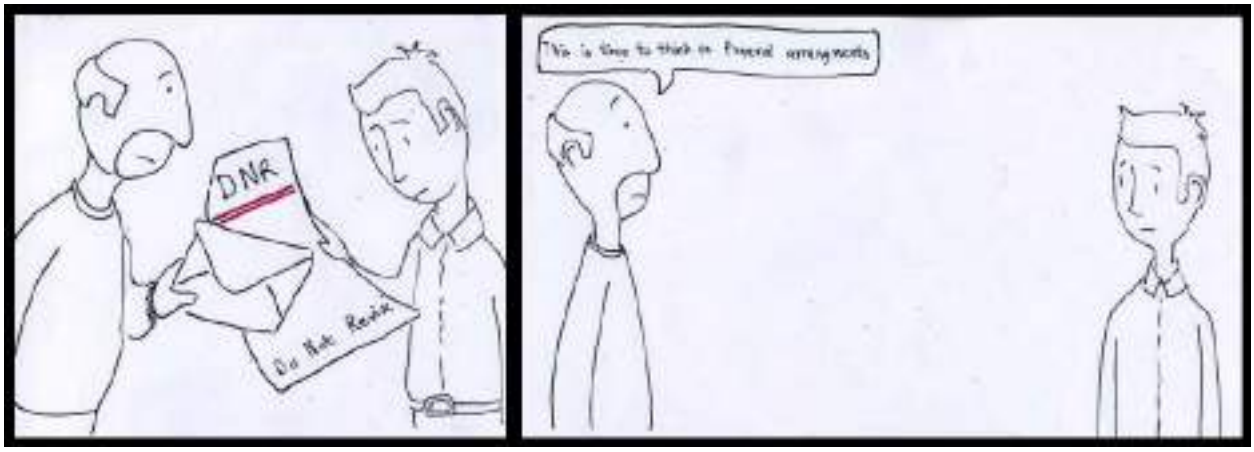
A few hours later, the Accompanied calls the CF about a medicine dosage issue. There are two optional scenarios at this point:

1. An experienced CF is able to guide Accompanied by asking the Accompanied a few questions.
2. The CF does not have the information, but knows how to get it and with whom to consult. The CF tells the family they will get back to them with information after consulting. The family is already familiar with such a scenario from the past, therefore they are not worried. After a few minutes, the CF calls the family with the answer. The CF uses this opportunity to remind family that the hospital hospice solution always exists if they regret choosing a home hospice.

This question and answer scenario occurs several times during these 17 days. If needed, the CF has backup from the CF center where they were trained.

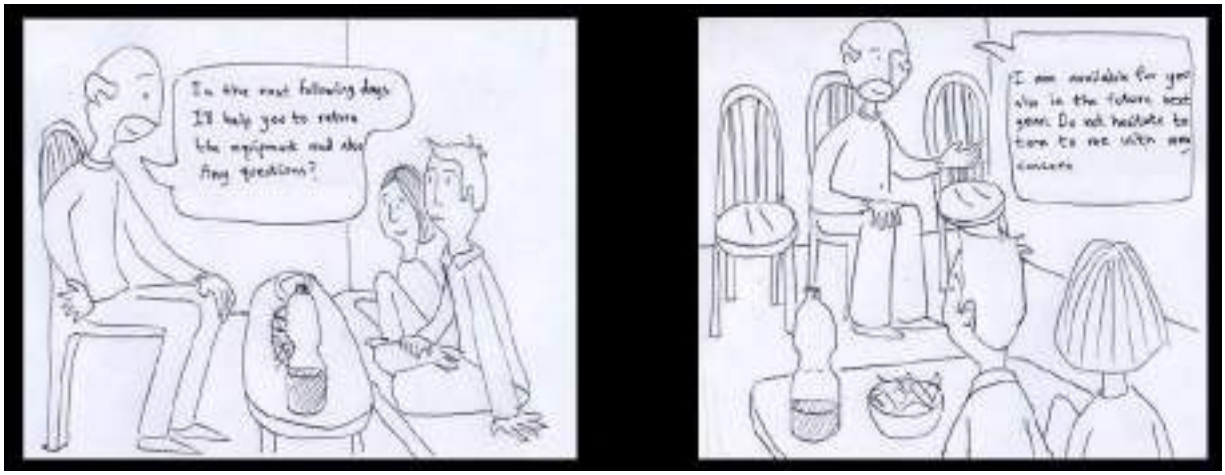


Based on the terminally ill patient's instructions, such as do not revive (DNR), the CF instructs the family on how to prepare for the day of death.



The day of death arrives. The family contacts the CF, informing them that the patient died.

The CF helps the family organize the funeral. Following the funeral, the CF visits the family, providing information about the following days, verifying that the family has what they need, and reminding them that, although the patient has died, they are available for them. As time goes by, the CF's accessibility decreases.



Product features

CF qualifications should be:

- Interpersonal skills
- Holistic view of the patient and family
- Knowledge and experience in systems and the liminal space authorities, such as healthcare, social systems, municipal authorities, religion, and medicine
- Ability to find missing information
- Life and health system professional experience
- Service consciousness

Following step

One of the CF solution's disadvantages is the additional factor in the liminal space, which already contains multiple authorities and functions. CF is a personal solution. Thus, it is not suitable for all. In fact, there are some advantages in dealing with liminal space (Barron, 2013) without CF. The aim is to experiment with the CF solution and to find a business model which answers the next questions:

- Will this service cost money or will it be free?
- Is it possible, based on current standardization in Israel, to supply this service?
- Which authority will be responsible for the CFs (budget and management)?
- Who will train CFs?

One of the biggest hospitals in the country, which has patients from different community healthcare systems and geographical areas—including patient from abroad—is willing to do a pilot.

If the CF solution is successful for the Accompanied, it could be scaled up to fit any person dealing with liminal space—for example, parents of disabled children, the unemployed, migrants, and children to elderly parents.

Summary

The number of Accompanied is on the rise. Literature and field research have found several pain points when dealing with liminal bureaucratic space –the space of transition, waiting, and not knowing (Barron, 2013). The authorities are missing the potential of providing Accompany needed services, although there are multiple national and local authorities, which would like to provide the in between needed service.
Accompany pain points include the diagnosis of a terminal illness, missing knowledge, and dealing with routine while accompanying a terminally ill family member up to, and after the patient has died. At these points, the Accompanied is helpless. Therefore, how can the Accompanied continue their routine without reaching a breaking point?

What will help the Accompanied? Will knowledge help? Or a specific person? Will the family physician as a case manager be the best solution, or other professionals?

The CF solution fulfills the project's goals. The CF will provide the Accompanied with the opportunity to maximize their limited resources. The CF solution was chosen because of the different levels of involvement potential throughout the entire process, rather than just the critical point 17 days before patient death (Nir, 2013). This is a holistic solution for all Accompanied pain points.

The CF solution was presented to the manager and nursing manager of the biggest hospital in Israel, and to a senior caregiver in the healthcare system. Research findings and the CF idea were approved by them. There is a similar solution for chronic diseases in the Ministry of Health work plan (Health, 2017; Health, Nursing administration 2017 work plan, 2017), yet it is not applied in the system.

The CF solution could help the Accompanied, who make up a quarter of the labor market,[26] by providing the needed "in-between" service that is most required at this time and moment by the Accompany. Authorities recognizing the Accompanied's liminal space experience, could use liminal space potential, for a better system service. The success of the CF in coordinating between systems and authorities, could be developed to other liminal space systems, which could solve many problems, for people who find themselves, dealing with the liminal space between many authorities.

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Appendix A

Some examples of "Memento mori" still life images

Philippe de Champagne (1602-1674), ***Still-Life with a Skull*** *(Champagne)*

Christian von Thum (1625-1696), Vanitas Still Life with Astronomical Instruments

Jan Davidsz. de Heem (1606-1684), ***Books and a Lute on a Table***

Appendix B

Table 1: Informants layout

Informants	***Profession/ Role***	***Age (Estimated)***	***Interview Date***	***Interview Place***	***Gender***	***Interview Duration (Minutes)***	***Interview Form***
YS	Psychologist	37	04.12.2017	Home	F	120	Frontal
DG	Director of legal clinic[27]		10.12.2017	Clinic office	F	120	Frontal
GK	Undergo multiple fertility	40	14.11.2017		F	60	Telephone
SR	Researcher	42	11.12.2017		F	60	Telephone
GP	Physician & ALS patient	45	22.12.2017	Work place	M	Few minutes	Frontal
HK	Manage support group of Accompanied	70	Dec. 2017		F	Few minutes	Telephone

[27] This legal clinic, opened in 2017, was a cooperation between; law faculty, the school of social work, and medical school. Because of budget issues, it was closed in July 2018.

OB	Accompanied for a year and seven months	35	Dec. 2017	Cafe	M	180 *	Frontal
EP	Pensioner & biology PHD	70	03.01.2018	Work place	F	80	Frontal
BP	Information librarian	55	03.01.2018	Work place	F	15	Frontal
ID	Application founder	40	04.01.2018		M	20	Telephone
RL	CEO & company founder	50	07.01.2018		F	120 *	Telephone
IR	Accompanied for four and half months	46	13.01.2018	Home	M	60	Frontal
HB	Volunteer in knowledge transfer organization[28]	67	16.01.2018		F	60	Telephone
EE	Hospice nurse	55	21.01.2018	Hospice	F	120	Frontal
AK	Hospice social worker	50	21.01.2018	Hospice	F	120	Frontal
DS	Physician & Medical education	50	16.04.2018	Hospital	F	90	Frontal
ER	Social worker & Manager	60	25.04.2018	Hospital	F	90	Frontal
LW	Oncologist social worker	45	25.04.2018	Hospital	F	90	Frontal
TE	Physician & Hospital CEO	45	19.06.2018	Hospital	F	30	Frontal
RR	Nursing & Hematologist	50	26.06.2018	Hospital	F	40	Frontal

(in two sessions)*

[28] This organization; responds to the needs; of the hospitalized elderly who are missing knowledge. Most of these elders, have language issues which make them helpless in the liminal space of their health and elderly rights.

Appendix C

Since missing information was identified as a weak point, I observed an information medical center—which is staffed by volunteers—to see how they handled information issues. This center provides up-to-date information on medical innovations, based on an UpToDate[29] database. The volunteers' role is to find the requested information and make it accessible, through knowledge or language, to any person who looks for this information.

Figure 7 The information medical center

The motivation behind observing oncologist day hospitalization was to see what the daily routine of the Accompanied and their patient looked like. The waiting room was full. Half of the people were Accompanied.[30] It was difficult and inconvenient in the treatment rooms and radiotherapy room.

Table 2: Observations layout

Observation Place	***Observation Date***	***Observation Duration (Minutes)***
Oncologist day hospitalization	24.12.2017	105
Information medical center	03.01.2018	105
Hospice	21.01.2018	240

[29] https://www.uptodate.com/

[30] Patients were recognized by hospital bracelet. They did not appear to be having treatment side effects.

Appendix D

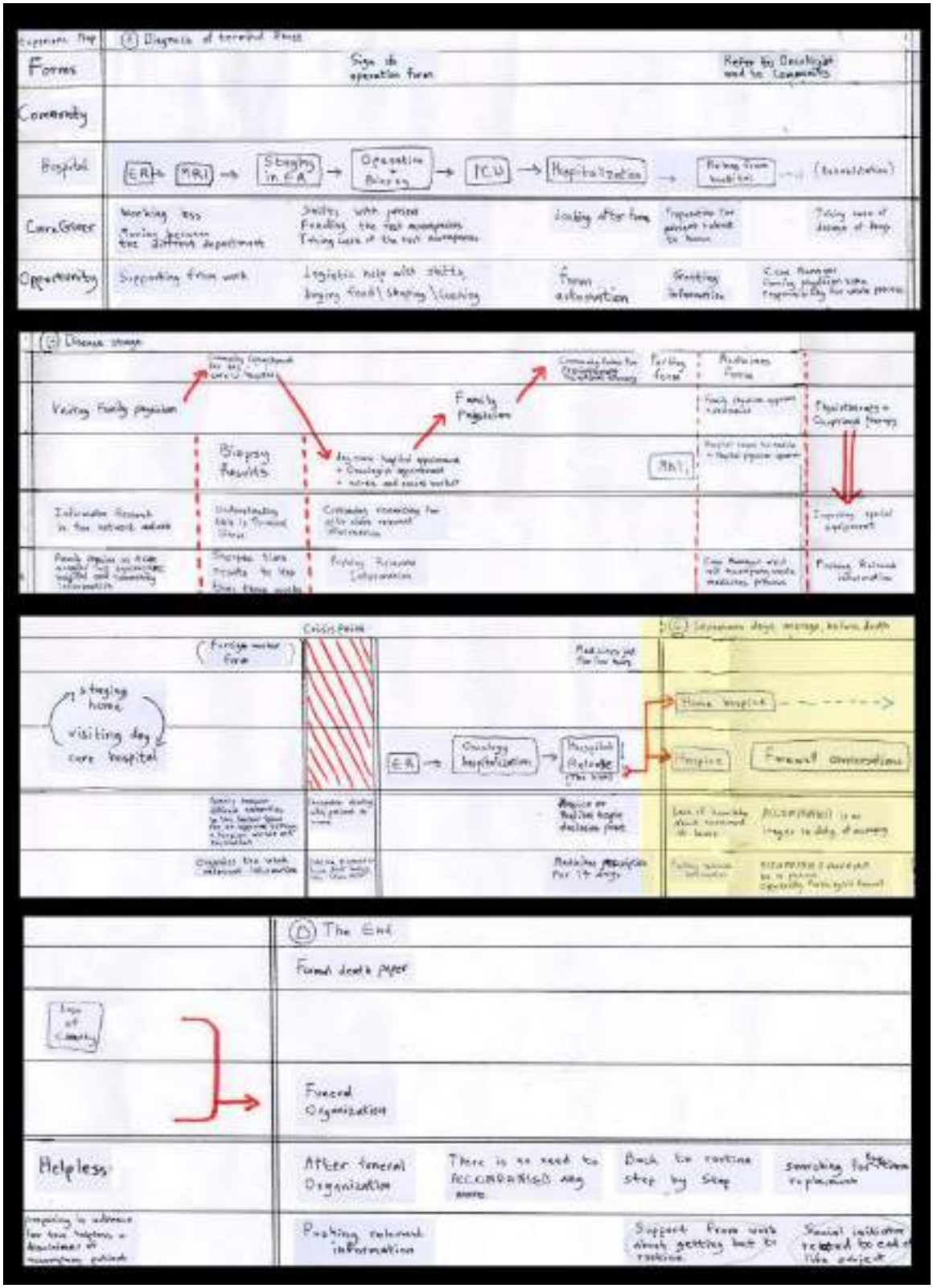

Figure 8 Full experience map (left to right), highlighted fifth pain point

Appendix E

Figure 9 Five storyboard strips; each is based on one pain point from the experience map

Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

'Project Kapıdağ: Locality of Production': A Case of Research for Social Design in Complex Collaboration

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Social design is a much-discussed topic in the context of facilitating change towards social ends. Growing problems in the social and political realm can trigger social change. In the last few years, Kapıdağ, Turkey has been stuck between top-down mass industrialization and longstanding local production dynamics. "Project Kapıdağ: Locality of Production" was emerged from the struggles associated with local production in the region and was realized in collaboration with local organizations, local community and İstanbul Bilgi University Faculty of Architecture. The project aims to pinpoint the assets Kapıdağ for the collective wellbeing of the region and reveal the potential intervention opportunities in the region through mapping out the network of relations between production, materials, public and institutions. In this paper, the project will be examined as research for social design case in complex collaboration. Different proposals that were developed out of this undertaking will be exemplified to discuss issues on the responsive role of the designer in *'infrastructuring'* social design process. The paper further attempts to demonstrate how the research process can also function as an alignment tool between collaborators to attain objectives and open up possibilities for new collaborations and projects.

Keywords: Research for social design, infrastructuring, collaboration for social design, visual diary

Research for social design

Introduction

Social design is a process where design practices are led by social needs and carried out in collaboration with a variety of societal actors pursuing change for the improvement of social ends (Markussen, 2017; Manzini, 2014; Maze, 2014; Thorpe & Gamman, 2011). The problems caused by fast social and financial changes within an area can lead to an intervention space for social design (Manzini et. al, 2010).

Kapıdağ, where this project was carried out, is a peninsula extending into the southern Marmara region in Turkey (figure 1). Although it was a major tourist destination in Turkey in the 1950s, it has since lost its importance due to a variety of local management issues in time. In addition, because of the new industrial transformation around the region, the Erdek - Kapıdağ Peninsula has been dragged into social, cultural, economic and ecological changes. According to population data of the Turkish Statistical Institute (TUIK), it can be seen that the village population of Erdek has decreased since 1990 (TUIK, 2018). During recent years, companies have purchased many farmlands to establish factories in Erdek Gulf; as a result, several villagers have moved to urban areas in search of new ways of living (Öğdül et. al, 2018). Top-down political reforms of mass-industrialization threaten the socio-technical and ecological balance in the region, which, in turn, endanger local practices developed throughout the years.

One of the project coordinators is a native of Erdek and whose parents still live there; thus, she is a first-hand observer of the changes in Kapıdağ - Erdek. The initial idea of organizing such a workshop and employing the process of research for social design in Kapıdağ arises from this personal urge. The first contact with governmental authorities was made through local acquaintances. Erdek Municipality is also conscious of the situation and the demands of its residents; thus, they want to collaborate with volunteer associations and universities to create opportunities. The project coordinators used the opportunity to organize a workshop in the summer term, and the students participated in the project on a voluntary basis.

'Project Kapıdağ: Locality of Production' is a research study in the field of social design aiming to pinpoint the assets of Kapıdağ through engaging in a variety of social practices and things to open up resilient socio-technical and ecological possibilities that will enrich the region's self-sufficiency. It was realized between local stakeholders and Istanbul Bilgi University, Architecture Faculty members and students between August 14th and August 27th, 2017. Several collaborators were engaged in the process and brought their knowledge and resources to the study. Through ethnographic fieldwork, design students documented and analysed the assets of the region for further generation of ideas.

Figure 1: The geographical location of Kapıdağ Peninsula. Source: https://goo.gl/maps/CrnvRovaXEH2, 2017.

Infrastructuring Social Design and the Context of Kapıdağ

'Infrastructuring' (Hillgren et al., 2011) approaches social design as an ever-growing process focusing on developing the relationship between different stakeholders to facilitate new networks and resources that might give way to design opportunities. Unlike pre-defined paths, the flexible approach of infrastructuring allows fitting in complex situations and dealing with unexpected inputs as well as the mess inherent to a given social context (Björgvinsson, Ehn & Hillgren, 2012; Hillgren et al., 2011).

Therefore, in Project Kapıdağ, we contextualized the social design process as an open-ended, long-term relationship between different societal groups in the field in order to enrich and extend opportunities and discover assets which could be developed further. In each step of the project, new relations were built and existing ones were deepened. The knowledge and practices of collaborators informed the process to be able to discover existing *'assets'* (Manzini, 2014; Thorpe & Gamman, 2011). Social design reinterprets these assets in the light of the social and material context to lead up to social change (Binder, Brandt, Ehn & Halse, 2015; Manzini, 2014; Thorpe and Gamman, 2011).

Project Kapıdag aimed to detect the region's assets through a social design process taken as open-ended and was divided into different phases, thus building relations with different groups within the field. Kapıdağ is made up of a variety of societal groups with different cultures (though affected by the Convention Concerning the Exchange of Greek and Turkish Populations in 1923) and economic practices (from agriculture to mass industrial manufacturing). Today, the peninsula is inhabited by different ethnic groups—mainly by Turks, Pomaks and Cretans (figure 2). They share the same land while retaining their own rituals, habits and traditions. In time, these people of different backgrounds developed their own means of livelihood by making use of the natural resources of the region. This cultural diversity makes the region's ecosystem richer and more varied. To be able to explore homogeneities and heterogeneities in the field, the community was thus taken as a network of intertwined relationships between the social and the material, as well as between

humans and non-humans (Binder et al., 2015). Accordingly, research was designed towards discovering and mapping out these relations and making them available for further interventions.

Figure 2: Old photographs of Aunt Zeynep's mother and father when they first came to Erdek, Turkey, through the population exchange. Photograph: Participant students, 2017.

Research for Social Design in Complex Collaboration

Thorpe and Gamman (2011) define social design problems as *'wicked'* and note that they require a collaborative process where diverse actors play the role of co-creators to tackle with the complexity of the situation at hand. Because there is not one true answer that would make all human and non-human actors equally satisfied, a collaborative process is needed for all actors to be able to utilize their agency (Thorpe and Gamman, 2011). For example, we—as the coordinator of this project—played a role at the intersection of meeting the educational goals and expectations of local collaborators. We gained experience of conducting fieldwork to students, visualizing data from the field and turning them into ideas; we were also obliged to propose fruitful and applicable ideas in the region.

Although conflating education sensitivities with the needs of a project in a social realm with multiple collaborators outside the university can be tricky, collaboration between the university and the local government is also an important part of the social design process. Collaboration between design schools and local organizations is a fruitful platform for research, as well as for analysing and generating new ideas for social ends (Manzini, Zhong & Baek, 2010). Schools can be centres where new proposals are generated and tested through design research for a positive change. In the meantime, design students can also learn more about social problems, how to address these problems, and ways of developing the skills necessary for acting in sensitive situations (Margolin and Margolin, 2002).

Project Kapıdağ was realized in collaboration with a variety of stakeholders, each of whom brought a different set of ideas to the table. These included the local residents, local independent initiatives (Yesil Valiz Association for Responsible Tourism, Bandırma Mountain Club, Erdek Exchangeee Association), local governmental organizations (Erdek Municipality, Erdek Chamber of Commerce), İstanbul Bilgi University as an institution alongside project coordinators who also authored this paper, and 24 design students from different departments (industrial design, interior design and architecture).

Stages of the Project Kapıdağ: Locality of production

Pre-Project

The research proposal was presented to Erdek Municipality and Erdek Chamber of Commerce four months prior to the start of the project; initial arrangements for accommodation and transportation were then made. To establish the initial contacts with local bodies and people, project coordinators pre-visited the region, meeting and contacting more than 25 local people in the villages. Since the starting point of the project was the pinpointing of existing and potential local income sources within Kapıdağ, coordinators grouped these sources into five main routes after initial visits. These routes included: historical sites, villages, production

facilities, centre and shores, and bazaars. Besides thematic consistency, locational relevancy and convenience of transportation were also taken into consideration while deciding the routes and their contents.

In-Project

The research steps of Project Kapıdag were planned in the following order: understanding of the area with ethnographic methods; investigation of existing social and production practices; participating in local activities; and dividing the participants into smaller groups in order to reach personal stories for the purpose of deepening the knowledge obtained. Data was collected both via observing on-the-moment interactions between people, as well as by students participating in these interactions. Observation supported by interviews (Blomberg, Giacomi, Mosher & Swenton-Wall, 1993) was the main ethnographic method. The process was also supported through unstructured interviews, note-taking (both written and visual), written sources, videos, photographs and sketching (Barab et al., 2004).

The routes were discovered with design students; they had the first-hand experience and learnt about Kapıdağ's villages, sites, agricultural products, hand-made products, and different cultures and practices. Additional information was obtained on the locals' methods of generating income, the ecological potential of the area, the variety of flora and fauna, the different uses of plants, and the opportunities that the sea brings (i.e. fishing and sea tourism).

At the end of each day, design students were asked to keep 'visual diaries' (Blomberg, Burrelland & Guest, 2003) as a means of preparing self-reports in order to be able to handle intense data. They sorted out and categorized the photographs they took according to the practice they were referring to and supported those photographs with texts on what they had learned, accounts of villagers, questions that arose in the field, and their ideas. These diaries also functioned as media for discussion between design students in the process of idea generation (figure 3).

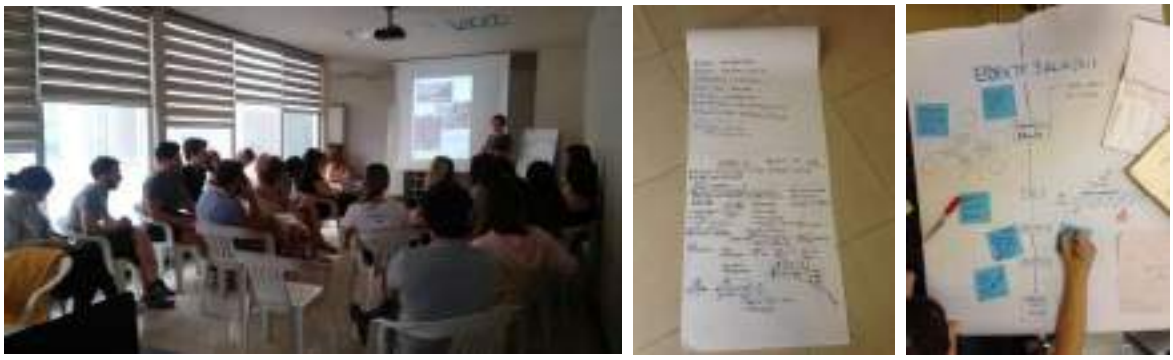

Figure 3: Scenes from a discussion session in the workroom that the Municipality provided. Photograph: Participant students, 2017

At the end of the first week, all participants came together, and a pool of visual diaries was formed. Each design student began to form both their area of interest as a potential for Kapıdağ as well as their potential for generating ideas. Next, seven groups of students were formed based on these interests. These seven groups approached Kapıdağ's assets from different perspectives and focused on the following: agricultural products; historical sites; cultural diversity; women's labour; architectural textures; fishery; and activity tourism. While some of the five initial routes were highly inspirational for students, some did not, in the end, trigger enough potential. For example, no ideas emerged from the production facilities route. In this route, participants visited large- and medium-scale production facilities, such as olive and olive oil production, dairy production, and a marble plantation. We believe that, because of these facilities' highly institutionalized nature and grand scale, students could not envision change within their capabilities. On the other hand, agricultural products, cultural diversity, women's labour, architectural textures groups were directly affected by what they encountered and observed during the village route. The diversity of cultural and agricultural production and social life in the villages is what students found unique and worth further elaboration.

After these seven groups were formed, the project obtained a more responsive structure. Each group had different needs to acquire deeper knowledge of their subjects. Being able to meet those needs required new collaborations, different paths and time tables. Then, design students as researchers also assumed the role of

facilitators (Thorpe and Gamman, 2011). How these roles were realized within the process will now be explained through a closer look at some of the projects.

- Cultural Values in Kapıdağ: The group that was interested in different cultures in Kapıdağ, namely Pomaks and Cretans, contacted Erdek Exchange Association and paid several visits to the area. After gaining trust, they were able to visit some of the exchange participants at home and at work (in offices and bazaars). In this way, they learned about their foods, herbs, alternative healing mixtures, and rituals (figure 4). Students visualized the information they gained and exhibited their drawings at an exhibition. In doing so, they obtained feedback from a wider audience and also interacted with people unaware of these traditions.

Figure 4: 1. Kahya Dessert (Cottage Cheese Dessert); 2. Stuffed squash blossoms; 3. St. John's wort Blossoms; 4. Olive Oli Soap; 5. Crete Bagel; 6. Olive Oil; 7. Cretan Keriman. Visualization: Didem Erdem - İpek Öztiryaki - İrem Altınsu - Naz Pamukçu, 2017.

The knowledge that was sought was deeply situated in specific locations and groups of people. Thus, reaching even seemingly simple knowledge was challenging because it required strong networks and collaboration. For example, returning to a village for further investigation was a problem due to a lack of transportation facilities and walking paths. Thus, design students needed to get in touch with the people they met in the villages and bazaars so that they could be transported.

The projects of two groups, which focused on Ballıpınar Village, where transportation options were limited, provide insight into the challenges of the research process within situated knowledge. Many coastal villages in Kapıdağ have moved away from agriculture and chosen sea tourism as their main source of income. Ballıpınar, despite being a coastal town, is still a closed community, and their main source of income is agriculture, especially the purple onion (figure 5). The purple onion is very popular in the region and is known for its sweet and juicy taste, durability, healing power and purple colour (even women working in onion cultivation wear a purple skirt, as it does not permit onion stains). All families in the village in one way or another work in onion cultivation, women taking an active part in the production and preparation of onions for sale.

Figure 5: Purple onion, separate and weaved by their stem; Aunt Ayşe from Ballıpınar Village with her purple skirt. Illustration: Participant students, 2017.

- The lifecycle of the Purple Onion: One of the student groups documented and analysed the journey of the purple onion from soil to the dinner table. They tried to understand and visualize the steps of cultivation, how it was prepared for sale, and what the sales channels and actors involved were. They further proposed a labelling system by printing an onion on textile and showing its inner purple rings. Villagers can use this system to promote and sell their products in the bazaars.

- Ballıpınar Original Architecture: The architectural and rural structure of Ballıpınar is shaped especially in accordance with purple onion production. Every house has an awning (figure 6) made of wood and wicker. Women sit under these awnings, weave the onions by their stems and store them by hanging them from awnings. These awnings also function as social gathering points where women eat and drink together, while men prefer to gather in 'kahvehanes'. Ballıpınar Village is especially interesting for the nice combination of social and material values. Onion production affects social life, the architectural texture of the village, and even clothing. The group documented the architectural texture, streets and houses of the village and the social and material relations arising from onion production by examining the building techniques and materials used in the houses and awnings by section and detail drawings (Figure 7).

Figure 6: An awning used for weaving under and storing onions. Photograph: Participant students, 2017.

Figure 7: An original housing visualization from the village of Ballıpınar. Visualization: Burak Özçakıl - Burcu Berber - Büşra Hamzaoğlu, 2017.

Other projects include proposals on different activity themes and routes for tourists and locals; exploring the fish and fisheries culture in the region; women's handiwork by weaving, crocheting and knitting; and the pattern map for the Temple of Hadrian to assist visitors in understanding the excavation area and discover ancient historical stone structures.

End-project

At the end of Project Kapıdağ, a festival was organized with the cooperation of the municipalities and associations around Erdek and Kapıdağ. As a result of the two weeks of documentation and analysis, powerful visuals with clear visuality and clarity prepared by the students were exhibited together with activities organized in the district square (Figure 8). The fact that this exhibition was held at the festival dates increased the number of visitors to the district and led the project outputs to be reached by more people.

Design students stayed on and interacted with local people regarding the outcomes. Visual boards became tools for discussion and the exhibition turned into an open forum where people visited and shared their ideas about the place they lived in and gave feedback on the ideas for further development.

Figure 8: Exhibition in the Erdek town hall. Photograph: Participant students, 2017.

Key Learnings and Outcomes

Project Kapıdağ is situated as research for social design study that identifies the assets of the region to open up further ideas and possibilities aiming at social change in the region. The seven projects developed by the

students have as a significant strength the ability to make the future of the region more resilient. Not only these seven projects but also the interests of the students and collaborators, created a mutual understanding on social development for the region. These are fruitful initial outcomes for the project, as Project Kapıdağ was planned as the first step of a long-term social development study in the region. In addition, it can be said that an alignment of goals and objectives between different contexts and with different collaborators was achieved. Collaborators agreed to make the Kapıdağ Project a more complex social design engagement for generating ideas towards collective social change in the region.

The next step of the project was planned as a series of workshops for participatory idea generation with local people and collaborators to raise and strengthen awareness of the assets of Kapıdağ. The outputs of the Kapıdağ Project would provide a useful input for this second step. Meetings with the municipality and other organizations were carried out. However, due to political issues on the side of the municipality, these workshop sessions could not be accomplished. In spite of this, this project opened up new collaboration opportunities and future steps turned into new projects in new places. In the 2018 Fall academic term a design studio project was carried out in the city of Bursa (two hours away from Erdek) with a non-governmental organization which was met through Project Kapıdağ. Another design studio project is planned for the 2019 Fall term with the same organization in the town of İznik, an administrative district in Bursa.

As for educational purposes, the researcher-coordinators and participant students of this project gained experience in dealing with real project conditions in situ. Coordinators practiced developing a workshop between educational and governmental issues and sustaining communication between them. Students had experience conducting their own fieldwork, taking different roles within the project as researcher, designer and facilitator, and working and talking with people from different parts of the society. They enhanced their data collection and visualization skills and had a chance to interact with the people who played a significant role in the process. These teachings and gains were the main objectives of the project from the point of view of education.

Conclusion

'Project Kapıdağ: Locality of Production' was an attempt to *'draw things together'*, to contextualize and reframe existing practices and things in Kapıdağ to ensure regional development while protecting both the socio-technical and ecological environments. It aspires to highlight the local production assets in the area that have the potential to trigger change towards the collective well-being of different social groups. Material engagements of different communities were observed in their unique contexts. Looking at how these assets intertwined in the process of knowledge production allows us to handle the ethnographic field as a design space. This way, design can reconfigure relations between socio-material practices and contexts of use to attain social ends.

Besides being a research phase, Project Kapıdağ also functions as an alignment tool between collaborators. An agreement on the goals and objectives between collaborators is important for conducting a grounded project. It also enables discussion through practice where collaborators learn about each other's perspectives and ways of working through action. We believe this kind of an introduction through practice in a social design process will avoid any possible power imbalance and competition between organizational logic in further studies that will be longer and more complex. Also, mutual rapport among locals and design students was established. Many villages of Kapıdağ are closed communities; thus, building trust is especially important to be able to obtain knowledge, as this necessitates one-to-one observation and the participation of locals in daily life. Finally, Project Kapıdağ confirmed the researcher-coordinators' view of the region as a spot rich in cultural and ecological resources while offering diversity in practice and embracing change.

There were also difficulties and constraints encountered during the project. The duration of the project, which was realized through stakeholder in kind aid, was determined as two weeks, so the process was planned as a research phase and ended with the mapping of various possibilities. Although new processes are planned to explore design potentials through the findings, because of the timeout, negative impacts such as a decrease in the momentum, distance from the field, and the change of certain actors can be seen. At this point, as Thorpe and Gamman (2011) state, non-long-term commitments that do not involve the implementation process appear as a constraint to some of the projects proposed by students. Factors determining the duration of the project include the context of the project (summer internship) and limited financial support (again one of the cases listed by Thorpe and Gamman (2011)). Being aware of these constraints, the project coordinators designed the project objectives and questions at a certain level and maturity and set achievable targets. As a

result, the targets were achieved, a fruitful experience for the participants and a promising experience for the stakeholders were provided. This positive and progressive process has been seen as a step towards cooperation between stakeholders and has enabled long-term plans to be made.

As a positive result of the Kapıdağ Project's mediation tool function, other design studio projects are planned to be carried out in the nearby region amongst similar stakeholders, and it is hoped that the results of research for social design will be taken forward and become design ideas.

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Research Perspectives IN THE ERA OF Transformations

Equity, Listening, and the Transference of Power in Design-Driven Healthcare Innovation

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The American Heart Association has almost 100 years of experience uncovering barriers to better health across the United States. Looking to transition towards a more equitable approach to health, the AHA partnered with verynice, a design strategy consultancy, in 2017, to develop a design research toolkit that could understand the needs of rural communities, align scientific understanding with human-centered design, and build capacity for qualitative design research. In 2018, Professor Matthew Manos of the USC Iovine and Young Academy led a group of 19 graduate students on a Professional Practices Residential in Dallas, Texas. Along the way, students developed a series of strategic recommendations for the organization moving forward. In a second application of the toolkit, Professor Manos led 20 additional graduate students in a residential experience with the Children's Hospital of Los Angeles in 2019. By introducing the framework in the offerings of the Academy, we saw first-hand the power of the methodology in an educational environment as a tool for teaching students how to listen to community needs, and suspend their bias.

Keywords: Design Research, Design Education, Social Impact

The Challenge: Creating a Toolkit Centered Around "Listening"

According to the Center for Disease Control, the "factors that influence the socioeconomic position of individuals and groups within industrial societies also influence their health." (U.S. Department of Health and Human Services Centers for Disease Control and Prevention, 2013). Further, according to the American Journal of Preventive Medicine, over a period of 40 years, people living in urban environments have shown a significantly more rapid growth in life expectancy than their rural counterparts. Specifically, this gap is found to be attributed to higher rates of cardiovascular disease among other issues (Stephens, 2014). The American Heart Association (AHA) has almost 100 years of experience uncovering barriers to better health across the United States. As a national organization, the AHA has a unique challenge to represent all needs from all communities in order to fulfill a holistic mission to "be a relentless force for a world of longer, healthier lives." Some communities, especially those that are rural, can go unheard or can be inadequately addressed by solutions that don't match their circumstances. In recognition of the growing understanding of social determinants of health as well as the rural life expectancy gap, the American Heart Association needed to develop an approach that would allow them, and other mission-driven health organizations, to better understand the needs of all Americans.

Design Research and Human-Centered Design have a unique ability to serve as the connecting bridge between people and business. This is typically accomplished with an empathy-first mindset that believes impact within

a community, organization, or enterprise can come upon shifting from a top-down mindset to one that is bottom-up and "people first". When compared, the promise of design research, and the gap of understanding the needs of rural and vulnerable communities in the United States reveal a unique opportunity to apply the human-centered design process to the outreach and health equity initiatives of the American Heart Association. As a result, the AHA collaborated with my design strategy consultancy, verynice, in 2017, in order to develop a creative methodology that could build capacity for Design Research and "Listening" within and beyond the organization. The goal of this toolkit is threefold:

1. Understand the assets, needs, and circumstances of rural communities.

2. Align scientific understanding with a more human-centered perspective.

3. Build staff capacity in qualitative design research and rapid ethnographic methodologies.

In addition, it was important to both the client and the consultancy that the resulting methodology be made publicly available for any individual or organization tackling similar issues. While counterintuitive to open-source a new "trade secret" that would soon be developed, both the client and the consultancy understood the potential ripple effect of impact that could take place if the methodology were to be made openly accessible. Further, as both the lead Strategist for the development of this toolkit and an Assistant Professor and Assistant Dean at the University of Southern California, I saw a unique opportunity to take advantage of the toolkit's open access and apply it to the classroom environment. The primary goal of this application was to teach students actionable skills and approaches to suspending their bias while also learning to be collaborators *with* the end user as opposed to designers *for* the end user.

The Process

My working relationship with the AHA began in 2015. I have personally led projects with the organization related to business planning, strategic planning, and research & development. These projects include the revitalization of the organization's "Heart Walk" experience, and the redesign of the organization's strategic value proposition. When approached to create a new toolkit for the organization that would merge the principles of design with the incredible impact of the AHA, I was thrilled.

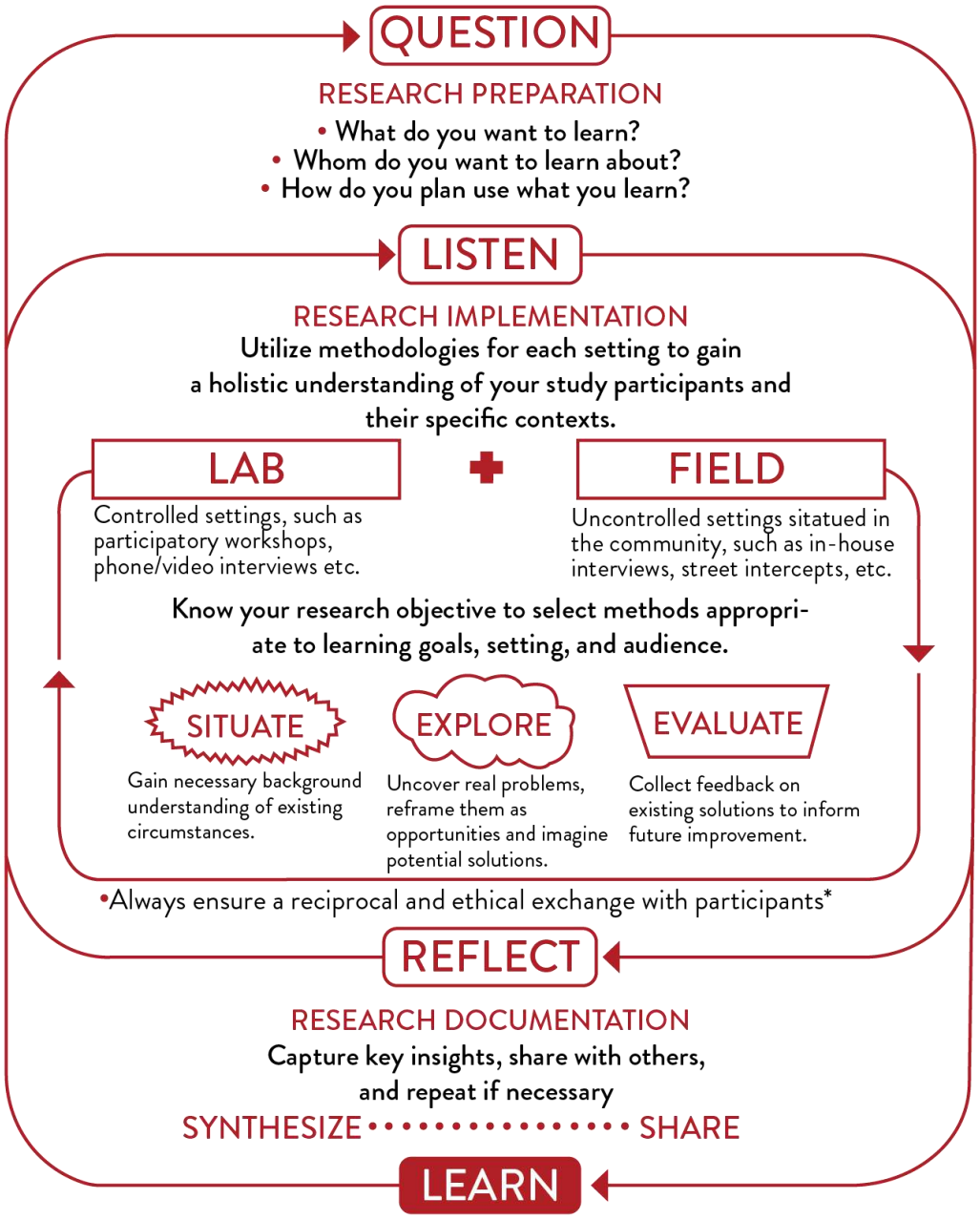
How might we develop a design research methodology to better understand the needs of rural communities? With the primary goal of the toolkit being to design research methods and build capacity within the organization for listening skills, we began the project by doing a deep-dive into exploring "listening". To begin, we identified a series of 7 experts to interview about the art of listening. These experts included practitioners in journalism, leadership coaching, education, and social work. The interviews were synthesized and provided to the organization in the form of a series of short films. In addition to the films, we produced and moderated a panel discussion and workshop at the AHA's Los Angeles office with additional experts in listening.

Following this initial research, the team at verynice developed a draft of the design research methodology to prototype with a rural community in Salinas, California in September, 2017. This participatory workshop was held at a local community center. Over the course of 2 hours, our facilitators led 14 participants through a series of activities. From the workshop, we made adjustments to the flow of activities as well as the instructions, and came to a finalized model and toolkit for the organization.

The Methodology

The methodology itself is comprised of 4 key phases including Question, Listen, Reflect, and Learn. This toolkit differs from the mainstream design process of "Empathize, Define, Ideate, Prototype, and Test" by filling a necessary gap in Design Thinking: the ability to transfer power. In Design Thinking, the end user or beneficiary is typically involved in the beginning stage (empathize), and the end phase (test). This creates a power dynamic in which the designer is the translator and author of the subject's own ideas and observations. In doing so, bias is naturally attached to the ideation and prototyping phases. Instead, with this toolkit, the user is involved throughout the entire process. In doing so, the the person who is empathizing does not become a hero, and the person who is being empathized with does not become silenced.

Figure 1 The toolkit includes the above diagram. The methodology itself is comprised of 4 key phases including Question,



Listen, Reflect, and Learn. In the Listen phase, the designer identifies both the setting of their research as well as the key research objective in order to proceed and select more specific activities. The full toolkit, videos, and additional documentation is available for anyone to freely access at https://ahaislistening.tumblr.com/ (Manos, 2017)

Question: Every great study starts with great questions. The first phase of the methodology consists of research preparation. In this phase, we reflect on what we want to learn, whom we plan to learn about, and how we plan to use what we learn.

Listen: The best way to learn about others is by listening to them. The trick is being able to hear what you need to learn for the purpose of the study. The second phase of our methodology uncovers answers to the research questions by implementing the research. The toolkit includes scenarios and

suggested research activities for 3 research objectives (situate, explore, evaluate), and 2 research settings (lab, field). While the lab setting is a controlled environment such as a participatory workshop or phone/video interview, the field setting is uncontrolled, with interviews and interventions taking place in the community itself. The objective to “situate” is most appropriate in a scenario in which the researcher aims to gain a necessary background of understanding within a community. The objective to “explore” leads to the uncovering of real problems, re-framed as opportunities. Finally, the objective to “evaluate” focuses on collecting feedback on previously developed solutions. The methodology recommends a blended approach as it pertains to setting, but a specific approach as it pertains to objective.

Reflect: The reflection phase is about making sense of what was heard. This is done by way of reporting out on findings to the larger research group and community, or through written synthesis.

Learn: In this phase, the researcher completes the research by putting newly gained understanding into action. The researcher thinks about the observations, interpretations, and implications, and what those mean for the greater goal and impact of the study.

Upon completion of the toolkit’s development, verynice hosted a training with the AHA in order to onboard all staff working in health equity and community impact. The training was recorded so as to allow those who could not attend to have equal access to the content. The organization continues to use the tool in rural and vulnerable communities in order to gain key insights for the ways in which they can best assist as a national organization.

Applying the Toolkit to the USC Iovine and Young Academy’s Professional Practices Residential Experiences

Shortly after the methodology was made available online for anyone to access and use freely, our toolkit was incorporated into a course at the Santa Monica College, a public, two-year, community college in Santa Monica, California, United States. The course focused on teaching students the design thinking approach and mindset. Santa Monica College students leveraged this toolkit to conduct field research for a group project focused on the issue of food deserts in Southern California.

After hearing of the success of the toolkit when applied to the Santa Monica College, I became intrigued to apply the toolkit as the centerpiece for a class of my own. At the USC Iovine and Young Academy, we have an online graduate program, the Masters of Science in Integrated Design, Business, and Technology (MSIDBT). While primarily online, the MSIDBT also includes a series of Professional Practices Residential (PPR) experiences, that bring students on-the-ground into an organization or enterprise to take on a challenge over the course of 5 intensive days. The purpose of the course is to give students the opportunity to work on a design research challenge with a real organization facing a real challenge. When asked to lead a PPR focused around healthcare, I immediately thought of the AHA as a perfect partner.

With 19 graduate students, we embarked on a journey to the AHA’s headquarters in Dallas Texas in order to leverage the toolkit in local communities to help the organization identify new partnerships and opportunities for impact. Students were provided the following prompt upon their arrival in Dallas, Texas:

> *For nearly 100 years, the American Heart Association has been fighting heart disease and stroke, striving to save and improve lives. With the unique mission "to be a relentless force for a world of longer, healthier lives", the American Heart Association has developed a range of approaches to driving innovation from an equity first perspective at a national and community level. In this Professional Practices Residential, graduate students in the Iovine and Young Academy are challenged to leverage Design Research methodologies in order to conduct field work in local Dallas communities. Inspired by their field work, students will enter two intensive hack-a-thon sessions in order to synthesize, ideate, and further develop a series of strategic recommendations for design-driven innovation opportunities that can inspire future work by the organization at the local level.*

In addition, students were assigned to work with a partner organization in one of 4 Dallas communities in order to minimize the time required to understand the nuances and environment. Finally, students were trained on various methodologies and activities from the Design Research toolkit that would be specifically

relevant in the context of the communities they were assigned. The experience resulted in tangible strategic advice for the organization's various non-profit partners including business model design for a local community garden, a concept for a community mural, and curriculum for an afterschool program.

Our next Professional Practices Residential experience was in partnership with the Children's Hospital of Los Angeles (CHLA). CHLA has a history that spans over 100 years, and offers 350+ pediatric programs and offerings to meet the needs of their patients. At the commencement of this residential, students were trained on the toolkit, and were provided the following vision statement:

> *OUR VISION is to enable our patients with diabetes and their families to lead healthy, thriving lives with minimal disruption and inconvenience. We want our program to be adaptable to a patient's developmental stage and life experiences.*

Guided by this vision, students engaged in a series of interviews, interventions, and observational studies in order to clarify their understanding of the current patient experience. Following this serie of ethnographic studies, students developed strategic recommendations and product design concepts for the hospital's innovation team to carry forward. This included a chatbot that would reduce emergency hotline calls, a mobile health clinic to reduce the pain of traffic for patients, and a gamified onboarding experience for new patients.

Next Steps and Initial Conclusions

Based on the success of the toolkit's application to the PPR with the AHA, the tool is in the process of being implemented into the core curriculum of each residential experience in the MSIDBT program as well as an undergraduate course on Design Consulting/Design Strategy. The university is currently planning to work with the AHA for another 2 PPR experiences in the Summer 2019 and Fall 2019 semesters to take the tool to Boston and Puerto Rico. The following are 3 key learnings from the engagements to-date.

What people say is often different than what people do.

Limiting the research process to phone interviews or surveys is limiting. By leveraging design-driven techniques such as drawing exercises, and by learning how to pay attention to body language, we drew more comprehensive research results that led to more impactful recommendations for the clients. For example, in a class we recently had students interview their grandparents about the process of using prescription pills. One student claimed their grandmother had no issue with the pill bottle itself, but after further observation, the student learned this was due to her "hack" in which she removed the caps of the pill bottles and replaced them with plastic wrap.

By having an on-the-ground partner/client, student work can be less disruptive.

It can be very disruptive to a community when a group of students enter without context and begin interviewing and speaking to as many people as they can. By developing on-the-ground partnerships with organizations that work in the space day-in and day-out, we were able to earn buy-in more quickly. Further, by incorporating the end user throughout the design process, we can more successfully design in an manner that is not filtered through our own biases and aspirations.

Shift focus in design for social impact.

In teaching design research practices in the classroom, there is a great opportunity to focus that work by assisting organizations such as the American Heart Association and the Children's Hospital of Los Angeles who do incredibly impactful work with significantly less resources than many other private sector enterprises. For example, in previous institutions that I taught in, we would create speculative client projects. Instead of the speculative approach, we are able to have the same rigor of project, but make it "real" by reaching out to the community in order to turn those speculative projects into challenges for our students to contribute to.

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Research Perspectives IN THE ERA OF Transformations

Design Thinking Mindset: Exploring the role of mindsets in building design consulting capability

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This case study reflects on the role of design thinking mindsets in building design thinking capability within professional services consultancies. The nine design thinking mindset attributes developed by Schweitzer et. al (2016) formed the basis of five engagements with consultancies including workshops and semi-structured interviews. Data collection and observation by the authors identified key themes relating to the role of design thinking mindsets at an individual, team and organisational level, as well as the challenges and opportunities of embedding design thinking mindsets to build capability. The authors believe that capability development through the use of design thinking mindsets has the potential to support professional service consultancies to make more significant progress in embedding design thinking beyond the current focus on methods. Potential experiential learning frameworks and measurement tools are also identified.

Case study context

Design Thinking (DT) has gained popularity and awareness within private and public sectors in recent years for its ability to develop unique responses to complex problems and enable a human centred innovation agenda (Verganti 2009; Dorst 2015). Following this, many traditional professional services consultancies (including business, engineering and technology specialists) have moved to acquire, hire and develop their own internal design capabilities (Rousseau 2015). The objective is to both improve business operations and processes to become more client focused and to offer professional design expertise as a consulting service (Muratovski 2015).

In this case study we draw from our experience in practice-based design and innovation research, which includes working within professional services consultancies as designers/innovators and working within a university research environment studying and supporting organisations to develop design capabilities.

Working with consulting practitioners we observed their significant emerging need to better understand the role of what is described as DT mindsets alongside the often already well understood methods or tools of design. We find that while a focus on practising DT methods is widely used and has been effective at communicating the value and ways of working through design (Liedtka 2018), it is limited in achieving the full potential that DT can bring to both solving complex problems and the consulting services associated with it. Current efforts to build design capability are too often falling short of effectively changing the way people work to what Adams et.al call the “different way” (2011 pp.589) that DT seeks to provide. We believe that further understanding the role of DT mindsets and finding ways to enable practitioners to reflect and build upon on these will help professional services consultancies and other organisations make more significant advances in their capability development.

In this case study, we draw on recent research that began to establish a set of distinct DT mindsets (Schweitzer et.al. 2016), which has since been further refined and validated. We then report insights and discuss implications from engaging consulting and research professionals with DT mindsets.

The evolution of design thinking as a method and mindset

Design has a varied history through the many fields of architecture, product design and graphic design. While some fields such as product design initiated a focus on human usability, others saw design as an end process to improve the visual appeal and marketability of products (Brown & Katz, 2008; Dorst 2015). From the 1960s, the design professions began to advance in their development as a science and the opportunity to develop non-physical things including software and interactions (Szczepanska, 2017). Following this time, design began to attract broader recognition for its ability to create new ideas over a focus on aesthetics (Brown, 2008) and researchers and began studying the way designers think and work in order for other professionals to be able to learn from these creative approaches (Szczepanska, 2017). A new understanding of 'design thinking' was then identified, described in various ways from a cognitive style, a general theory and an organisational resource (Kimbell 2011) and promoted as a powerful approach to enable business innovation by early proponents (Buchanan, 1992; Brown & Katz, 2008; Martin 2009).

The iterative stages of a typical DT process include deep empathy with end-users, re-framing of the problem area, ideation, prototyping, and testing. While hundreds exist (VanPatter & Pastor 2016), notable examples include:

- Double diamond model - discover, define, develop, deliver (UK Design Council 2005)
- d.school design thinking process - empathise, define, ideate, prototype, test Plattner, (Hasso Plattner 2010).
- Liedtka's design thinking phases - What is?, What if? What wows? What works? (Liedtka & Ogilvie 2011)
- Frame creation - archaeology, paradox, context, field, themes, frames, futures, transformation, integration (Dorst 2015)

While such codified articulations of DT as a process and set of tools are helpful toward explaining the actions or 'steps', they do not yet explain how individuals or innovation teams enable these steps cognitively when interplaying between and throughout the design process. Other definitions of DT have articulated and explored the role of mindset in undertaking DT in practice, stating that DT is both a method and a mindset. As a mindset, DT refers to the underlying values, cognition and resulting behaviours that over time find their way into individual and organisational practice.

It has been argued that the notion of 'design as a state-of-mind' implies that true innovation is a company-wide phenomenon and should not be left to marginalized functions within a company (Venkatesh 2012). While individuals and whole organisations can adopt the processes and tools and learn new innovation practices over time, it is the mindset that ultimately helps achieve innovation objectives at a deeper and more sustainable level.

While DT is being adopted in other business contexts, definitions of design mindsets are largely drawn from design practitioner accounts without considering the placement of these into new organisational contexts that design is being practiced. These definitions also vary in characteristics and emphasis with few attempts to make a distinction between mindsets in the frame of cognition versus behaviour. Further, they have not been developed through broader research input, or tested for coherency and application into business let alone professional services consulting.

Defining Design Thinking Mindset

We refer to DT mindsets as an articulation of how individuals will possess or seek to improve in the way they think, feel and emote in their practice to support design thinking activities. In other words, a mindset is a characteristic mental attitude that determines how one will interpret and respond to situations. Boland and Collopy (2004) referred to design attitude as 'expectations and orientations, one brings to a design project' (pp 9), whereas, more broadly, Gollwitzer describes mindset as configurations of cognitive procedures; e.g., being open-minded (Gollwitzer 1990).

In the context of DT as a service, consultancies often focus on developing design thinking capability with an emphasis on teaching the 'process and methods', which omits consideration of the individual who is undertaking the training and the role they might have in achieving a desired innovation outcome. In sharing and discussing DT mindsets with consulting practitioners, we have discovered that they are important enablers in providing a deeper understanding about the different ways of working that are representative of design practice compared to more traditional business practice.

Exploring Nine Design Thinking Mindset Attributes

Throughout 2018, this research involved exposing large professional services consultancies, who had all made significant efforts to embed design capabilities within their business over the last 10 years, to the DT mindsets across five engagements. The mindsets we focussed on in this work were the nine attributes based on the work of Schweitzer et. al (2016), which are described below:

Table 1: Design Thinking mindset attributes, Schweitzer et. al, 2016.

	**Be curious**: The extent to which a person demonstrates curiosity and a desire to learn new ways of understanding the world.
	**Be collaborative:** The extent to which a person buys into working together toward a shared purpose and solution; is effective in the service of the team's purpose believing that no one person is responsible for the final outcome.
	**Reframe**: The extent to which a person challenges and re-frames assumptions associated with a given situation or problem, thinking differently to create new contexts and perspectives.
	**Embrace ambiguity**: The extent to which a person is comfortable with ambiguous and complex situations.
	**Embrace diversity**: The extent to which a person can work with and engage people with different cultural backgrounds, diverse experiences and diverse ways of thinking and working.
	**Make tangible**: The extent to which a person understands and activates all five human senses to make ideas tangible
	**Take action:** The extent to which a person has a preference to take action and get things done.
	**Be empathetic**: The extent to which a person experiences another individual's needs and context from their perspective. It is the ability to place yourself, your thinking and feeling in the view of another person.
	**Be optimistic:** The extent to which a person is hopeful and confident about achieving positive and favourable outcomes.

The format of these engagements included workshops in which DT mindset attributes were used as a reflective tool for capability development with groups of professional services design and innovation leaders

and in-depth interviews with design and innovation leaders within professional services consultancies to test and validate the conceptual clarity and relevance of the DT mindset attributes.

The workshops particularly focused on testing how individuals relate to the mindset attributes in their work, including how they understood them in their individual and group contexts. A specifically designed reflection and sharing activity helped participants to experience DT mindset attributes. This was designed in three parts.

1. **Attribute discussion and validation:** a group discussion to share the definition of the mindset attributes, discuss what these mindset attributes mean in the participant's organisational context and consider further dimensions of the attribute which may be relevant.
2. **Personal reflection:** an activity where participants were asked to reflect on their strengths and weaknesses in relation to each mindset attribute and consider how each mindset is relevant in the way they work as innovation leaders.
3. **Making differences visible:** in order to reflect on the mindset attributes as a group, three attributes were chosen and the participants were asked to self-organise along a line on the floor in order from where they felt the attribute was a particular strength to weakness. Participants then shard stories about where they placed themselves on the line.

Our findings are based on the analysis of workshop artefacts, interview findings and direct observations as well as our own collective reflection on experiences working in professional services consultancy contexts for more than 10 years.

Key learnings: DT mindsets in professional services consulting

> *"Design thinking is rarely a graceful leap from height to height; it tests our emotional constitution and challenges our collaborative skills, but it can reward perseverance with spectacular results" (Brown & Katz 2009, pp.65)*

We were surprised by how strongly the DT mindset research has resonated with managers working to build design capability within professional services consultancy. While these insights were defined through exposure of DT mindsets to consulting practitioners, the broad reflections on the challenges and opportunities of embedding DT mindsets may also provide useful and relevant for any organisational context where DT capability is being developed. The findings of our case study are presented as key learnings below.

Practitioner challenges adopting DT and the relevance of mindsets

As a result of exposure to the mindset attributes, practitioners of both workshops and in-depth interviews expressed a realisation about why DT had been challenging to adopt in their respective organisations. These insights also highlight the relevance of DT mindsets as a reflection and learning tool. The following are themes were observed:

- **Individual experiences:** Every individual is unique and therefore brings different thinking biases and strengths and weaknesses across different mindset attributes to the practice of design
- **Awareness of self:** In order to continually develop design expertise, individuals need to be self-aware and actively undertake reflection of their own practice. While consulting practitioners were familiar with reflecting on their behaviours and actions, the experience of reflecting on mindsets was a new and novel experience.
- **Diverse disciplines:** Professional service consultancies represent diverse skill sets and individuals who have been trained across different disciplines. These disciplines bring with them their own unique ways of thinking, seeing and emoting. The articulation of DT mindsets can more clearly communicate the internal changes that consulting practitioners need to embrace in order to increase their depth of design expertise.
- **Team to individual:** Often design thinking is discussed at a team level, with a focus on how methods can be integrated into a program of work. Less attention has been paid to individual cognitive transformations that occur when actively learning and practising design. While these insights support individual learning, they also transfer to improving team dynamics through highlighting different mindset strengths and weaknesses in a design team.

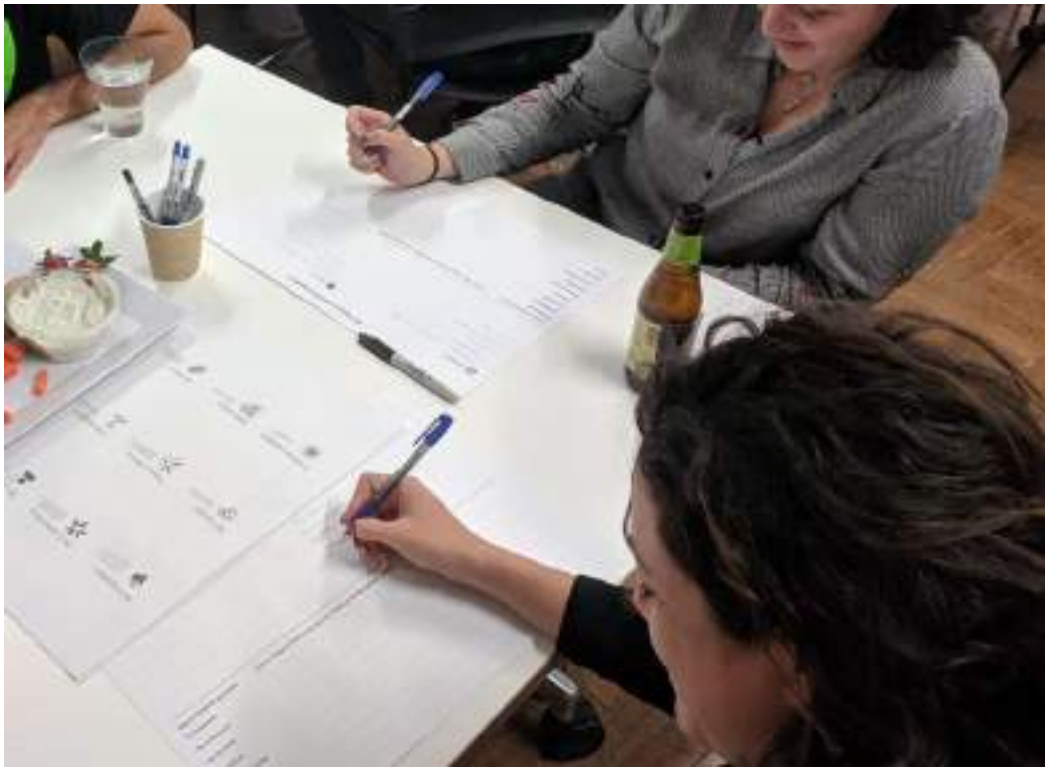

Figure 1: Workshop participants engaging in a personal reflection activity on the DT mindsets

Professional services consulting context and the adoption of DT mindsets

The professional services consulting model of selling highly defined and trusted methods and expertise does not align easily with the framing of DT projects and utilisation of mindsets. While design practitioners with high levels of expertise can consistently apply strong methods and approaches to new problems, there will always be uncertainty in the results. For example, results can involve broadening the problem frame, finding new ways to perceive the problem, or identifying new stakeholder challenges or opportunities that may not align with the client's original expectations and brief. While these reframes, and the methods and mindsets adopted to achieve these, are exactly what is so valuable about design, it becomes challenging when sold within a business model originally based on results, assurance and confidence (Rousseau 2015).

Likewise, traditional work pipeline management within professional services consulting does not always allow for the more explorative and adaptive nature of design processes which may require more flexibility than standard milestone and deliverable schedules. This characteristic of consultancy practice in turn results in the reliance of more reliable and 'known' methods in order to achieve project outcomes, essentially limiting out the opportunity for DT (Martin 2009). This highlights the need for consulting leaders to navigate these forces to ensure that projects are scoped and planned sufficiently and that DT can be effectively pursued. That DT mindsets are able to flourish in realising project outcomes and teams can be set up for success from the outset.

Encouraging DT behaviours and implications to organisational culture

When the professional services consultancies we engaged with began to understand the nature of design thinking mindsets, their perception of capability development shifted from considering individual skill development, to the development of team and organisational culture. This brought new interest in DT from managers in Human Resources and culture change roles to consider what cultural enablers can encourage design to flourish. This realisation highlights why DT is so difficult to fully adopt, as essentially it is proposing not only a change in how the individuals conduct themselves but how the system (organisational context) allows for that way of thinking and working to take place. As Martin (2009) states "Even as corporate leaders chase the vital elusive spark of creativity, their organisations' structures, processes, and norms extinguish it wherever it flares up. Their culture and routines privilege analysis over intuition and mastery over originality"

(p.7). This positions a new role for design researchers and practitioners to explore the implications of culture to support DT capability (Kimbell 2011, Michlewski 2015)

Building DT mindsets

Our experience running these engagements around DT mindsets highlighted key considerations for the approach to effectively build mindset capability. Firstly, it was clear that the group workshop engagements provided a richer source of reflection on DT mindsets than the individual interviews. This seems to be based on the benefit of participants hearing and discussing other perspectives in a group setting and considering how their own understanding and experience of a mindset related to their that of their team members. This raises the question of the nature of organisational learning and reflects claims by Stacey (2003) that learning is simultaneously individual and social and that learning cannot occur in isolation. There is the potential to investigate the nature of organisational learning further and to develop DT mindset training that draws on the latest knowledge about social and experiential knowledge.

The unique individual strengths and weaknesses across DT mindsets and the diverse disciplines being drawn to design practice also highlight the need to better understand and measure levels of DT mindset maturity on a cognitive and behavioural level (Howard et.al 2015). Various manifestation of DT maturity frameworks have been developed to aid how DT capability may developed (Kretzschmar 2003; Storvang, Jensen & Christensen 2014; Peppou, Thurgood & Bucolo 2016). Further, Gardien, & Gilsing (2013) provide a comprehensive articulation of how a custom maturity framework can assist in teasing out the unique contextual considerations to a given organisation. Custom DT maturity matrices that incorporate DT mindset considerations for consulting practices could provide useful tools in seeking to work through the complexities of individuals and team dynamics in capability building programs.

Case study limitations

This case study is limited to a small number of engagements and reliant upon informal data collection including reflections by the authors. We envisage undertaking further formal research studies to understand the role of DT mindsets within professional service consultancies and other organisations. Further studies would also benefit from stronger alignment with behavioural psychology and organisational culture studies, including using these theories to explore how a DT mindsets maturity tool may be developed (Kolko 2015).

Conclusion

Our exposure of the DT mindsets to professional services consultancy highlighted the relevance of mindsets to support organisation in their journey to embed DT capabilities and move beyond the limitations experienced when focussing primarily on embedding DT methods. The insights from this research also highlight opportunities to further develop experiential learning resources and measurement tools to support professional service consultancies in their efforts to build DT mindsets, as well as opportunities for broader changes in culture and support systems to foster an environment that consulting practitioners can think, feel and emote in more creative ways.

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Research Perspectives IN THE ERA OF Transformations

Case Study – Designing a business unit and creating the first ever responsive kitchen

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Introduction

Is it possible to transform stone into a technological and innovative device?

The meeting with one of the main stone transformers in Europe produced the intention of a disruptive operation that could affect the strategy of the whole company. A contagious singularity.

By intertwining LEAN methodologies and the human-centric approach of design thinking, we mapped the value creation in the company activating a dialogue with the workers and the management, listening to people, asking for ambitions, discovering problems and the potential of production.

This qualitative and quantitative analysis conducted with a multidisciplinary approach by designers, architects and marketing strategists allowed us to define a new method. We used it to design a platform that could let all the players express their potential to the maximum.

This is how the group's research laboratory was born, with the aim of promoting the relationship between humans and stone through product innovation. With this goal, we coordinated the new team, developing technologies that would allow creating a more direct relationship between man and surface, making the stone reactive. The result was the first responsive kitchen ever.

Context & problem / opportunity area

The worktops market is one of the main sectors of consumption for natural and synthetic stones with 133.24 million square meters sold in 2016 globally. A relevant part of this amount (7 parts on 8) goes to the kitchen and bathroom industry. The companies that produce and process stone slabs on an industrial scale are therefore closely connected to the world of furniture, its behavior, networks and production approach.
One of the leading European stone processors has hired us to design a demo product that could express the technical capabilities of the company, to launch a branding initiative for the Milan Furniture Fair (i Saloni).
The company wanted to enhance the value perception of its worktops and its range of surfaces for architecture & design.
The company's plan posed a risk. Launching a demo to the public in the same exhibit where its clients were unveiling their new products could present the company as a competitor to her partners.
For this reason, we proposed a re-briefing: instead of creating a demonstrative product (a kitchen) to show the technical potential of the company, we would research the know-how potential of the company to understand how to apply it and to build the best storytelling of it.
This reverse process aimed at mapping for the problem-solving practices implemented by the company during the years in a sort of “native” PDCA iterative approach (Plan–Do–Check–Act) as in the TQM’s continuous improvement of processes and products. Our ultimate goal was to make explicit the innovative behavior of the

firm and, subsequently, to apply it methodically on new subjects through a pilot-unit devoted to b-to-b special projects development. Something similar to the Value Stream Mapping in the Lean methodology.

This re-briefing allowed:

- to refine the focus of the initiative: to establish the firm as the best partner in its field, consolidating existing business relations and creating new ones.
- to initiate a company that considered innovation as a product's upgrade, to the concept of innovation as a contaminating internal agent inside the organization.

The Narrative

Empathy

To start the exploration phase, we activated a round of desk research and one-to-one interviews within the company. The first interviews led our group to define desk research that led to the second phase of more targeted interviews in order to dig into the VOC (voice of the customer both internal and external).

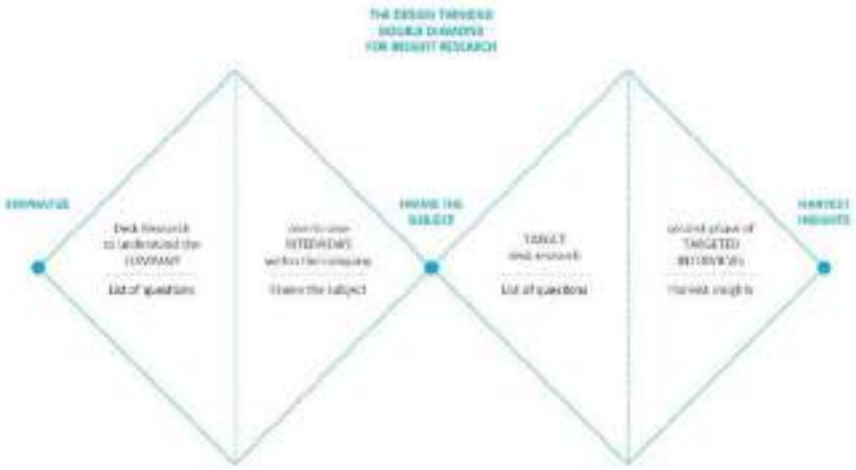

Figure 1: The Double Diamond of Insight Research. source: TIPIC 2019

We interviewed key people working in diverse positions inside (department heads, production supervisors, marketers, sales, board) and outside the company (suppliers, distributors/retailers, architects). In this way we managed to collect a wide information base on industrial production, customers, market, employees commitment and we analysed them looking for insights.

The survey team was made by a multidisciplinary group of professionals like strategic marketers, architects, industrial designers and mechanical engineers, in order to capture the diverse typology of relations and decision making inside the company and their strategic, economic, productive impact on the firm’s proposal to clients.

The project managing team included the marketing manager and the company's research and development manager in order to maintain a strong connection with the corporate structure.

The multidisciplinary composition of the group supported an open platform for debriefing and analysis based on mutual integration, essential for the understanding of such diversified data. In an extremely compressed time (only six weeks) we visited the corporate factories in Italy and Germany, mapped the company's distinctive capabilities, verified the reference markets, and the main trends.

The Definition

The research allowed us to identify the three main company know-how macro-areas:

- The production of synthetic stone (the culture of the material);

- The industrial processing of stone worktops (the company's core business);
- The inclusion of technologies (a relevant theme as worktops are the playground to many devices).

We crossed the insights from our investigation to the three know-how areas to identify potential innovations responding to the emerging insights from the empathy phase: “customizable integrated devices insanely easy to use” and “new durable materials with natural touch”. However, we were missing the tool that could stream the action without affecting the company's D.N.A. but bringing value to the all group through its work. Thus we outlined the guidelines for a "Group Product Research Laboratory", an independent business unit that could engage experimentation, operating dynamically and building bridges towards new directions . The new unit would have been devoted to prototyping new ideas, products and solutions based on the collaboration of the different group competencies and technologies. Its pillar are:

- Customer centricity;
- Strategic approach;
- Employee involvement;
- System and competencies integration;

Common principles with the fundamentals of TQM system used by companies engaged in organizational advancement through a commitment to customer requirements.

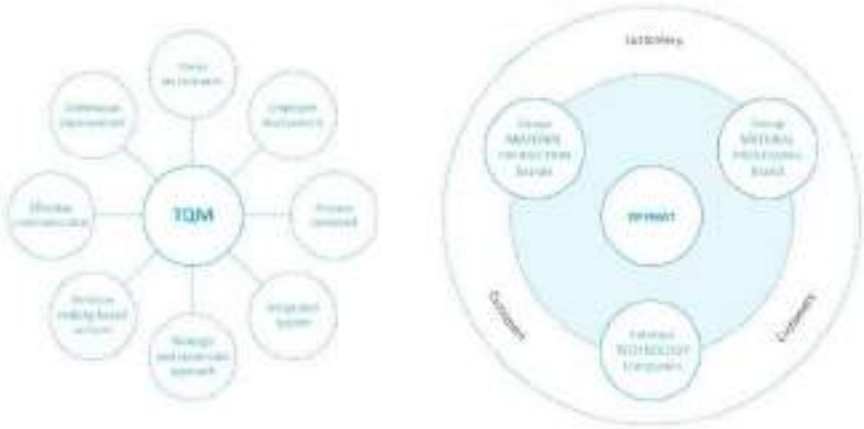

Figure 2: TQM pillars and the Offmat ecosystem. source: TIPIC 2019

Since the company identity is intimately connected to the stone processing and its products are sold as technical elements to design furniture brands, we defined a strategic framework based on quality, collaboration and mutual enhancement: the ingredient brand approach (like Intel, Gore-Tex, Vibram). This allowed us to create the necessary coherence filter to activate parallel experiments which could then be summarized in a common synthesis. We called the new unit "Offmat", from the union of "Officine" (Workshop) and "Materia" (Matter)

Impossible Stones

Starting from the synthetic stone production, we reversed the common design approach based on the Market Follower strategy in a Customer Centric Strategy. Instead of designing a new perfect imitation of the natural stone we activated the research team to identify a series of macro trends in design and architecture projects. We then selected a panel of blends proposal based on the different cultures and market areas and implemented it in the industrial process of engineered stone production prototyping samples in a series of iterations to optimize possible technical and qualitative issues. The final result was a collection of “impossible stones” proposed as tools for architects in the design process.

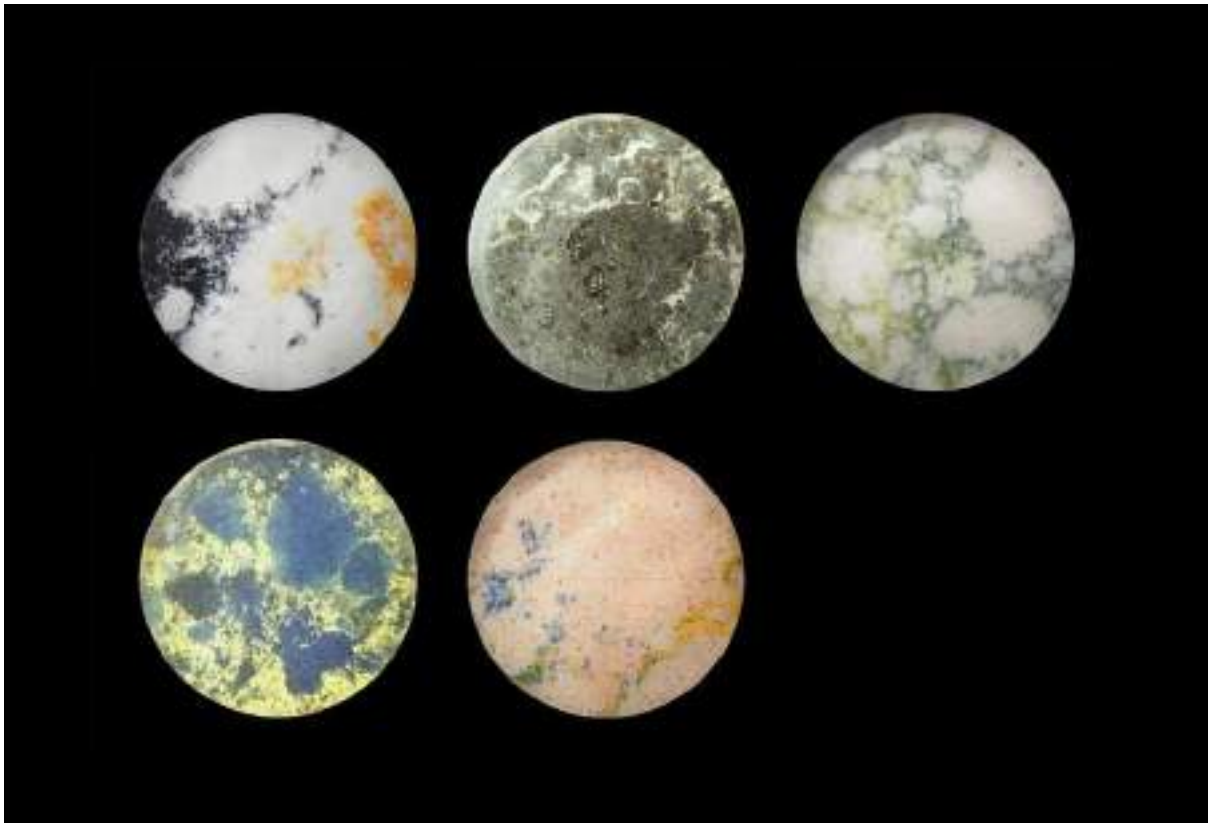

Figure 3: The Vulcans stones samples from the laboratory tests. source: TIPIC 2018

It was a small revolution in an industrial sector (the production of synthetic stone) where technology had always been used to produce better and better imitations of natural stone and not to create “new design tools” (a step forward from push to pull strategy).

The collection was named "Vulcans", inspired by the place where mother nature mixes matters.

This process, a sequence of customer centric research, ideation, prototyping and industrial implementation, results can be read as a contamination between the 6 sigma process (DMAIC) and the Design Thinking. It mixes the advantage of the Design Thinking emphatic approach and sprint execution with the 6 sigma scientific approach through analysis, prioritization and measurement for effectiveness.

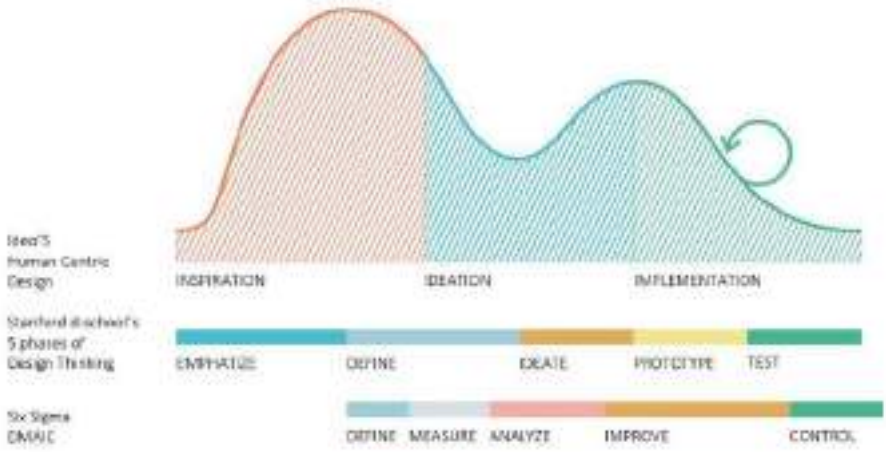

Figure 4: Comparison between the Ideo Human Centric Design Diagram, the D.School 5 phases of Design Thinking and the 6 Sigma DMAIC. source: TIPIC 2019

A new relationship with stone

The inclusion of technology is a recurring issue in the worktop processing industry. Every worktop, especially in the kitchen, must support diverse devices that manage washing, heating, cooling with different technologies (electricity, magnetic induction, gas, water) matching strong safety standards both on individual products and on their possible interaction. It is an overcrowded technical playground in which the stone worktop declines in relevance.

Thus we mapped the actions that take place in the kitchen like in the production line stations. We cleaned the area from the unnecessary and focused the attention on the essential user actions to design a simple and efficient process using Lean methodologies like Spaghetti Diagrams in production flow analysis.

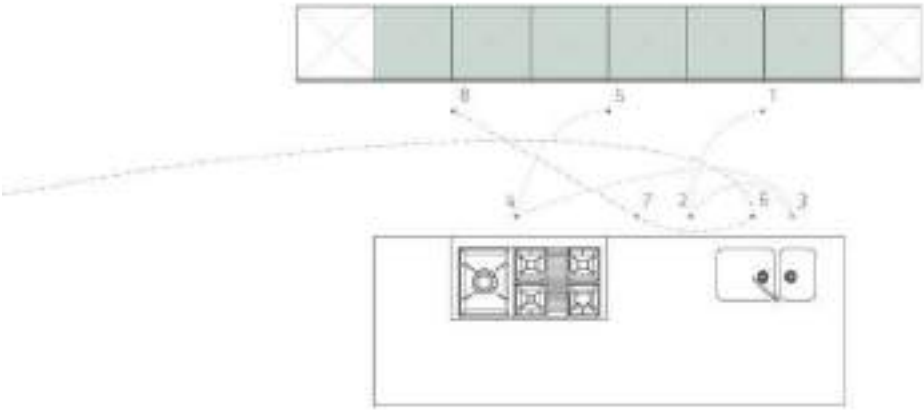

Figure 5: Mapping the user actions in the kitchen. Spaghetti Diagram as a design tool. source: TIPIC 2018

To enhance natural gestures in the kitchen we removed all unnecessary accessories creating a more direct relationship between the user and the worktop.

To go deeper, we tried to understand if it was possible to cook, wash, prepare on the stone without accessories. So we disassembled induction cooking systems, faucets, scales, loaders, drawers, to understand how they worked and we redesigned them as integrated elements on the same worktop, testing and testing evolutions of devices gradually customized (a practice known as “reverse engineering” in the lean methodology).

We focused primarily on the three main phases of food preparation:

- Stage one, the washing: thanks to I.O.T. sensor technology we coded the gestures that could control the flow of water and the opening of a hidden sink without touching any object when operating with hands in direct contact with food ingredients;
- Stage two, the fitting: we designed a new visual scale U.I. to integrate it into the worktop and make the stone itself capable of weighing for an effective preparation area;
- Stage three, the cooking: we studied many materials couplings in order to manage the thermal stress due to the cooking process to integrate an induction system in the stone worktop;

This is how the modular system of integrated solutions was conceived, a line of innovative accessories for the stone worktop: the “Offmat Solutions”.

Processing to the limit

Still today the company core business is the processing of stone worktops, with significant efficiency and quality. Furthermore, the company patented an invisible junction system that allowed to join slabs of stone without signs of evidence.

To express this know-how, we developed tense and angular geometric lines that would bring to the limit the firm stone processing capacity, creating a demo worktop that would remind a slab of natural stone of unprecedented dimensions. The plan was made using the new “impossible stones” (Vulcans) and integrated the responsive solutions that enhanced natural gestures, thus proposing a coherent synthesis of the whole innovation process. We called it "Tulér" as the old 19th-century tables from the Italian kitchen culture, used to make homemade egg pasta, equipped with marble top, integrated rolling pin, cutting boards and removable shelves.

Tulèr was the first ever responsive kitchen.

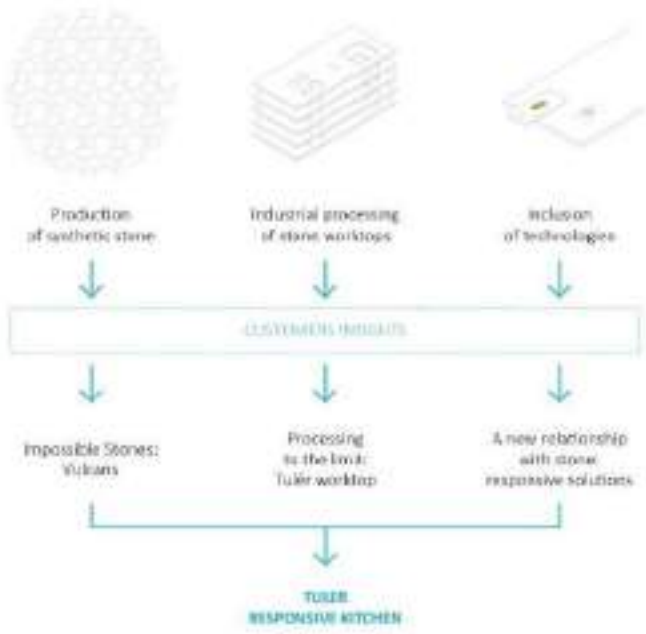

Figure 6: From Group Know-how macro areas mapping to Offmat initiatives : TIPIC 2019

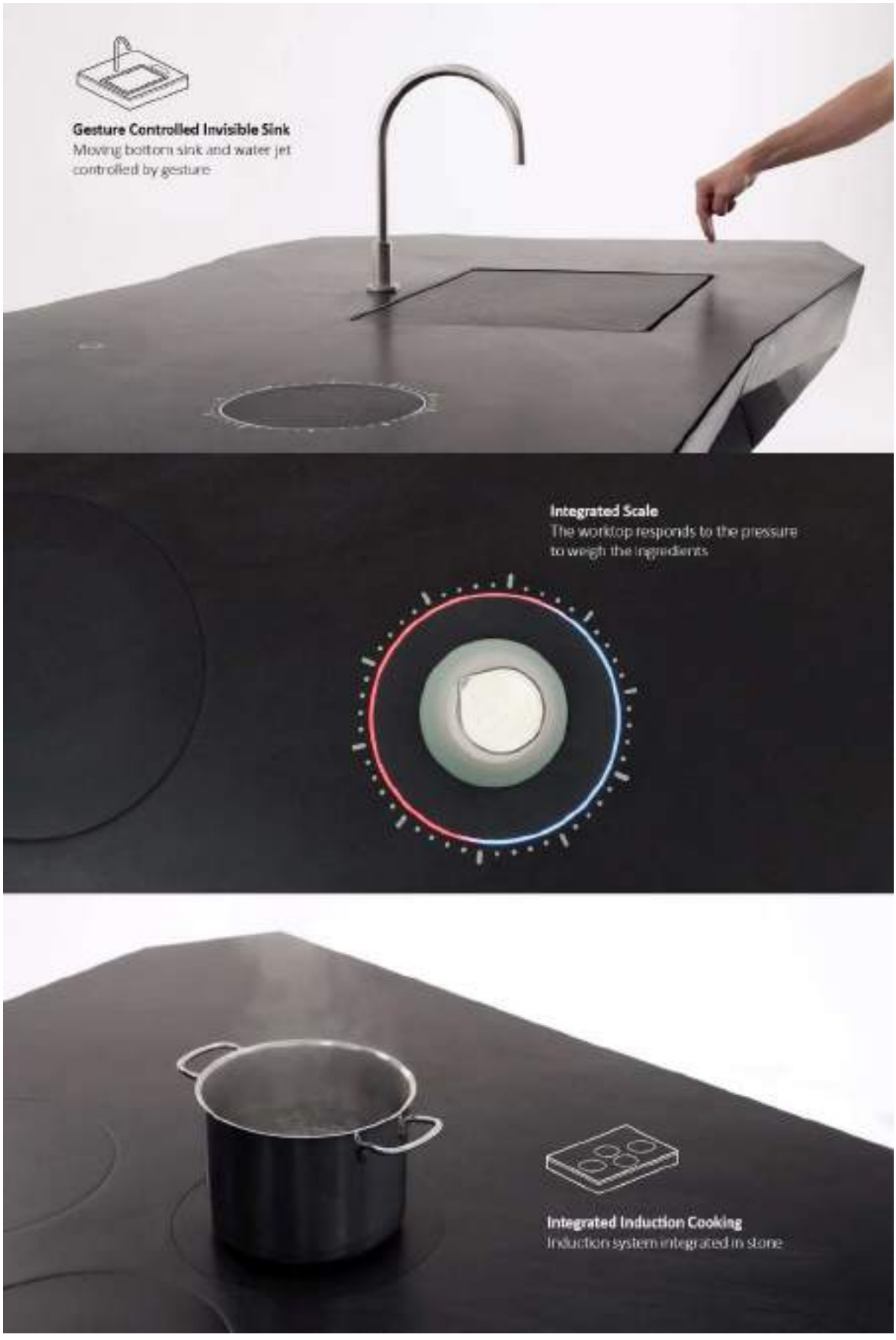

Figure 7: The responsive solutions that enhance natural gestures. source: TIPIC 2018

The key learnings

The “Offmat project” met excellent feedback, but it was especially a contagious singularity.

Not all the Offmat products have become standard products, but the company has recognized the value of the experimental process and the effectiveness of devoting pilot units to exploration and prototyping, to test ideas in a fast and effective process. The Firm has today launched a new reorganization of its company group of which Offmat has become a central element.

Other companies in the field have started to present experiments in the direction of simplification of gestures and functions and are now exploring a growing integration between technologies and materials. The human-centric culture is pervading the industry.

On the other hand, the empirical approach based on the reiteration with increasing awareness, usual in workshops and formalized in the "ideation-prototyping-test" cycle of Design Thinking, has allowed us to find precious and faster "insights", even in strategic research, and to implement them in the short term.

Working between strategy, marketing, product and frequenting the production line has allowed us to identify similar patterns in methods coming from different disciplines, such as the Lean / Six Sigma Methodology, the Design Thinking, the Design Sprint and the Mapping of distinctive capabilities in Strategic studies. They are discrete tools that merge along the line of the project, notably in the face of complex issues that require multiple validations.

In such circumstances, our working group horizontal structure proved to be fundamental to allow the needed flexibility in face of the “fluid” challenges that occurred.The Offmat team consisted of a mix of people internal and external to the company, with different levels of responsibility and different culture. This allowed

to proceed quickly without losing focus, maintaining traction, enhancing resolutory debates. It is an example of how the ability to interact accelerates knowledge and the transfer of knowledge with relevant effects on the company's growth and innovativeness.

We have called this modular approach "Thinkingram", from the matching of "Design thinking" with the "Tangram" game, where each piece represents a module of the process and the modules together, depending on their order, shape unlimited figures.

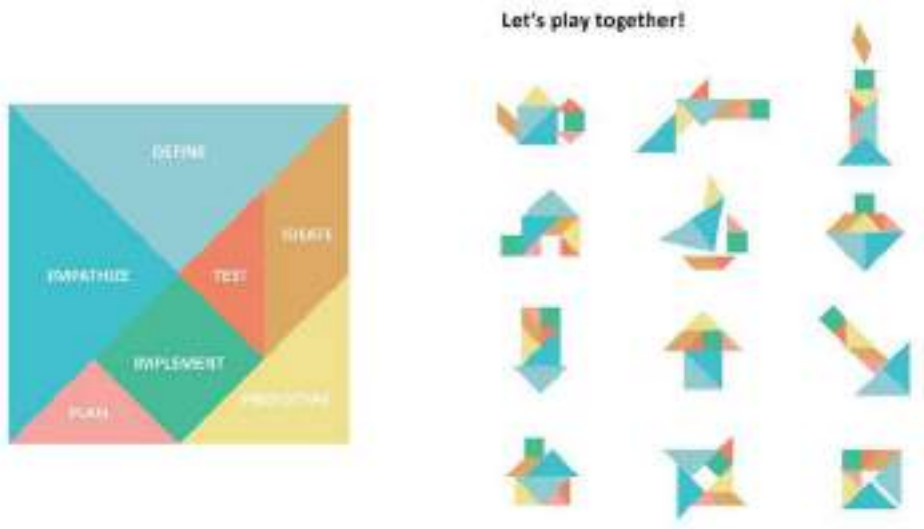

Figure 8: The Thinkingram Diagram. source: TIPIC 2018

In addiction to the 5 phases of Design Thinking theorized by Stanford d.school we have identified two specific moments that allow us to design a complete framework of the consulting activity from research to market.

These two phases are:

1. plan: “Plan” is when the team plans future events, allocates resources and tasks and involves possible external supports and contributors. “Plan” turns the target of “Define” in a series of actions.

1. implement: “Implement” scales the result of the "ideate-prototype-test" cycle, managing and monitoring the planned actions to integrate the product or the service in the company ecosystem or brings it to the market.

The 7 resulting phases (Empathize, Define, Plan, Ideate, Prototype, Test, Implement) let us describe and organize the complete process from the beginning of research to the marketing plan implementation in a unique storyline that integrates strategy, marketing and design.

The Thinkingram is our possible answer to the emerging need of integrating design thinking with strategy, marketing and efficiency methodologies in a common framework. The modularity of this approach emphasizes the single phases without losing the big-picture. It is a plus in complex projects in which multiple subjects are called to collaborate.

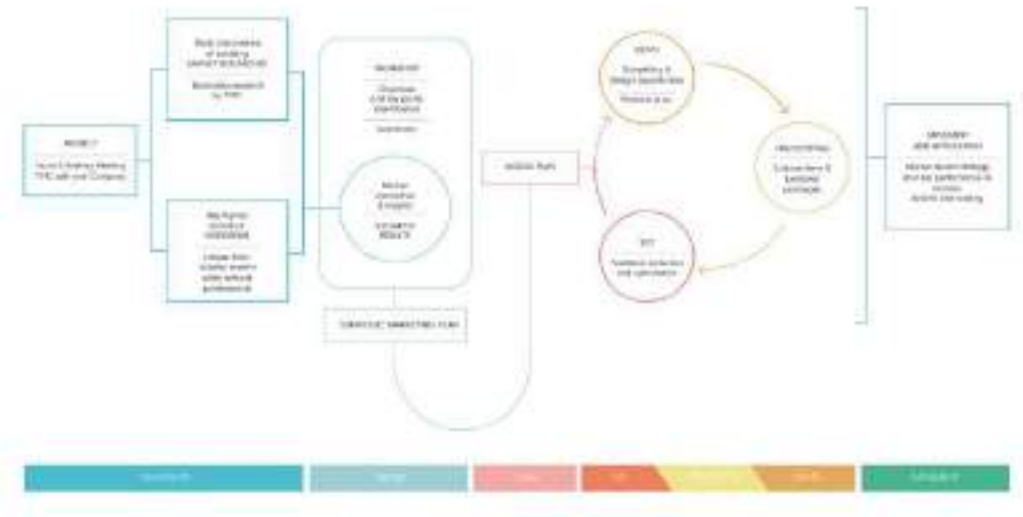

Figure 9: The Thinkingram’s phases Diagram. source: TIPIC 2018

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Research Perspectives IN THE ERA OF Transformations

Designing a coherent land registration system for rural Portugal

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After almost a century of several attempts to establish a coherent land registration system across the whole country, in 2017 the Portuguese government decided to try a new, digital native approach to the problem. Thus, a web-based platform was created, where property owners from 10 pilot municipalities could manually identify their lands' properties using a map based on satellite images. After the first month of submissions, it became clear that at the current daily rate, it would take years to achieve the goal of 100% rural property identification across just the 10 municipalities. Field research during the first month after launch enabled us to understand landowners' relationships with their land, map their struggles with the platform, and prototype ways to improve the whole service. Understanding that these improvements would still not be enough to get to the necessary daily rate, we designed, tested and validated an algorithm that allows us to identify a rural property shape and location without coordinates. Today, we are able to help both Government and landowners identify a rural property location with the click of a button.

Keywords: Service Design, Design Thinking, Rural land, Big Data

Context & problem

For the past century, several Portuguese governments have tried to implement nationwide rural property registry initiatives, not only focusing on gathering ownership information, but also rigorous property boundaries identification. Though several methods have been tried - some promoted by the government, other by local power - with varying degrees of success, as of today only half of the country (mainly south of Tejo river) is registered in an updated database of both rural ownership and property boundaries. The other half (which contains a much larger number of smaller, individual properties) has been stuck on a negative feedback loop, resulting in the degradation of the value of said properties, and also hampering the ability to sustainably manage these lands, either by owners or public institutions. This loop has been boosted by various reasons: an aging rural population, the loss of knowledge about where properties are and the fast declining of commercial exploration of these properties. All these factors result in large areas of unkempt vegetation and forest, which then leads to even less interest in these rural properties. Unfortunately, this unmanaged territories have also been the ones where environmental catastrophes, mainly fires, have been the most common.

So, it was not surprising when in June 2017, 53 thousand hectares of land in the Portuguese interior were destroyed by one of the biggest forest fires to ever occur in Portugal, also taking the lives of 64 people. This human and environmental catastrophe would then be followed by more destruction, just four months after, in October 2017, when hundreds of smaller fires consumed another 54 thousand hectares of land across the whole country, resulting in the death of 50 more people.

Though a new initiative for rural properties registration was already in the works, the June fires sped up the urgency of understanding who owned what and where. As one of the main constraints of previous initiatives had always been the high costs of acquiring GPS equipment and hiring (or training) technicians that could go on the field to gather hundreds of thousands of precise property coordinates, this time a digital native mindset inspired the writing of the decree-law behind the new initiative.
Hence, BUPi — Balcão Único do Prédio (roughly translates to Centralised Property Desk) — was born.
A web-based platform that would allow for rural landowners to register their properties and identify its boundaries using aerial/satellite photos. Because the main target of this tool would be a very aged population, the decree-law also included the setup of physical counters where technicians could help owners using the platform. These physical counters were positioned at each municipality's town hall and could be accessed by appointment only. Though web-based, during the first 8 months of the initiative, the platform could only be accessed through the physical counters and with the supervision of the technicians.
Because of its novel approach, BUPi was designed as a pilot program, to be tested in a small region of the country, before a wider launch. The June fires ended up being one of the decisive factors in the selection of the 10 municipalities that would become part of the year-long pilot. In order to rapidly implement the defined vision, an assembly of companies, with different types of skills and know-how, was hired. As a Strategic Design Consultancy, specialised in research, strategy and design outputs, we were invited to evaluate the service, both in the digital platform and the physical counters, and devise a communication strategy that would generate the necessary demand by the targeted local communities.

The narrative

To better tackle all of the challenges ahead we assembled a multidisciplinary team composed by a researcher, a digital strategist, a communication strategist, a service designer and a digital designer, working together throughout the duration of the whole project. Our very first challenge was a kind of *go-to-market* strategy before the research project even started. We only entered the project one month before the decree-law's starting date (November 2017), and during the first full month we focused on helping to create the conditions so that BUPi could work from day one. This work involved service design for the counter, reviewing/improving the existing web platform and creating the first communication pieces to be used. It is important to note that for the first six months of BUPi, the online platform could only be used by certified technicians, provided by each municipality.
Though this was not part of our core challenge, we embraced it and saw it as a way to set up the stage where we would be doing research. During this initial period, we were able to engage in web platform testing, use roleplaying to experiment with different counter concepts, establish productive connections with the most relevant local actors, and build several prototypes for communication mediums that, besides serving for the upcoming launch, would also allow us to understand what kind of messages resonate with people. This was also the time when it was decided that we would focus our research effort mainly in the municipality of Penela.
When the pilot was launched, we started a two-month-long field research phase during which we not only visited Penela, but actually lived there for several weeks. This was an intensive research and empathy phase, containing not just information gathering, but also reiteration and prototyping.
Besides doing research on every village of the municipality, talking with both private and public actors, interviewing all kinds of owners, observing how people interacted at the BUPi counter, even trying to buy a rural property, and using tools for property boundaries identification, we prototyped a lot: new kinds of counters, new ways of identifying a property (both digital and physical), several versions of communication pieces and even town hall meetings. All of this served not only the purpose of mapping the challenges and improvements to the physical and digital services, but also rapidly understanding what actually worked, in order to spread it across the other 9 municipalities.

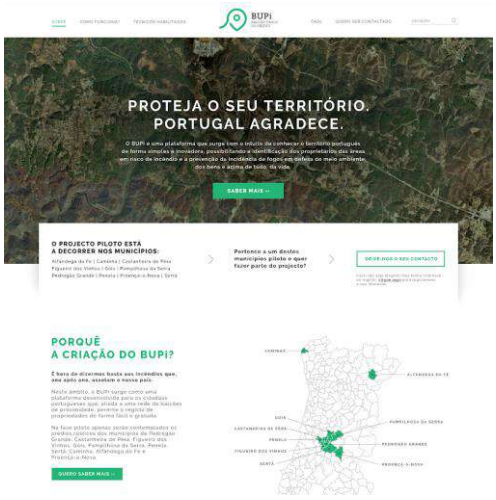

Figure 1: The first landing page we built

Figure 2: Our attempt to buy a rural property helped us understand how lands are priced and sold.

Figure 3: Besides using the digital platform, we also experimented identifying properties through the old fashioned way.

One example of this research approach is the prototype for a decentralized counter we created in Penela's weekly market. After understanding that some of the main bottlenecks of the project were the time each technician spent with each owner, each municipality having only one technician per counter, and the hard time property owners had searching for their properties on a 2D migital map, we decided to test a way that could allow each owner to get to the counter with as much applicable knowledge as possible about the whereabouts and boundaries of their properties. So, for 3 wednesdays in a row we set up a table at the center of the weekly market and using Google maps, a digital tool already used either by the target population or close relatives, we helped several people drafting the shape of their properties on top of Google satellite images. This whole experience allowed us to understand several things:

- The kind of questions a technician might use in order to help a property owner;
- Mapping of strategies for knowledge gathering before an owner goes to an official BUPi counter;
- The different media that owners use to record this type of information;
- The way this knowledge should be structured for easy reading by the technician;
- How a decentralized counter might streamline the whole process;
- The new role we would have to create for this kind of *help counter;*

Figure 4: We prototyped a new "help counter", outside the city hall, where owners could get support, gathering information before going to the main counter

Figure 5: Testing Google Street View as a way to streamline owners' identification of property location

Figure 6: One of the prototypes we built with the goal of raising awareness and collecting owners contact information at local restaurants and other gathering places

By the end of this intensive research phase we had identified 4 main issues present in the whole initiative:

1. Disorganized and complex communication between the different entities and with the target population, originated by a lack of understanding about the overall goals of the initiative, different interpretations of the law, lack of a coherent governance model and generalized misunderstandings about what the digital property boundaries identification was all about;
2. At the base of the creation of the decree-law and the first batch of communication were unrealistic scenarios that did not take into account different kinds of property owners and the different reasons why each different type of owner might be interested in this initiative;
3. Although the main goal of BUPi was to allow for a better management of rural and forest lands in the future, the registry of rural properties ownership was seen as the single most important thing in the user flow, reducing the identification of property boundaries and shape to either a hard in-between step, or an after thought that was dismissed by everyone;
4. All the work imperative to reach the initiative goal was dependant on the daily work schedule of each technician, a factor that would be very hard to scale.

To tackle these problems, we defined a strategy around three main principles:

1. Refocusing on property boundaries identification, not only communication-wise, but also in the way both the digital and physical flows were designed;
2. Decentralization of the counters, using public spaces and under-used public resources (e.g. computers, vans);
3. Highly targeted offline communication taking into account three different types of rural property ownership and the different and idiosyncratic communication spaces available.

Using these three principles we redesigned everything across the whole project and delivered a service design and communication report. Several key recommendations were implemented days or weeks after the report was presented.
But all of this was done inside the scope defined by the decree-law, which contemplated only one of the ways the overall goals — rural property registration and boundary identification — could be accomplished. So we went further and redefined not only the overall goals, but also the way to get there.
We understood that the end goal was not amassing property registries and pixel perfect boundary identification. The end goal was to increase existing knowledge about a massive area of rural properties and forest. This redefinition allowed us to show to the Portuguese Government that in order to better manage this huge area there was no need for thousands of owners to go to a BUPi counter or learn how to use the online platform, and identify exactly where their properties were. Attributing this responsibility to landowners could actually delay reaching the previous goal — to registry and map one hundred percent of rural lands in a year — by decades.
The passive approach adopted by the Portuguese Government, whose role besides creating the decree-law and building the offline and online tools was simply to wait for owners to seek the service, did not make sense in an age of satellite images, artificial intelligence and huge amounts of data. Thus, on top of everything we recommended, we also proposed a redefinition of the vision for the whole project, to use satellite images,

historical databases of ownership and every bit of publicly available georeferenced data, together with computer algorithms, in order to understand the amount of rural properties that exist in a given area, the most likely boundaries of these properties and who might be their owners.
This new approach opened the door to new opportunities in the long run. If successful, it would be possible to get a citizen to confirm if what was deduced was true, changing the incentives system for participation: you wouldn't have to put in the work, just check if everything you owned was deduced. It would also allow for more clear identification of the owners who had neglected their properties (increasing the risk for catastrophes). So, together with one of the other companies working on the project (specialized in big data) we started a two-months-long proof of concept, with a mini project.
During this period, we collected public information from both public and private institutions, tested different kinds of satellite imagery, cleaned and improved databases. In the end, using three different methods according to the data points available for a given property, we were able to show that it was possible to identify the probable location of any given property in the municipality of Penela, the municipality chosen for the proof of concept. This capability was then included in the platform, in which both technicians and property owners could now automatically get the probable location for a given rural property number, without any other input. The development of the property boundaries identification algorithm is as of today a work in progress, together with the further development of the overall concept behind this new vision, in order to scale its capabilities and usefulness.

Figure 7: First concept of the location and shape detection algorithm

When we presented the service design and communication report, together with the new vision for the project in January 2018, two months after the launch of BUPi, the average goal completion for the 10 municipalities was around 2%. By November 2018, the project was able to go above the 50% mark of overall goal completion — properties location and boundaries identified/checked by its rightful owners. BUPi became one of the fastest initiatives of its kind, and extended beyond the initial 1 year pilot program. As of today, a national roll-out is being discussed in the Portuguese parliament. The big data effort also allowed for an increase in the project scope. For the first time, georeferenced data that was *owned* by different institutions and seldomly shared is now centralized in a single platform which allows an unprecedented level of knowledge creation about the Portuguese territory. As a tool, this knowledge can only grow in capabilities, with the potential to go from a tool deployed for catastrophe prevention, to an active platform available to everyone who wants to reinvent how value is generated using areas that have been abandoned for several decades.

Key learnings

From all the things we learned during the research phase and the following months of implementation of the report recommendations and the new vision, we want to highlight four that we believe can be applied by anyone practicing Design Thinking:

1. Taking time to setup the real world conditions where we will apply Design Thinking is not a problem, but rather a strength even when we have to actually build the things we will end-up studying. We would even argue that this is at the core of prototyping and testing as principles of Design Thinking;

2. Applying the Design Thinking principles, beyond a linear process, is in itself a way to start solving the problem we are studying while doing the project. Everything we did during the research phase in Penela, even just talking with people at local coffee shops, helped this municipality being the one with the best average completion goal while we were there. No one can study a problem in a vacuum, Design Thinking can be used as an impactful change agent during this process.

3. Gradually presenting micro-results and strategically valuable knowledge generated in an immersive and empathy-focused Design Thinking approach allows for growing confidence within the project team and third-party entities, uplifting design to be the discipline that leads a strategic and innovation process across multiple dimensions (law-making, operational support, communication, service, digital platforms);

4. It is quite common for the challenge to be set around means goals and not end goals, which can limit how the strategy is developed. In any project, taking a step back and reaching a clear and defined overall end goal can open up or even change the scope of the challenges and solutions devised within the strategy.

Final thoughts

Before the program was launched (November 2017), there were 243.195 hectares of properties that needed to be georeferenced by its owners on 10 pilot municipalities. From November to the middle of January, the program had achieved the 2% mark of completion. This was around the time when we presented our research reports and the new, data intensive approach. Once the service design report recommendations started being applied we saw significant improvements in the number of properties georeferenced across all municipalities and the percentage of completion skyrocketed to 47.47%, until October. This percentage includes 82.860 properties identified, for a total of 35.601 hectares of rural land. On top of this, all the mobilisation generated 45.000 individual counter bookings that couldn't be fulfilled as of October: by the end of the project, demand exceeded supply.

Besides the expansion of the project, improvements of the algorithm and development of visual supports for mass media communication, we are already studying how the data collected can be used to empower entrepreneurs from all over the country to find new ways to enrich rural Portugal.

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Research Perspectives IN THE ERA OF Transformations

Development of JIT patient-specific implants: design-led approach to healthcare and manufacturing transformation in an Australian context

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Design thinking and human-centred design is often discussed and utilised by teams and organisations seeking to develop more optimal, effective or innovative solutions for better customer outcomes. In the healthcare sector the opportunity presented by the practice of human-centred design and design thinking in the pursuit of better patient outcomes is a natural alignment. However, healthcare challenges often involve complex problem sets, many stakeholders, large systems and actors that resist change. High-levels of investment and risk aversion results in the status quo of traditional technology-led processes and analytical decision-making dominating product and strategy development. In this case study we present the opportunities, challenges and benefits that including a design-led approach in developing complex healthcare technology can bring. Drawing on interviews with participants and reflections from the project team, we explore and articulate the key learning from using a design-led approach. In particular we discuss how design-led practices that place patients at the heart of technology development facilitated the project team in aligning key stakeholders, unearthing critical system considerations, and identifying product and sector-wide opportunities.

Context and Background

In 2017, the Australian Government funded a unique collaboration between a specialist orthopaedic and oncology hospital, University Technology Sydney and the Royal Melbourne Institute of Technology and a medical device manufacturer to produce bone tumour implants based on 'just-in-time' (JIT) principles[1] in a hospital environment. The determinants to deliver this manufacturing transformation research project were based on the hypotheses that a JIT patient-specific pathway would not only improve the speed and accuracy of surgery but also improve overall patient, hospital and health system outcomes.

This innovative, technology-led project aimed to combine specialised imaging techniques, the accuracy of robotic assisted surgery and 3D printing to deliver a personalised implant in time for the surgeon to remove the tumour and repair the patient's bone in one operation. Currently, the patient specific implant design, manufacture and delivery process can take between 8 – 12 weeks.

[1] Relating to a manufacturing system in which parts and materials are delivered when they are needed, rather than before and reduces the cost of storing parts and materials and reduces waste.

To achieve this, the project aimed to:

- Develop innovative manufacturing and health care pathways
- Reduce implant production timeframes,
- Reduce cost of implant manufacture,
- Deliver custom solutions to oncology patients
- Save lives of young and older Australians, and
- Improve limb salvage surgery.

Each member of the research team were tasked with discreet parcels of work relating to the overall manufacturing research brief. This case study documents how practitioner-based researchers from the Centre for Business and Social Innovation (CBSI) and the Design Innovation Research Centre (DIRC) from the University of Technology Sydney (UTS) facilitated a design-led innovation workshop to understand and explore the business considerations relating to this overall research project. Specifically, it examines the role of workshop design, facilitation and artefacts to achieve business model innovation and sector transformation – with considerations specific to additive manufacturing and delivering a just-in-time (JIT) patient-specific solution in an Australian context. The transdisciplinary research team was formed by members from both CSBI and DIRC at UTS and consisted of a strategic design practitioner, with a background in communication design and business management, a visual communication designer, and an industry transformation research fellow, with a background in business development, project management and stakeholder engagement.

The anticipation of introducing a new technology to the market can often transcend a true benefit assessment that such new technologies might bring to a value proposition and the end users. Thus, critically assessing the need for new technology at the pointy end of service delivery was required with a design-led frame and specific attention to the role of; patient-centred design, visual artefacts and workshop facilitation. A design-led approach is representative of the application of traditional design practices into non-traditional contexts – also known as design thinking and human-centred design (Brown & Katz, 2009; Martin, 2009; Kelley & Kelley, 2013; Dorst, 2015; Liedtka & Ogilvie, 2011).

The narrative

As part of the broader manufacturing research project, The UTS research team was tasked with undertaking research on the sarcoma stakeholder eco-system, to form an understanding of the business model considerations related to project delivery. The UTS team worked collaboratively to gather and synthesise qualitative stakeholder research across the broader medical device and health system including stakeholders from industry, government and hospitals (including: patients, surgeons, other health professionals, design and manufacturing, operations, governance, regulatory) . Extensive semi-structured interviews revealed the pain points of the current patient and stakeholder journey whilst also highlighting the gain points and opportunities the JIT project could address.

The UTS team adopted a design-led approach to developing workshop activities and facilitation plans in order to enable all project partners to fully explore and make use of the rich research findings. This approach was specifically adopted to help facilitate broad stakeholder engagement to comprehensively explore complexities and considerations relating to a project of this scope.

The team also drew upon service design methods (Stickdorn & Schneider, 2010) for mapping patient and stakeholder experiences and creating current and future state ‘Patient and Stakeholder Journey Maps.’ These journey maps were the culmination of a six-month qualitative research program, synthesised for the purpose of sharing insights from this with participants of the interviews as well as the broader project team.

Applying a design-led approach; reframing, synthesis and artefact development

Whilst CBSI team members conducted the qualitative research, the DIRC members brought a design-led innovation approach to reframe the potential of this project around the benefit for patients. This shifted the focus from a technological viewpoint only (Bijker, Hughes, Pinch & Douglas, 2012) to one that considered the patient as core (primary beneficiary) and surgeons (primary user) and broader system participants including healthcare providers, insurers and regulatory bodies (Figure 1).

DIRC’s design practitioner skills assisted in the ‘sense-making’ (Kolko, J. 2010) of the vast volume of data accumulated through the qualitative research phases (including 30 semi-structured stakeholder interviews).

The team was tasked with translating the data into visually digestible artefacts to share with stakeholders' representatives from across the system. These artefacts not only supported the relevancy of reframing the problem but pointed out the true opportunity that the innovative technology had for the system participants and what might need to be explored in realising this.

Both centres worked together to synthesise the research of the patient pathway and system, and discuss how best to organise this information in a way that would be:

1) Easy to understand
2) Visually stimulating and relative to current state
3) Consultative and participatory
4) Representative of future state scenarios
5) Developed to inform business model innovation

Figure 1 – Participants first worked together in small groups debating and validating elements of the current state while stepping through the journey of the patient and stakeholders.

Agenda as a design output and process

In the curation of the design-led workshop, the articulation of research insights and the outcomes of the workshop needed to provide input into the team's objective to build information and knowledge about what kind of business models may be most suitable for the realisation of this technology. Therefore, the agenda development was an important step in the process toward realisation of this. Agenda items were designed not only to inform stakeholders of research outcomes and strategic intent, but to also help shape possible business model innovations.

The process of developing the agenda (Figure 2) was time consuming and took over two months to finalise. It was a complicated process as there was an interplay between several moving parts:

Figure 2 – The agenda as a working document showing the interplay between all the moving parts of the workshop.

The workshop experience and facilitation

One element of the workshop's success hinged upon the facilitation of the workshop itself and the management of participant experience. The objective being to elicit all knowledge present in the room across key agenda activities. This process was important as it relied on each member of the UTS research team to perform specific roles as part of the facilitation process. These roles included:

- **Lead facilitator:** research project lead, and owner of key data inputs from research,
- **Second facilitator**: facilitating design-led activities, providing explanation of why activities would be conducted in certain ways, content knowledge, and
- **Support facilitation:** Working with teams, guiding participants on how to engage in design methods, documentation of workshop.

Figures 3, 4 and 5 illustrate key points in the workshop for participants to come together using the visual artefacts.

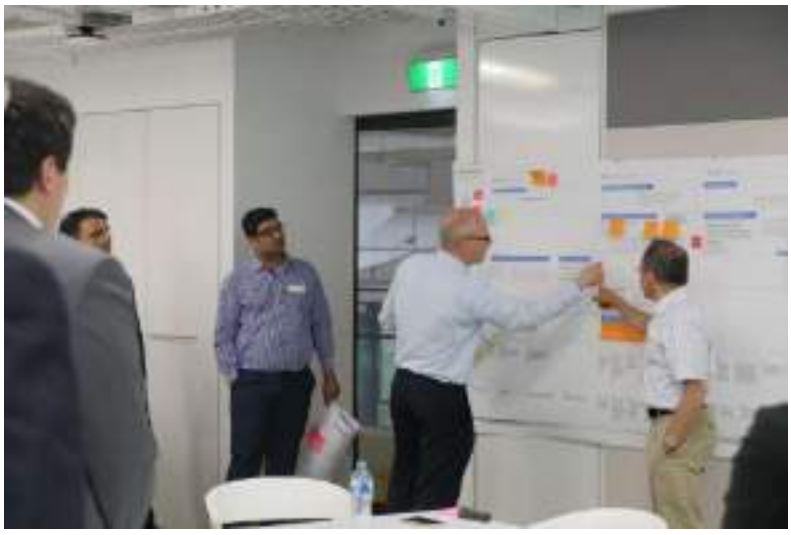

Figure 3 – The scale of the artefact allowed for physical interactions to take place simultaneously to the verbal discussion, also highlighting particular areas of the patient journey to emerging areas that could be changed or we deemed as important by participants.

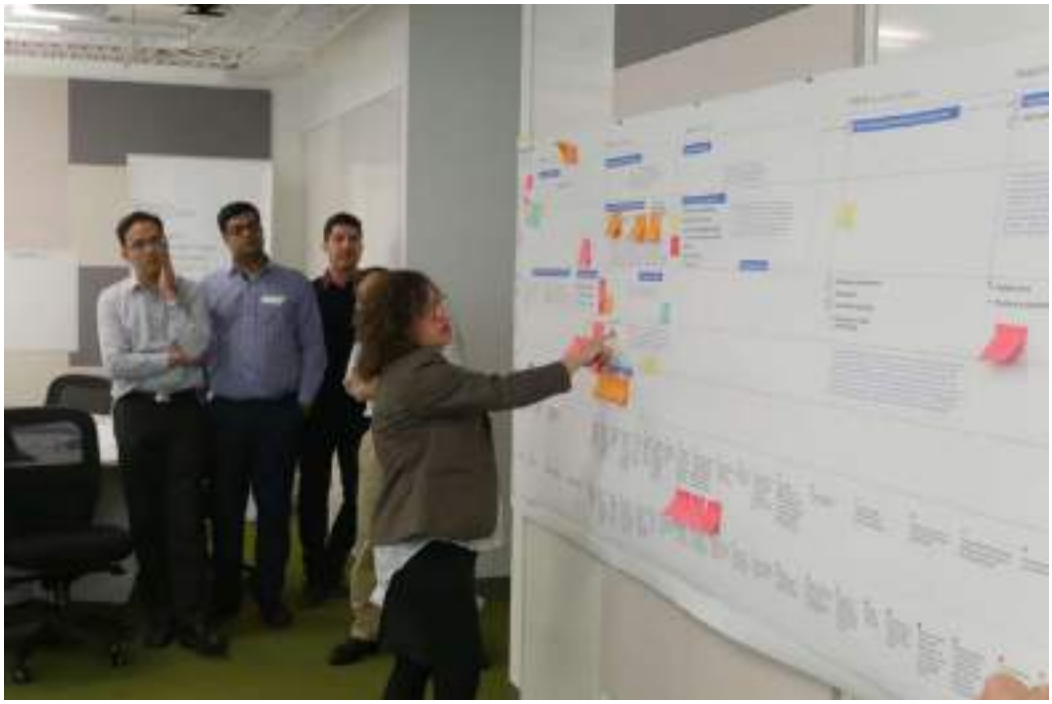

Figure 4 – A whole group discussion facilitated around the large format journey map artefact allowed for different perspectives and expertise to be heard and then visually collated, resulting in the discussion to progress to a validation of the current patient journey.

Figure 5 – Groups became more comfortable with the design process as the workshop progressed and embraced the physical space around the artefacts as their place for discussion around the patient journey.

Key Learnings

The problem framing and reframing (Dorst, 2015) generated an important pivot for this project refocusing the attention of the manufacturing research project members to patient and system needs. However, further supporting the value of this, the development of physical artefacts (including the Patient and Stakeholder Journey Maps) was critical to aid the communication of data insights and the patient process flows and

dynamics (Boland & Avital, 2015). The 'Patient and Stakeholder Journey Map' was key to achieving effective collaboration and input from diverse stakeholders of the project to inform the business model design. Further, it helped to build a consensus amongst stakeholders about the project direction and possible initiatives to consider. Ultimately this artefact was adopted by the project team as a 'working system tool' and guide for the project going forward.

Consideration was also given to understanding gaps and opportunities not only for the project team but the sector and medical device industry more broadly that could not be anticipated in advance. The outcomes of the workshop and project to date have generated a 'ripple effect' across key stakeholders in the journey including government regulators, health insurance agencies and supply chain. At a macro level the project has also generated new opportunities to provide enhanced patient pathway interventions related to this issue not otherwise understood – all of which derived from the main project scope.

On the surface, the delivery of *one* design-led workshop could have been perceived as a simple task, with benefit measured by the experienced of the event. However, as the research project team from UTS and broader manufacturing research group discovered, the workshop process and deliverables were critical in ensuring:

- a synthesised current and future state journey were achieved
- identification of pain and gain points to explore opportunities to address gaps in the journey
- initial ideas were developed for business model innovation options including 'scale' of market development and 'space' for physical location
- stakeholders validated and understood the existing research and next steps of the project
- the importance of the project to the patient and stakeholders across the system
- an articulation of the project system, what it set out to achieve and what it would need to consider to be able to share with others from outside the immediate project group in the form of artefacts

Contributing factors

The key components that contributed to a successful collaborative design-led process are identified as follows:

Table 1: Contributing factors

Synthesis of research findings	
Insight development	Synthesised stakeholder interviews through 5 - 7 iterations – what was the 'so what' of each insight and how to best summarise key points that would be effectively communicated.
Developed and reworked workshop agenda and artefacts	
Problem definition (reframing)	Validate the definition and need of JIT, and the problem that the team was aiming to solve. Thus emphasising the importance of the patient experience as a starting point for how we understand the problem and that success primarily hinges on good patient outcomes (rather than achieving the delivery of new innovative technology in itself).
Map system complexities	Identifying all of the key stakeholders and beginning to map dependencies within the system for technologies' success within the health care system.
Journey stages and stakeholder interactions	Working through key steps in the system that may significantly need to change through the realisation and support of technology and its users.

Critical journey moments	Articulation of the Patient-centred journey mapped to all system actor pain points and gain points and opportunities.
Future state pathways	Develop future state opportunities. Given the volume of content and limitation of time in the workshop, there was a need to identify some hypothetical futures and process options (which also arose from research undertaken by the team) for validation and exploration into the workshop.
Designing of things	The role that visual communication design played in developing a patient-centred journey artefact and associated content. The artefact has now become an instrumental device for the manufacturing research project team and medical device manufacturer ongoing and is continuing to evolve. Recognition that the agenda development was also a subject of design; considering how associated artefacts and experiences would align to achieve desired outcome for the workshop.
Business model inputs	
Space	Explore the options and needs of a physical space required to house the technology and the implications and considerations of this on service delivery to patients.
Scale	Explore options about how the technology application may be more broadly applied to other patient-specific solutions beyond osteosarcoma –
Prioritisation and validation by workshop attendees (project team):	
Concluding with purpose	Discussing critical factors for the project and what needs to happen next (which was curated by the UTS team, but the needs of project members also directed the prioritisation of these). Identify broader project needs (involving people and system) in order to realise project vision.
Teaming and collaboration	
Diversity of thought	Leveraging the diverse skills and experience that the joint UTS team brought to the project. Particularly for this project the mix of business, design, strategy and visual communication design (graphic design) expertise. Further to this, understanding each other's backgrounds, skills and being open to new ways of thinking through the project requirements was key to this successful partnership.
Facilitation interplay	The interplay between facilitators within the workshop. Sharing roles throughout, leaning on each other for support and the ability to adapt and change where required through the day, and sensing from participants when this would be needed and what it might involve.

To achieve these outcomes, the bulk of the work and thinking was completed in the preparation of the agenda, workshop design and development of visual artefacts. The collaboration of skills from the expertise of the design team joining forces with experts in business development practices, strategy-led approaches and innovation management, that led to the outcome. The key to this collaborative partnership was in the tensions that arose when meeting together to discuss approaches to the design of the workshop, types of activities and ways to communicate the artefact. These tensions can be further explained as traditional strategy-led frames with biases toward solutions (hypothesis) meeting exploratory design-led frames whereby future directions and opportunities were kept open (Martin, 2009).

Conclusion

Successful innovative products and services do not simply arise out of the realisation of a new technology in itself. Their success is dependent on integration across the whole ecosystem and the implications across a range of human and non-human actors within that system, and a collective fit within an organisational culture and business model. Further, key attributes and characteristics are not known until stakeholders within a system are aligned. All stakeholders need to be aware of the considerations and implications that introducing a new technology and process will have on the broader system and to be actively participating in designing and considering not only the technological solution, but also the social, economic, cultural and environmental implications of innovation (Brynjolfsson & McAfee, 2014). Therefore, we propose as this case study demonstrates that the fusion of both design-led practices to business strategy approaches is a powerful mix for complex system-wide innovation challenges, and that engagement of design practitioners be encouraged in an effort to create physical experiences and tangible artefacts in aid of such project efforts.

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Designing and Developing Entrepreneurial Culture for a Small UK Based University

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An undeniable truth is the rise of status and responsibility assigned to Enterprise and Entrepreneurship within the UK Higher Education Institutions, as a means of crafting a more competitive economy. With a growing interest in this area from the Creative Industries, there is a need to articulate the entrepreneurship developments more often, and pinpoint where, how, and to what degree, design innovation management research is supporting this in a meaningful manner. It shares why the development of entrepreneurial culture has been purposefully designed and offers insight into how this has been achieved. This is to give a tangible example of design as a strategy for leadership. The case study is a reflection on practice; a contemplative dialogue on design innovation management research as agency for cultural change and development of a process of *becoming* an entrepreneurial university. It is an example of work undertaken to create an outward-facing, more networked entrepreneurial culture within a small UK based university, as well as leveraging adjacent cultural and economic resources as part of a more entrepreneurial ecosystem within the residing city and country. It discusses a grand-scale entrepreneurial activity within a traditionally rigid structure i.e. a University, as a means of sharing how design innovation management can be used to nudge cultural change over the medium term and beyond design's own discipline and culture. It captures the essence of concept development using a macro lens. In addition to deploying traditional methods, the work uses a dynamic participatory process, designed to grow iteratively and deliberatively working with people as collaborators throughout. The five key learnings shared are the importance of making entrepreneurship a strategic priority; employ design as a strategy for developing an entrepreneurial culture; uphold the act of being inclusive; value a strategically activist approach, and actively manage risk using design principles.

Keywords: Design, entrepreneurship, education, culture, knowledge exchange

Introduction: context and opportunity

In the UK's Creative Industries, a sustained interest in enterprise and entrepreneurship education stems from a need to strengthen the sector's business infrastructure; maximise its network (and its associated resilience), craft new engagements and heighten impact with other sectors. Additionally, its driven by a duty to innovate, with a concern to economically enhance and support its largely self-employed, freelancing practitioners, micro enterprises and small businesses (Department for Culture, Media and Sport, 2006; Clews, 2007; Dellot, 2014; Dellot and Wallace-Stephens, 2017). Lately, a further rise in status and responsibility for enterprise and entrepreneurship within UK Universities has occurred because, for example, of the EU's ambition to be the most competitive economy, the QAA's strategy for Enterprise and Entrepreneurship Education (2014, 2018) developed to capture impact while providing a roadmap for the future; the wider educational entrepreneurial

reports highlighting a pressing need for change in enterprise education and skills development (Universities Scotland, 2015; APPG, 2018) and the UK's Industrial Strategy (BEIS, 2018) that fuels an exigency to be the most innovative economy via grand opportunities with ambitious modernisation.

In 2013, the University of Dundee in Scotland were looking to solve a problem and ended up transforming their idea into a new design-led Centre of Entrepreneurship in support of new business start-ups and cultural nudging. What began as a traditional academic exercise to manage resources with greater efficacy and impact, organically grew into an orchestrated partnership strategy with dedicated commitment, resource and investment from likeminded individuals across the full breadth of the organisation and its network. Through a four-year process (2013-17), the University of Dundee drew on a design for business innovation model to fashion new relationships, mobilise fresh ideas, secure investment and further cultivate an appetite for change by design towards entrepreneurship education for all subject specialisms. This curated a new product and a new service, thereby presenting a unique hyper-local offering in a growing competitive marketplace.

Role and Expertise

With an established design research and knowledge exchange background with experience of delivering impactful entrepreneurial projects (notably the conception and development of V&A Dundee) I began working in this area as the Director of Knowledge Exchange and Enterprise, before becoming academic lead for entrepreneurship. My vision (and place within an emerging pan University team) was to build upon the momentum. It was to develop a culturally developing recognition of design as a strategy for social and cultural transformation with economic impact that was occurring in the University, across the City of Dundee and Scotland more widely: design-led entrepreneurship. This understanding of design is a relatively new characterisation in the eyes of the general public and outside of the discipline of design.

In itself, V&A Dundee, Museum of Design exemplifies design-led entrepreneurship in three ways: 1) attracting a world leading brand, namely V&A , to Dundee which is a city of <150,000 people, 2) its manifestation as an award winning, world leading piece of architecture designed by the renowned Kengo Kuma and, 3) as an entrepreneurial example of design innovation management in terms of the process by which it was conceived, developed and realised (2007-2018), and its subsequent developing impact on social and cultural transformation of a small city (which is ongoing). Together these acts and levels of entrepreneurship are facilitating cultural change in terms of growth and behaviours: scale of ambition – collective and individual, creative confidence, policies and politics, perception of self, external perception of the City and its Universities as a game-changing community.

Problem and Purpose

In this case study, a relation between design, education and entrepreneurship is highlighted. It is a topic and set of relationships that are not well-established academically. In UK higher education institutions, entrepreneurship is predominantly offered as an extra-curricular service or activity; it is a subject largely confined to business and management schools, and it is uncommon to have it applied to and proactively used for developing University strategy.

Entrepreneurship education is slowly growing within teaching and learning programmes with an increased interest that is fueled by the new Teaching Excellence Framework. In the academic business of Research, entrepreneurship is similarly propelled by the impact agenda and responsibilities of the Research Excellence Framework; research council funded projects which seek to ignite new possibilities while concurrently comprehending the benefits of multi-million pounds investments in innovation, research and development, beyond the traditional confines of University environments.

Characterised as 'the pursuit of opportunity beyond resources controlled' by Professor Howard Stevenson, (Eisenmann, 2013) entrepreneurship in higher education is often taught through management frameworks, theories and case studies which are frequently hierarchical in nature. In this case study, design-led entrepreneurship is the lens with which operation is led; a middle-out centrally connected model. Its focus is on collaboratively creating new interdisciplinary activities with a commitment to regular active experimentation and meaningful output. Entrepreneurship is embedded as a life skill as much as business start-up and business growth process. Design as a strategy for change with its thinking tools and processes coupled with entrepreneurship brings design-led entrepreneurship: a capacity that is within us all; a mindset

and skillset that can be taught (Aulet, 2013; Neck, Greene and Brush, 2014; Spinelli Jr and Adams Jr, 2016; Neilson and Stovang, 2015).

Design as a Socially Dynamic Principle for Driving Cultural Change

Phase 1: identifying, framing and defining the problem (September 2013 – October 2016)

Drawing on the work of the Creative Problem-Solving Group Inc., the LIMA Institute, John Maeda (2011), Liz Sanders (2013), Richard Buchanan (1995, 2001), Rachel Cooper (2011), Nesta UK, Neilson Norman Group, Design Council UK and the Hasso Plattner Institute's design thinking research, the character of a design for business innovation and design-led entrepreneurship is one of inclusivity; a curious questioning mindset; an approach driven by a concern for value and love of people; collaboration and the act of co-conception and co-creation; visual thinking and the capacity to visualise; an iterative and rhetorical cycle of looking, listening and questioning which takes the form of physical and virtual making, testing and learning from an idea. The design knowledge, mindset and methodology were implicitly and explicitly used to create a basic infrastructure and roadmap for developing a more entrepreneurial culture. In addition, the globally growing interest in design for social innovation and social impact (Manzini, 2015, 2016), along with increasing attention for design thinking, design sprints, and agile management as tools for change also came to bear directly (Figure 1).

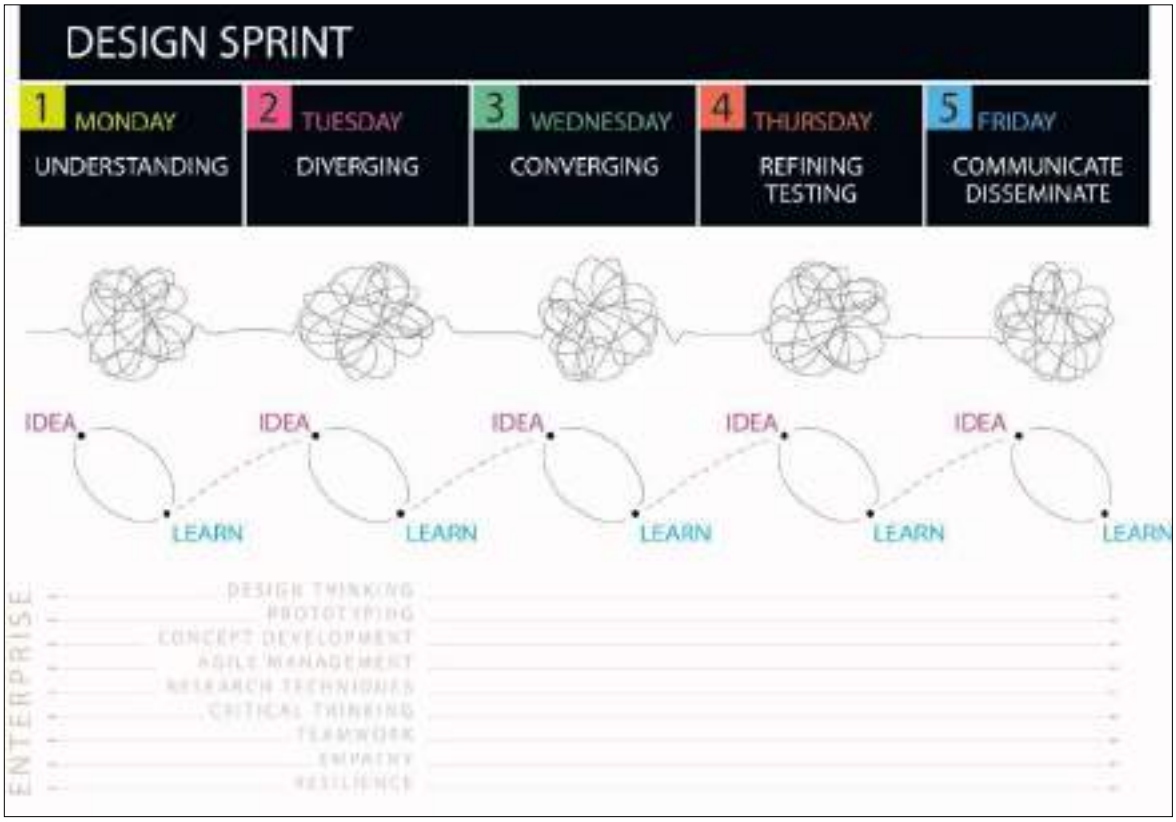

Figure 1 A visual summary (created and applied by the author in her work) of an example of a five-day design sprint developed through research and used to teach design enterprise as a socially dynamic process with an inherently entrepreneurial mindse. It employs design thinking for challenge led problems (such as breast cancer, mental health), and introduces the theories and practices of agile management, teamwork, prototyping, empathy, resilience, design process innovation techniques and design management research methods.

Drawing on design for business innovation management processes and design-led entrepreneurship experience, a series of activities were organised with an open-invitation to academic and central services staff (of all levels) across the organisation: three 'Pollinate' ideation workshops, three 'Show and Tell' seminars, three Creative Futures workshops, and four invited talks. The aim was to understand how we might raise

awareness of the increasing function of entrepreneurship in UK Higher Education across our institution and, ascertain where an appetite to engage and facilitate a change exists.

Upon this basis, an entrepreneurship strategy development workshop was held with a rich mix of (18) senior academic staff, central services managers (such as careers, academic skills, library, research, and innovation services), president of the student association, senior and executive management, specifically the Vice Principals of Teaching and Learning and, Research, Knowledge Exchange and Impact. It used the HEInnovate method and eight generic areas of entrepreneurship related to University business – entrepreneurial teaching and learning; knowledge transfer and collaboration; preparing and supporting entrepreneurs; organisational capacity - funding, people, and incentives; the internationalised institution; leadership and governance; and measuring impact – to provide a shared platform for the potential growth of entrepreneurship in our institution. Subsequently, two additional activities were orchestrated in support of extending the reach of people contributing to how entrepreneurship is shaped:

A shared experience; a visit to an established social enterprise with an accelerator programme, in a different city and not attached to a University. The objective was to gift people a physical experience of the design of a new dedicated facility for nurturing new business start-ups with a distinct brand and creative interior environment designed to a high specification. The point being that if we do not pay attention to our environment then people cannot act in ways that are consistent with their goals. If we do not learn from existing lessons, then progress cannot be made. With this metaphoric mirror, the design led activity was inviting everyone to practically ask: How are we going to create an environment that is consistent with our goal of becoming an entrepreneurial University?

An inaugral pan-University EE symposium (a precursor to the now established Entrepreneurship Week, an annual event) was held. Its entrepreneurial focus was the principles of design, social innovation, and social enterprise. 60 people from across the University and the wider City community, along with invited guests – business leaders, entrepreneurs, ambassadors, policy influencers - working at the coal face of entrepreneurship today, took part in this which included a second HEInnovate workshop. The method of symposium was employed as a community improvement method and a listening exercise in terms of the perceived pain points and potential solutions when it comes to developing entrepreneurial ambitions and culture. It was used as an interactive learning tool and an awareness raising exercise about the intention of becoming an entrepreneurial University. The point being that we must actively listen to and dynamically engage with many people with a diverse range of backgrounds and experiences, in order to get closer to a fuller appreciation of what is actually needed by the community that we seek to service: to hold the principle of listening intently as a priority throughout the entire creative process of change and to make transparent the idea of transformation from the earliest point.

Visualisation and visual representation to communicate the outcomes of the HEInnovate workshop was strategically used because it captures the imagination and demands that information be processed in a rhetorical manner. This is critically important when managing an idea in a state of flux, especially ideas and visions which are embryonic. The visuals are seen to capture a moment in time within a creative process rather than offer a definitive description of an end point. They are used as facilitators of further conversation; a means to maintain ‘flow’ with and between people (Figures 2 and 3).

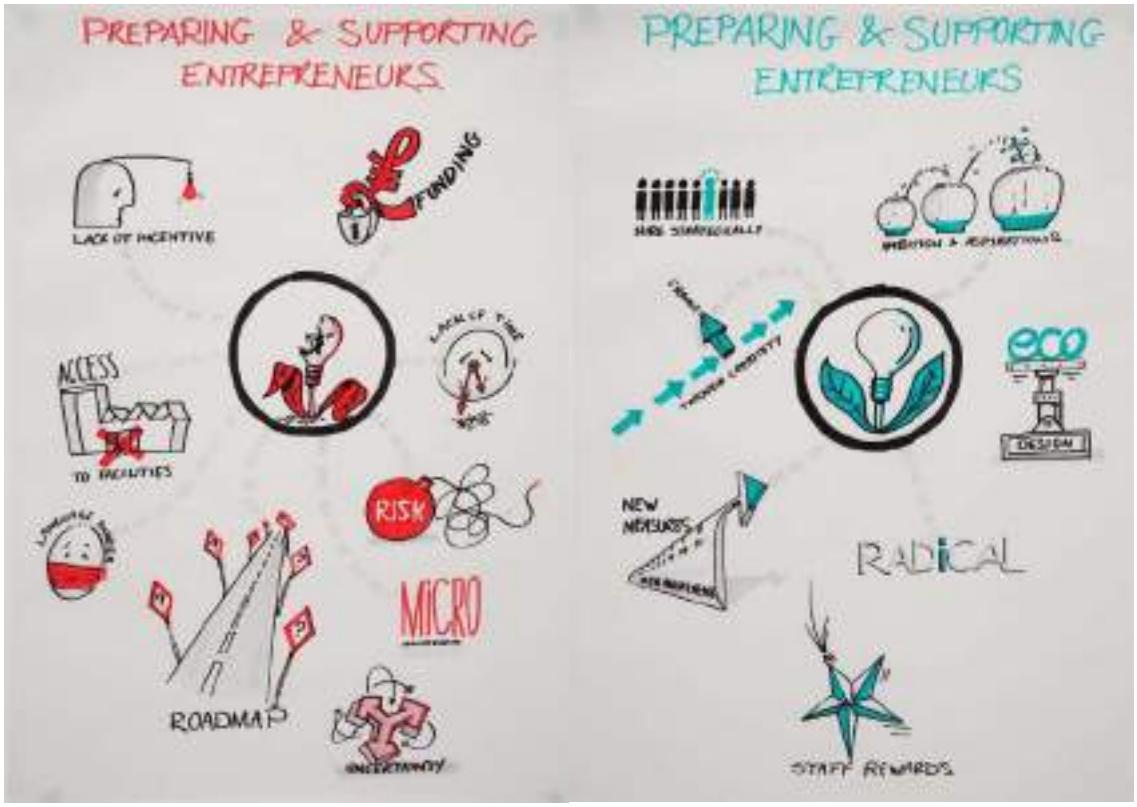

Figure 2 and 3: Upon completion of affinity mapping within the HEInnovate method, the results were visualised as a way of summarising the discussions and in figure 2 the visualisation of key pain points (which are denoted in red, on the left hand side) and the proposed key solutions in Figure 3 (denoted in green, on the right hand side) are associated with the strategic area 'Preparing and Supporting Entrepreneurs'.

'Becoming an Entrepreneurial University' was the identified mission emerging from this dynamic participatory process, designed to grow iteratively and deliberatively working throughout with people as collaborators. Eight specified solutions (to the eight strategic challenges) and an accompanying series of 36 priorities for facilitating and achieving these changes were arrived at (Table 1).

Table 1 Details the eight strategic areas with the solutions and 36 priorities identified for enabling change

Strategic Challenge Area	*Solution*	*Priority Activities*
Leadership and Governance	Metaphorically raise the anchor and permit the ship to explore; sail the seas to reach new shores	• Challenge the business culture • Encourage risk taking • Encourage people to get involved in EE leadership and governance • Provide coaching on EE • Talk less. Do more
Measuring Impact	Create alignment to the business strategy and group the impact measurement units; synchronise the energy between the different units.	• Broaden how we measure impact for EE • Better connect people and data to improve data management • Create a new framework for the very heavy load of DLHE
The Internationalised Institution	Metaphorically, 'the internationalised institution' is a jumbo jet in flight. The proposed answer is to expand its flight paths and airports with more trained pilots and more aircrafts.	• Create clear, strong links between the University's business plans and individual Schools • Embed more understanding of the international institution into the curriculum • Increase languages study offer

		• Develop more flexibility between research, teaching and learning • Sandwich. University, International, Business
Entrepreneurial Teaching and Learning	Metaphorically, the space rocket is on the launchpad waiting to lift off. Prepare a strategy with a team of 'astronauts' to enable a successful journey into the wider galaxy of opportunity.	• Include risk taking as a criterion in T&L assessment • Offer more practice • Include practical assessments • Offer choice • Promote mentoring and networking opportunities
Knowledge Transfer and Collaboration	When it comes to the subject of EE, people and communities are mute. Metaphorically, talking heads was the solution; to get people talking directly with each other about EE	• Value serious playtime • Engage in more collaboration and collaborative activities; • Join the dots; create a dynamic connected system • Create space(s) to think and act in this way • Unlock the doors; give Industry wider and greater access to University intelligence and facilities; make them feel welcome • Increase our global outlook
Organisational Capacity	There's no petrol in the tank. Fuel up; insert gas into the tank so we can travel.	• Nurture Entrepreneurs (and intrapreneurs) • Be more cross disciplinary in nature and outlook • Grow staff development opportunities • Create an entrepreneurial study radar to detect opportunities • Invest more in innovation
Preparing and Supporting Entrepreneurs	Care from the roots up. Feed the 'EE plant' for the continued sustenance of innovation and ideas.	• Hire strategically • Grow ambition and aspirations • Facilitate the change through creativity • Create new measures and new measurements • Be radical • Create staff rewards • Design ecosystem

These aforementioned activities ran parallel with the development of a new Entrepreneurship Strategy led by the Entrepreneur in Residence and a new EE University Working Group of which design was an integral voice. This included an initiative where each School within the University appointed an academic lead for the development of EE across their educational disciplines. The activities and decision-making processes culminated in a commitment to invest and provide a new purposefully designed Centre of Entrepreneurship.

Phase 2: Problem Solving with Impact (Oct 2016 – Sept 2017)

The creation of a dedicated centre of entrepreneurship ensued (opening to the public in September 2017). A flagship offering for staff, students and the local community to use for the development and growth of new business start-ups: a strategic partnership with Elevator UK whereby an innovative new, open access, public-facing, stand-alone facility was designed and developed to offer a suite of services, mentoring, and investment awards, in the pursuit of identified new goals. It organises 50+ events each calendar year: including Entrepreneurial Masterclasses, an Entrepreneurship Week, a Venture pitching competition (£27.5k fund annually with the School of Art & Design taking the position of most entrepreneurial School for the past three years), and large public lectures with leading entrepreneurs including Josh Littlejohn MBE, Mark Beaumont BEM and Mike Souter. It also boasts the first University strategic partnership with Entrepreneurial Scotland and is strategically building on Dundee's global reputation for design innovation and research (Duncan of Jordanstone College of Art and Design, UNESCO City of Design, V&A Dundee Museum of Design). The facility is one of the first entrepreneurial centres in the world to capitalise on a design-led approach in the way that start-up and

scale-up businesses are guided. It draws on this rich resource to apply 'design thinking' into the Entrepreneurial mind-set of the businesses within the centre along with specific design-led sessions delivered by V&A Dundee. Linking to this the university delivers a unique Design for Business MSc developed in parallel with V&A Dundee which has a close relationship with the Centre.

Key Learnings: Reflection on Practice

The case study is a contemplative dialogue on design innovation management research as agency for cultural change and development of a process of *becoming* an entrepreneurial university. It has not detailed the concurrent policy developments made or showcased all of the project work, partnership developments, advocacy, industry input, teaching initiatives and-or management meetings. The intention is not to diminish these procedures and junctions, rather to hold focus on the higher-level strategic use of design to fashion new strategic relationships to mobilise cultural change together in a middle-out centrally connected manner. To redirect attention from this would undermine the accomplishment of design for transformation within a University to secure investment and further cultivate an appetite for change towards entrepreneurship education for all subject specialisms.

The five key learnings to share are not rocket science but they are nonetheless imperative:

1. Make entrepreneurship a priority and place strategic importance on making time and resources available to find and network with new, likeminded people across three geographical levels - international, national, and local with a focus on entrepreneurship;
2. Employ design as a strategy for developing an entrepreneurial culture and when employing design and its middle-out centrally connected model, maintain respect for the hierarchy of current University structures; achieve executive buy-in to the use of design as a strategic tool from the outset with further sponsorship from academia, industry, external agencies and organisations to sustainably build on this;
3. Uphold the act of being inclusive *and* the design innovation management of fun, freedom, and friction to help achieve this;
4. Value a strategically activist approach to design innovation management to ensure the integral use of design as an agency of change from the outset;
5. Actively manage the risk taking involved when building a fresh collective of community champions for entrepreneurship through the principles of design

All five insights are risks needing to be managed with an entrepreneurial mindset, that of agility, resilience, gumption, and tenacity. The use of design innovation management as a framework is advocated to enable the sustained openness and the perpetual cycles of divergent and convergent thinking required. This is vital as it brings a mindset that views fear as a friend rather than a foe, which is necessary as getting it wrong – often and in small ways– is needed in order to get it right.

This was a large ambitious endeavor filled with complexities and politics, and in terms of capability building, the most challenging was the fact that the nature of design as a strategic process is (largely) antithetical to public facing hierarchical organisations, therefore learning to dance with this political tension becomes the job when seeking to advocate design as a strategic organisational and cultural development asset. Sustained investment in collaborative actions, innovative experiments, and activities by and through design were instrumental.

Design for social and cultural transformation is a long-term commitment to strategy and community. Drawing on V&A Dundee we know that from the point of conception to the point of delivery is a deeply intensive 10-year collaborative process. Going forward, the challenge for design as a tool for developing entrepreneurial culture is to measure the impact of applying the knowledge and practices of design for business innovation management to business, culture and society. It is to collaboratively engage in research to evidence the impact and value, thereby delineating what design is beyond the traditional and popular boundaries of products and services.

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Co-designing Community Dental Services software

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A dentist working in Community Dental Services (CDS) in the Northumberland Healthcare Trust of the NHS wanted to develop open source software to use in their clinics since most of the systems that they currently use are paper-based. The question was, what should the software look like? Here, where teeth are the easy part, oral health services are provided for patients with very complex or special needs or disabilities including autism, dementia and phobias. All NHS Trusts deliver these services and four Trusts with varying software systems agreed to second staff for half a day a week for six months to take part in the discovery. Co-design workshops were facilitated by the care analyst every second week and in alternate weeks staff were given tasks to do at their Trust clinics; observing, timing, collecting forms and data. Each Trust has its own version of every piece of management form. At first people act as though their document flow represents the pathways that should be "automated". Software specification in the NHS is often done by people without special skills or experience but persistent co-design delivered an agreed patient care pathway as well as an extended narrative for future software development.

Keywords: Open Source Software, Healthcare, Special Care Dentistry, Co-design

Context and setting

Where it started

OpenOdonto CIC launched a project setting out to frame the functions, reach and purpose, or discovering the user needs, of new, open source software that will be used in Community Dental Services (CDS), the providers of special care dentistry in the NHS in England. Essential to the brief was the aim to make open source software using an Agile software development methodology.

OpenOdonto CIC, a clinician-led Community Interest Company (CIC) was established in 2015, by a senior dentist practising within Community Dental Services in the North East of England, with funding from NHS England Open Source programme via Apperta CIC. The lead dentist was frustrated at having to use paper systems for everything from referrals and appointments to patient care notes.

Community Dental Services

Community Dental Services (CDS) is the part of each NHS Trust which 'does' Special Care Dentistry, oral healthcare provision for patients with complex disabilities or medical conditions. Clinicians practicing in CDS work hard to ensure dental care is available, despite complex difficulties in communication and access.

Clinicians and admin staff will say that "the teeth are the easy part" and patients' additional needs are complex and widely varied in their complexity. Examples of treatment complexity core to CDS and which are

outside of the mouth includes providing domiciliary care for people unable to leave home, providing care under sedation or General anaesthetic theatres for people unable to accept care with local anaesthetic alone, the use of hoists to transfer patients from wheelchairs to dental chairs, modifying communication to maximise understanding for people with dementia or learning disabilities and using interpreters when languages are different, balancing risks and benefits for older people on multiple medications. . What is now clear is that for CDS, the ageing population will continue to place increasing pressure on these services (Lievesley & Wassall, 2015).

Why do it this way

While the earliest drive for this project was from clinicians demanding a better way in the clinics where paper-based systems are in use, it is also fuelled by the frustration that dental software *is* available and is in use at some Trusts in other parts of the NHS, but it is seen as not fit for purpose and is almost impossible to improve or change. This crystalized into the OpenOdonto discovery project: what does fit for purpose would look like for CDS?

Studies on the non-adoption of technically detailed automated procedures note a lack of consideration of usability issues i.e. the "world of people and human purposes" for how the records, forms and letters are used (Thyvalikakath et al., 2007). Where "truth" about a patient is often arrived at through careful repeated questioning and patients have complex truths and have difficulties communicating, heuristic technical systems for populating electronic health records (EHRs), or making decisions, easily become too rigid and then clinicians will deviate significantly from the programmed methods (Walji et al., 2013).

The project team at Newcastle University – care analyst and living lab specialist – was contracted because the usual means of extracting the user needs for software in the NHS has proven insufficient. Currently where NHS software is bought using a 'specify and procure' process, clinical practitioners do much of the specification though often without the language and the agency to negotiate with software suppliers. The national programme for IT in the NHS highlights the consequences of implementing software that is 'bought off the shelf'; it "imposed uniformly derided systems that few if any wanted, delivered late, and ran up costs never seen for an IT project planet- wide"(Maxwell et al., 2010). However, there is an 'alternative way', in which digital tools are viewed as part of the continuous improvement of services (Government Digital Service, 2017) and opensource is embraced.

The choice of software development methodology affects the project fundamentally. Agile methodology has as one of its core principles that it values "individuals and interactions over processes and tools" (Highsmith & Cockburn, 2001) and therefore suits participatory design. In addition, it features works in small cycles emphasizing incremental development and small design steps guided by frequent interactions with customers (Martin, 2003), (Goldman & Gabriel, 2005). Working towards open source code also as has benefits of easier collaborations and higher quality (Government Digital Service, 2017).

For the living lab process real users are taken out of their place of work, guided in conversation and supported to make things together. To promote discourse, and thereby allow for the development of confidence among participants who then participate in co-designing the software that they require, extensive use is made of boundary objects (Sapsed & Salter, 2004) and prototypes (McLoughlin IP, 2016). The facilitator was the author who has training in computer science, industry experience in software development, and many years as a business analyst before joining academia.

The narrative

The four Trusts

Implementing new software at a CDS clinics means that there will be systems change through technology that solves particular problems and so it is essential that the most important problems are solved, as defined by the people who are working with the current systems on a daily basis (Mumford, 2006), who feel the frustration and will potentially be the people who would be working with a new system. These are the people who must be able to recognise the design of the proposed new system as being something true and that it will support better work (clinical care in this case).

Stakeholders were, in this first instance people from Trusts who could reasonably travel to Newcastle University on a regular basis because co-design works best when the community works together in person and do so over many meetings.

In addition to the directors of OpenOdonto CIC the lead dentist recruited four northern Trusts who seconded staff members to the OpenOdonto project for half a day a week from September 2015 to March 2016. Those involved were dental clinicians, including nurses, and administrators and managers of the service.

Participants were active, current staff employed in the Community Dental Services (CDS) of the Trusts listed below who were seconded by their Trusts.

Trust 1	Northumbria Healthcare NHS Foundation Trust (Northumbria)
Trust 2	The Newcastle upon Tyne Hospitals NHS Foundation Trust
(NUTH) Trust 3	County Durham and Darlington NHS Foundation Trust (CDDFT)
Trust 4	Pennine Care NHS Foundation Trust (Pennine)

Each participant in our exploration had a particular experience as Trusts have unique geography, clinic type, and composition of patient cohort.

For example the patch for the Pennine Trust in Manchester is urban and densely populated though it is geographically smaller than the Northumberland Healthcare Trust which includes more rural areas and clinics are widely spread out. Dentists have to see patients in multiple clinic locations; some clinics are in hospitals, some are part of community health centres, for domiciliary appointments patients are seen at their own homes and some elderly patients are seen at care homes. One patch has a large number of adult patients with autism, one patch has a lot of children currently looked after within social care services.

Differences mean that there is a legacy of accumulated systems: of the forms, letters and the piecemeal acquisition of software, and expensive hardware such as radiography. This is set against the similarities in training of clinicians and the straightforward expectations of the patients, the regulatory requirements and the practises that build up around this.

Co-creation and co-design: In the Living Lab with the care analyst

Discourse and sense making was the process whereby space was allowed for co-designing and preserving ambiguity. On alternate weeks all participants gathered in Newcastle University Business School KITE research centre's Living Lab workshop, a flexible and enabling space with large tables, computers and wall display and screen, wraparound whiteboards, flipcharts – material to represent whatever things that arise.

When the author identified herself as a business analyst it was very quickly made clear this has a specific meaning within the NHS, often being linked to specific software companies and, as such, not really trusted and later, when the author had to be given a named role, this became the care analyst. The researchers who were part of the design process were the care analyst, care system architect, and living lab specialist.

Since the enquiry has its own purpose i.e. to generate guidelines for eventual software development, workshops were iterative and data was allowed to flow naturally under the direction of the care analyst. Participants were given tasks before each meeting and for the first meeting participants were asked to find and bring along every form or document in use within their Trust and talk us through the processes that these represent. This was shocking to the researchers and the first stark reminder that while each CDS delivers the same care to a similar patient population that each one had evolved to be, seemingly, mutually incompatibly different.

After each workshop the care analyst gave the participants "homework", these were direct observation tasks and paper chases and timed activities about patient care at their clinics.

The care analyst's "homework" was to be ready for the next workshop; to process the data and stories and quantitative data and forms to 'make sense of it', gain specialist input such as from other future potential users of the software or other participants from NHS Trusts. Representations were developed: these are care pathways or models or physical pictures of the care and responsibilities or the roles that interrelate in a clinic / Trust and beyond. These are further boundary objects and these are then presented at the following Living Lab meeting. The boundary object / the model / prototype / architecture is shared and commented on and fixed,

iterated, discarded; omissions are added and misunderstandings pointed out in ways that does not happen with straightforward questioning. Through it all each participant's collective knowledge is grown.

Discussions off the topic – "they have no idea how long this takes us"

A fair amount of time was spent on discussions that seemed peripheral to software. As an example, participants compared the management structures in their Trusts or procurement processes or the X-ray machines in use at their clinics. These and other unrelated discussions were moments of rest that did not add to the boundary objects but these times of stillness seemed to allow new information to arise, general insights almost like revelations. The most important of these – information that nobody thought was important or necessary – was the insight about undocumented care.

For weeks the discussions followed formal processes, explaining data capture, what the forms mean, and harmonising understanding between Trusts around processes. Once participants trusted the format enough to reveal deep frustration in connection with correcting patient data in referrals documents they burst out with "they have no idea how long this takes us". Only then could we start to tease out all instances of what we came to call 'undocumented care'. This work is almost routinely done at some points in the care pathway, work which is essential to good continuous care but which is not recognised, nor planned in, nor paid for.

Direct Observation: Setting: Clinics

The care analyst conducted field trips, visiting clinics in Trust 1, Trust 2 and Trust 3, to observe the practises and processes in clinics directly, to ask questions and see and hear how staff explain what they do and why they make choices. Visits were done when there were no patients present and all available staff were queried; clinicians, dentist and dental nurses and admin staff walked the researcher through the systems – be they letters, forms, software, and people – that manage patient referrals, appointments and interactions and the management reporting that is required to record and arrange payment for care.

The final pictures and the show and tell

Within the timeframe of the project, there was a level of saturation (Bowen, 2008) and agreement about the following

- the patient care pathways (figure 1), (figure 2)
- User personas (figure 3)
- Paper prototypes of the referral system (figure 4)
- the video prototype of the preferred patient experience (Wassall, 2016)
- the reference architecture (figure 5)

Show and tell events were held to engage more widely with NHS managers, commissioners and healthcare software (open source) professionals. We hoped to gain more data for the business processes but they also provided a proving ground for the robustness of the boundary objects for clear communication and confirmed that these other stakeholders recognise this reality.

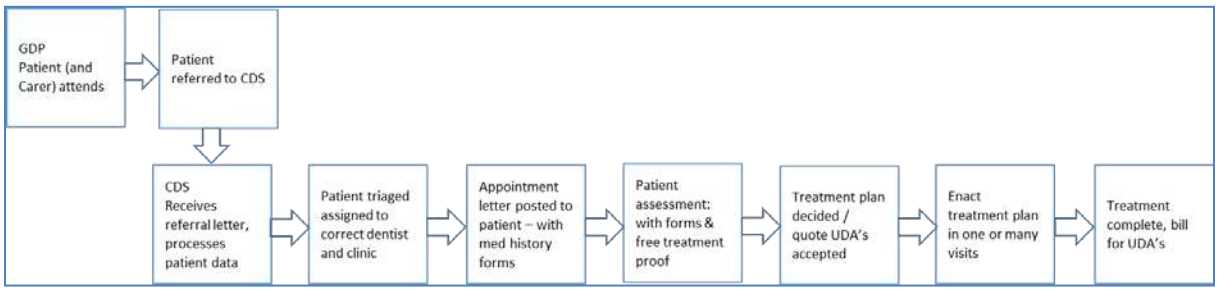

Figure 1 Patient care pathway from referral to treatment complete

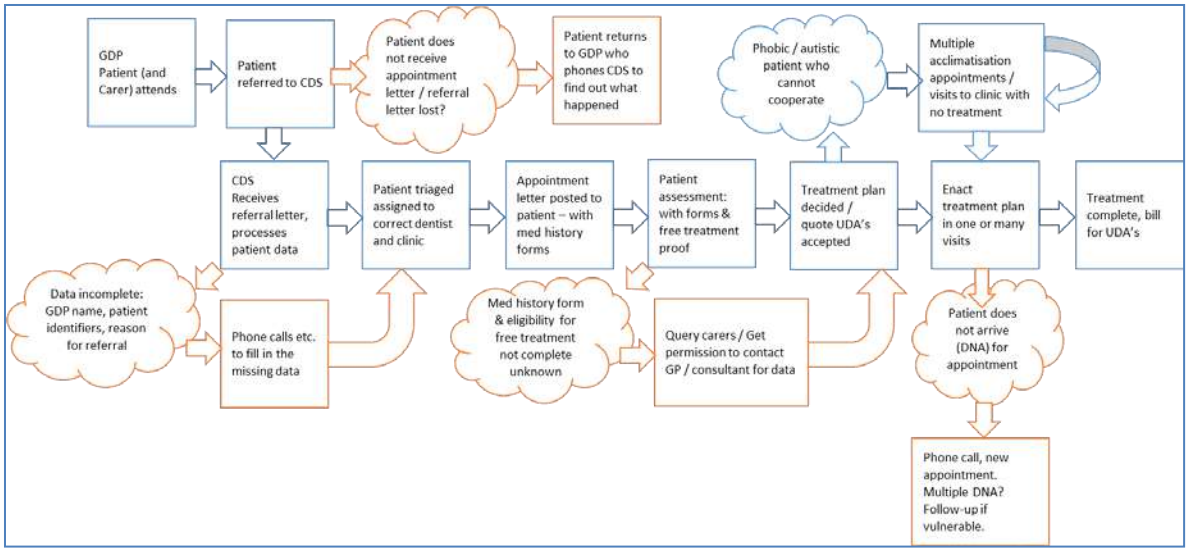

Figure 2 Patient care pathway from referral to treatment complete – showing 'undocumented care' (clouds in orange)

Persona:
Referring Dental Team

Photo

Fictional name: Linda Jones

Job title/ major responsibilities: Associate dentist at Apple Road Dental Practice / Do clinical dentistry efficiently and in a way that is a practice builder

Demographics:

- 31 years old
- Lives with partner in flat
- No kids
- Has a Post Graduate Diploma in Conscious Sedation

Goals and tasks: She is focused, busy, task-oriented within a strong desire to 'make a difference' to her patients. One of her concerns is maintaining quality within the increasing pressure to maintain productivity even though she now sees lots more poorly older patients.

Spends her work time:

- Working chairside with a dental nurse doing oral health assessments, X-rays and Treatment Planning
- Working chairside with a dental nurse making crowns and partial dentures
- Supervising a dental nurse who records, collects and curates documentation necessary for every course of patient care.

Environment Busy 5 surgery dental practice. There are always lots of patients in the waiting room, the reception has one shared PC and the phone is always ringing.

In her surgery Linda's dental nurse uses the PC most of the time to manage patient appointments, record history & clinical findings & outcome of Treatment Planning discussions on behalf of the dentist. In the 1 minute between patients Linda 'checks and approves' each record. Linda squeezes making referrals into her dinner hour.

Quote "Can I talk you through your treatment options and then you can make the decision that is best for you?"

Figure 3 User: Persona for software development

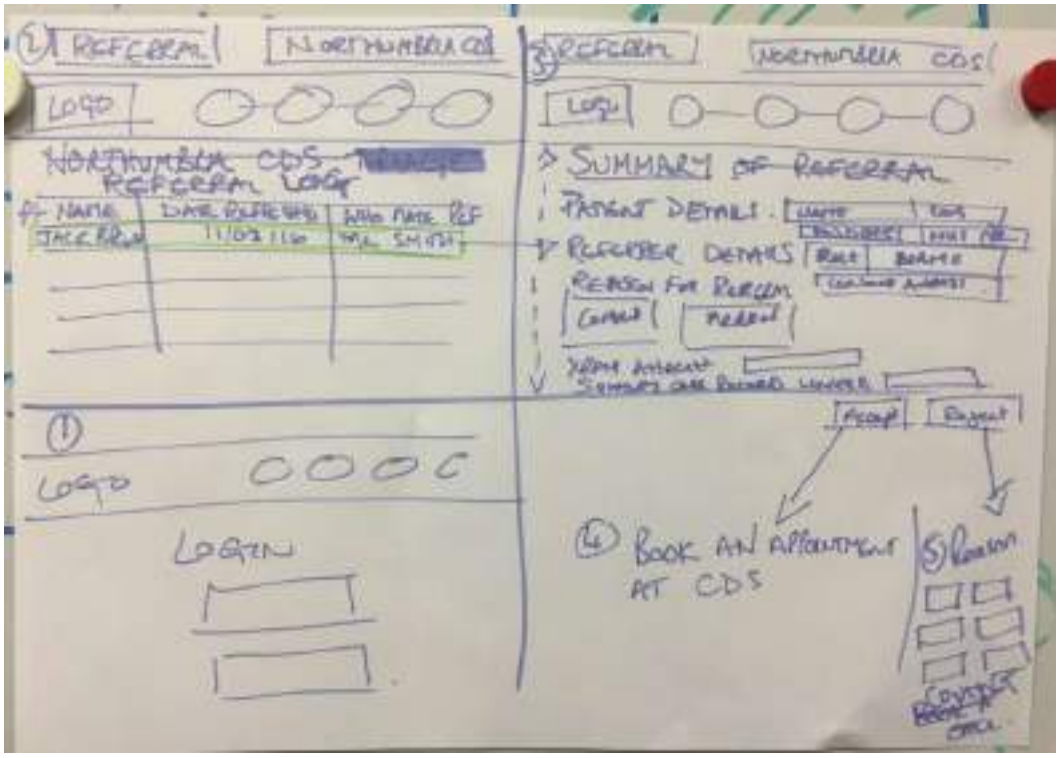

Figure 4 One of many versions of paper prototype - the referral system

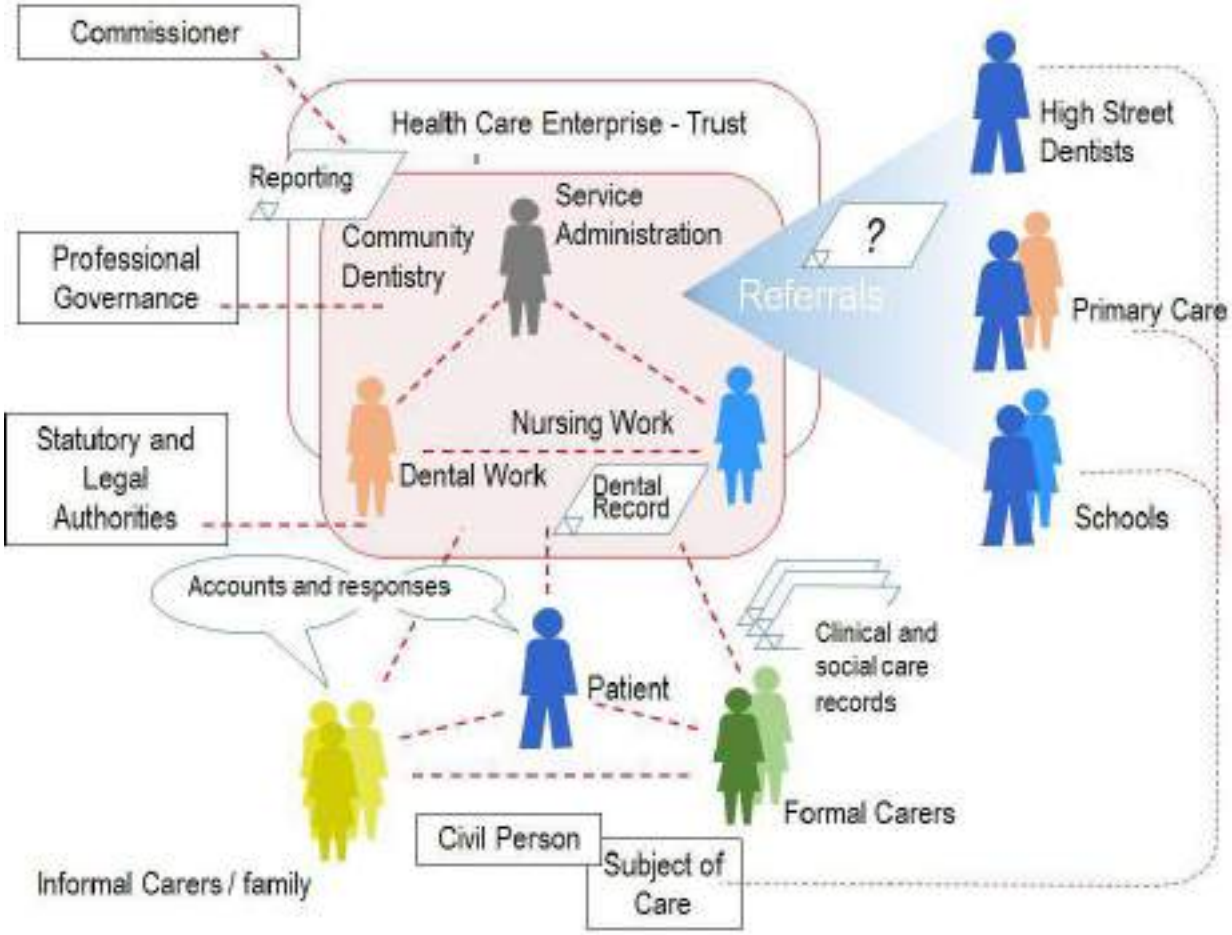

Figure 5 Care system reference architecture (Mike Martin)

Software that leaves room for care

In clinics where software is in use it is thought of as having value and people do not want to lose what they have, they like it when electronic patient data can be shared across the patch, when patients are more easily triaged, and appointments can be set up centrally. However the care analyst observed clinicians in practise and it is startling; their interactions with the software user interfaces were often a torture to watch.

In those clinical spaces insiders stop noticing the workarounds – the double data entry, pages long drop-down lists, transcriptions, data faking/placeholders that they later return to fix. But it was not a surprise to hear that it can take up to six months to be able to use the system properly. Since clinicians and admin staff at clinics prioritise patient care and "just get things done" their extra work becomes automatic enough so as to be almost invisible. Difficulties with software were hardly mentioned in the workshops, this is a testament to the adaptability and skill of all of the users.

In the meantime the extra work that this software adds takes up lunchtimes and extra time after hours. It also suggests that no software system should dictate what care should look like, software should support care and software should leave room for care.

The key learnings

Providing excellent care despite frustration

It was seen that when clinician time is taken up with administrative tasks that seem unnecessary or repetitive that not only will the clinician see fewer patients, they also feel deeply ill-used as they catch up with admin at their lunch breaks. When admin staff time is taken up by phoning and faxing around to complete forms and gather data, or fix data on the computer system after workarounds, all tasks that could have been collated more securely through digitally linked sources, there are more errors and fewer patients are processed and seen. Less time means that patients wait longer to be seen for acute dental care, the backlog on recall appointments is longer, and the CDS clinic "bills" for fewer units of dental activity (UDA's).

The sense-making tools of co-design

The co-design research provided the opportunity for sense making with the data allowing the emergence of the essential user needs for digital tools in community-based dental services. Mapping, personas, storyboarding and narratives allowed stakeholders to engage with data and create new user journeys based on their collective experiences, especially activities that take a lot of time, are necessary for safe care, but are not currently recognised, captured, or rewarded.

By producing prototypes, we make research findings more tangible – making it easier to imagine a better system and how those recommendations would affect the provision of services. Paper prototypes are so easily understood that administrators were developing proposed software interfaces.

A working prototype reduces the risk of misunderstanding and allows people to engage immediately with how such a tool is relevant to their own pressing needs in practical service delivery. When building digital tools for use by people in multiple roles and within different organisations we have found an iterative cycle of storytelling & prototyping allows divergent user needs to converge around the prototype. It also emphasises the stages of development that must be accomplished by actual clinical users.

A video prototype was made to demonstrate a preferred (ideal) patient journey which translated the vision of what the digital tools need to accomplish beyond the initial participants to the managers and commissioners and ultimately the software developers and funding agencies for that software.

Final software elements

It was agreed that every Trust Community Dental Service needs, at least

- a referral system including triage
- appointments management system
- a way to manage recall appointments
- manage patients' records
- patient communications

- chairside access to patient records
- chairside access to the payment system or FP17's
- flexibility in management reporting

Collaborative exploration means inclusive discovery

Extracting the software requirements by interviewing or observing people in a single Trust has often been done at these Trusts. However software user needs based on one Trust, no matter which one, would lead to a poor picture and software built on that poor picture would be less universal and less robust.

Working with participants from four Trusts with significantly different management and systems was long-winded. It is when participants contribute, listen and respond to one another, reflecting back and interrogating the stories over time, that they improve the quality of the narrative. That is when they start to talk about workarounds and accept that their superfluous activity has value and may be necessary for patient care.

Co-design was the tool that allowed delving into the stories of many clinicians over time, allowing for real constructive disagreement, significant empowerment of the participants, and the distillation of a believable common vision. This is more likely to support the development of software that leaves room for judgement and complexity and variability - and work in many Trusts.

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Research Perspectives IN THE ERA OF Transformations

Applying design to gender equality programming

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This case study explores the application of design methods and tools in women's rights programming and feminist grant making - both areas that are, despite growing interest and evidence on potential benefits, still rather underexplored. In 2018, following its first independent evaluation and with the aim to increase its grantees' qualitative impact, the Fund for Gender Equality, a grant-making mechanism of the United Nations Entity for Gender Equality and Empowerment of Women, launched *Re-Think. Experiment.*, an initiative exploring the potential for design to serve as a tool for innovation of programs. Through providing training in key principles of the design process and a safe space for experimentation, nine women-led civil society organizations operating in eleven countries have been equipped with tools and methodologies tailored to their needs to address specific project challenges. This case study introduces context, process and initial results of the initiative and discusses whether hopes for design to serve as a tool to foster innovation were met. Furthermore, it offers a critical reflection on its limitations, the need for contextualizing tools, and growing opportunities by marrying design methods with other social innovation disciplines.

Context and Problem/Opportunity Area

Using design to innovate development

Over the past nine years, the UN Women's global grantmaking mechanism, the Fund for Gender Equality (FGE) has directly impacted the lives of over 580,000 women and girls from the most marginalized groups across 80 countries and reached millions through policies and public campaigns. Its strategy combines grantmaking to high-quality projects supporting women's economic and political empowerment and strengthening the capabilities of women's civil society organizations (WCSOs) through technical assistance and training. As per independent evaluations, its projects have demonstratively advanced gender equality (GE), especially affecting changes around social norms, the creation of women's collective structures and development of their skills on the local level.

However, following its evaluation and a self-reflection exercise, FGE realized that its projects were not tapping into the full potential of the organizations driving them, that much more could be achieved with the same or even fewer resources posing the following events: Are we grant-makers and project implementers working in the most efficient and effective ways? Are our projects designed to respond to the real needs of the furthest behind? What alternative approaches and tools can lead to more transformative results?

At the same time, there is a large pressure to deliver effective and large-scale impact in the UN's Sustainable Development era, where 17 Goals have been identified as global targets for progress on key issues including gender, climate, education, health, peace, energy, and more. Traditional project approaches to tackle these issues are often times, good-willed and well-intentioned but many of them are complex and multi-faceted yet

are approached from narrow or misguided perspectives due to lack of capacity, buy-in, and participation from citizens, duplication of efforts, and donor-driven agendas.

Searching for alternative ways to address these issues, leading innovators have increasingly turned to design for help. (Dorst, 2015). As a thought process and way of problem solving, through its tolls and methodologies, design offers unprecedented opportunities to spying new opportunities for innovation and for managing ideas and creativity. (Yee et. Al, 2017). These considerations were the starting point of the Fund's *Re-Think. Experiment.*, launched in 2018, where over a nine-month span, nine WCSOs, were introduced to and trained in key principles of the design process to address a specific project challenge using a beneficiary-centered design approach.

In applying design to gender programming, the team saw an opportunity "to do development differently" with the objective of creating positive and more lasting impact while at the same time, putting into practice much of what it had been advocating for - placing beneficiaries at the heart of the work, flexible and adaptive processes, addressing root causes using systems thinking, and co-creative approaches that allow for inclusive and participatory development. Furthermore, despite increasing interest in how human-centered design might be utilized in the programming of development projects, its frameworks and concepts are still largely unfamiliar. With the *Re-Think. Experiment.* initiative, the team, also meant to encourage WCSOs to explore, generate and test design as a tool for their own social innovation in a safe-to-fail environment.

Ultimately, as the Fund supports WCSOs that both reach end beneficiaries – especially the most marginalized communities – and have the capacity to influence at a national level, investing in their innovation capabilities was a powerful catalytic potential to help yield more positive changes towards GE.

Figure 1: Key takeaways from the "World Café" exercise where FGE grantees examined the concept and practices of social innovation, at the FGE workshop in Istanbul in September 2018. Source: UN Women's Fund for Gender Equality 2019

The narrative

Complexities of designing in the social fields

As the Fund identified social innovation as a means to shift understanding and traditional project cycles, it had to change on two different levels—its own way of working as well as at the level of the grantee partners and their projects.

As a first step, the Fund connected with individuals within and external to the UN to gather knowledge and different perspectives on the topic and methodology. This resulted in a collaboration with two independent experts with previous experience in innovation work at the UN (United Nations Development Programme) and the academic world (Parsons School of Design).

The project laid out the purpose, objective, and methodology that initially structured it into six main phases of iterative character: 1) Identify a challenge, 2) Understand and Emphasize, 3) Redefine the challenge, 4) Ideation, 5) Prototyping, and 6) Testing. The process was designed with the intention of creating participants with a safe-to-fail environment that encourages participants to explore, generate and test design as a tool for social innovation through small grants of $15,000, individualized mentoring and coaching, a week-long workshop on social innovation.

The FGE invited 9 grantee partners based and working in 9 different countries to identify a specific challenge that was preventing them from achieving a desired result in their projects spanning from: “how might rural women from disadvantaged communities transition from small-scale producers to profitable entrepreneurs” to “how can we find creative solutions to keep women’s rights in the political agenda in a conflict setting”.

With the aim of unpacking these challenges - the design problem - and considering that it was the first time that most of the grantee partners were applying design methods to their programming, the Fund undertook an expanded phase of coaching on design methods and research at the beginning of the project. Having an extended focus on research at the start also aimed at deepening understanding and building empathy with the multitude of constituents involved in each context and allowed each organization to reflect how it was best positioned to respond and in what way. The provision of coaching and extended time and space for research and reflection was quite different than the usual practice that FGE provided to partners which placed the most attention on designing a results based framework for the project, the modus operandi for most UN projects.

Through virtual coaching sessions on design methods and research by the social innovation experts and FGE staff, grantee partners were encouraged to reflect their initial assumptions underpinning their current problem statements. This was considered critical as the challenges presented by our partners were of complex - or in Rittel’s words - wicked nature, that require engaging with unusual actors, exploring new points of view, trying innovative solutions. (Rittel, 1972)

In addition, considering that partners were located in nine countries on four different continents, it felt important to appreciate each context’s complexities. All research activities were, therefore, designed as a result of careful inquiry considering the reality of each context, resulting in different research activities for each organization. For example, while in conversation with grantee partners in the Philippines, observation was considered to be an apt method. Others, such as the Paraguayan partners, were encouraged to engage in in-depth interviews, mapping exercises, or - as in most cases - a combination of multiple methods. “The best aspect of this [research] exercise was to be able to have conversations [with beneficiaries] at such a personal and emotional level. It was a very special moment.” - Project Manager, Centro de Documentacion y Estudios, Paraguay.

While recognizing similar areas of experience and expertise, the team recognized the careful consideration of each organization’s context to be critical to the process. By recognizing the unique context and a strong focus on co-creation and capacity building, the team hoped to provide the condition that allowed partners to adapt broad and general design principles to their very specific contexts. Furthermore, "exporting" particular design practices - which might be seen as political as they often come value systems attached - might lead to unintended consequences and hinder pluralism in design practices.

These initial rounds of research resulted in great variety of artefacts such as journey maps, empathy maps, personas, social value canvas, or back-casting which partners were asked to bring to a week-long in-person convening in Istanbul in September 2018. However, the great variety of data that partners collected as part of their research inquiry also drew attention to need of data in the development context.

Large quantitative data sets and long-term studies provide helpful information and assessment on approaches and trends, however, they often lack regional specificities, e.g. disaggregated indicators at local level on women’s political / public role; economic situation, etc. and information about the underlying reality of people’s behaviors and experiences. In addition, typical research tends to narrow its focus towards specific solutions to well-defined problem. Design research, on the contrary, often results in a broader understanding of the problem domain and many alternative potential solutions. By putting an emphasis on integrating design research activities at the early stages of the project, the team ultimately aimed at addressing intrinsic human

needs that may not be easily generalized and develop the empathetic capability need to achieve results of meaningful impact. (Faste, Faste, 2012)

Several rounds of research, ultimately, concluded in the redefinition of the initial problem statements of all partners marking the beginning of our week-long design workshop, intended to create a space for learning and leadership, collaboration, ideation and prototyping of potential solutions.

Figure 2: Activity at the Istanbul innovation workshop organized by the Fund for Gender Equality in Istanbul with representatives of partner organizations from eight different countries. Source: UN Women's Fund for Gender Equality 2019

Beyond a one-off training opportunity, the workshop, by building leadership and creative capacities on design as a tool for social innovation, intended to have a long-lasting and sustainable impact on the work of participating partners: drawing from fields such as systems thinking, organizational sciences, design, and behavioral economics, once more, through several sessions we co-created beneficiaries' archetypes, stakeholder and ecosystem maps, blueprints before moving into ideation.

The broad diversity represented in the room - geographically, culturally, as well as in the form of expertise - was a crucial factor for this workshop - and its extended process leading up to it - to achieve the expected impact: by sharing their experiences and expertise amongst each other, participants allowed for the workshop to become a rich South-South co-creation space. "The positive energy, the friendly environment, and all the collaboration and joint brainstorming are helping me learn a lot and make linkages between ideas," reflected one participant.

The benefits of this cross-pollination of ideas emerged during ideation as proposed solutions were strongly informed by the approaches and experiences of other teams; and through prototyping, where grantee partners had the opportunity to build, present and receive feedback on their ideas. Once a prototype was selected by each organization, a mini-action plan was drafted for the testing phase. Further monitoring and mentoring sessions ensued.

One process, nine journeys

While the structured process was the same for all partners, their journeys through it, were clearly not. It was the first time that most were introduced to design as a programming methodology and this required continuous adaptation due to partners' contexts and capacities.

By highlighting some critical challenges, key insights and results, the team hopes to contribute to the body of knowledge on the co-creative design process in the development context. As an emerging area of increasing interest and the growing evidence on benefits of applying human-centered design, a high potential for improved outcomes remains untapped and through this process, the Fund and its partners hoped to learn and share its findings and lessons with peer actors.

The case of Athika

Grantee partner in the Philippines - Athika has worked for over 20 years with migrant domestic workers in Singapore and Hong Kong, helping them understand their rights, improve their savings habits, and encourage successful reintegration back to the Philippines when they decide to return.

Athika's model, consisted in a ladder training program on financial education and entrepreneurship, had reached over 5,400 domestic workers and allowed them to access savings, investment, capital and training – generating nearly $700,000 of investments.

Atikha's identified challenge was getting more migrant domestic workers to enroll in their training programme. Through observation and information interviews Atikha found that their beneficiaries, who often work six days a week living with their employers, have little interest, in spending their only day off in training - despite an expressed interest in accessing knowledge in this area. Another finding was that they had a strong longing for community and belonging as well as a belief that a higher religious power would ensure easing of "financial issues". At the same time, they also learned, that due to their often physically isolated living conditions, Facebook and WhatsApp were their main networks of connection and information.

Atikha decided to prototype the "Pinoy WISE iTV", a 30-minute weekly web-based show centered on savings, entrepreneurship, family issues, legal rights, etc. to their network. The idea came directly from beneficiaries themselves through interviews, intercepts, observational research and informal conversations, and they have tremendous ownership over it.

Figure 3: Estrella Mai Anonuevo, Atikha Executive Director, during one of the Pinoy WISE iTV programmes informing about investment opportunities for Filipino women migrant domestic workers. Source: Atikha Overseas Workers and Communities Initiative 2019

The case of Centro de Documentación y Estudios

Similarly, FGE partner Centro de Documentacion y Estudios (CDE) in Paraguay also works with women domestic workers, who are among the most marginalized in the country, often lack access to basic social services and do not have a minimum wage - the only sector to not have one in Paraguay.

CDE described their challenge as having limited beneficiary participation in their supported local associations which provide a space for workers to gather, talk about their issues, and organize for advocacy and action.

Through coaching, CDE went back to their constituents and found that they:

- have limited time to dedicate to activism
- are overburdened with work and family duties
- do not know these local associations exist or how to reach them
- have a sense of risk in engaging in advocacy actions
- prefer leisure activities involving their families and community

CDE came with ideas to the workshop in Istanbul but Atikha colleagues suggested what then became their solution: a weekly radio programme made by and for domestic workers to help them access information in a familiar and safe way – and in their own language (Guarani) - and connect with their peers in a playful and accessible form of activism. This initiative also enabled them to have voice and agency over their own rights and advocacy efforts.

The enthusiasm and devotion with which the domestic workers have taken on this project is beyond expectations and tremendously inspiring. By the end of the year, they had already conducted a pilot and developed additional content. They even engaged a popular artist who has created a musical cover theme for the radio show and developed their own branding.

Figure 4: Members of the Domestic Workers Union of Itapúa (SINTRADI) developing the "A Day in the Life of…". Source: Centro de Documentación y Estudios 2018

Key Learnings

As of today, the evaluation of the *Re-Think. Experiment.* is still underway with grantee partners wrapping up their testing phase. Final reports will be encompassing a two-part report: a narrative report and exit interview. The narrative report will focus on the results of the activities as well as the overall assessment and reflections on challenges and learnings. The exit interview will place more attention on the process and its effect on the organization and individuals.

Below are a few of the preliminary learnings:

Time investment in project design makes a difference.

- For grantees, the time allocation for project design and start-up is extremely important and not enough emphasis was placed on this moment previously. Rather, this stage of grants management was often rushed to get projects quickly starting up rather than taking the time to research, understand, empathize, and pilot activities to help inform the larger full scale project.
- From a design perspective this learning seems equally crucial. The fruit of an extensive phase of introduction of participatory design principles and research may not always be immediately evident, but as this project suggests, significantly impacts the short- and long-term outcomes. While the extended focus on research allowed the team to co-create solutions informed by insights gained through research or as one of the grantee partners summarized: "We thought, we knew everything about the issue, but the interviews showed, there are things we had not understood" - Project Manager, Pastoral Women's Council, Tanzania.
- Some preliminary feedback from grantee partners, however, also allowed the team to assume that the investment on strengthening the innovation capabilities may have longer-term effects as they continue to apply their learnings in participatory design methods, systems thinking, and leadership to other programmes and projects.

Enabling environment and good timing are critical.

- The right conditions and right timing allowed for this initiative to be designed and implemented with support from UN Women management and staff. The Fund's status of limited funding, an uncertain future, a downsized yet motivated team, a trusting donor, ample time allocation, and autonomous space were some of the key factors that allowed this experiment to come to fruition.
- The atmosphere of trust and openness that this project aimed to generate is the result of many factors, including the professionalism and personalities of the external experts. But it was also the result of a process that started years before: FGE had organized two in person grantee gatherings, including one a few months earlier, where informal and formal interactions were fostered in a relaxed and inclusive setup. The Fund started presenting concepts and practices of co-creation, reflection, "thinking outside the box" and horizontal relationships months before the initiative started, which prepared grantees to take on Re-Think.Experiment - by the time it started, they were aware and interested in trying different approaches. The coaching sessions also placed a central focus in being grantee-driven and had a friendly, safe-space feel, which was essential for to engage participants and devote time and efforts in such an unusual experiment.

Design approaches feel right.

- The team was pleasantly surprised about how most organizations almost immediately committed to the ideas that were being proposed. While other elements - such as the gender programming expertise of the social innovation consultants - played a role in this, the reactions observed during coaching conversations and workshops revealed a gratifying sense that proposals were resonating with counterparts and fitted their own previous experiences and thoughts about their projects, while providing new "aha" moments, as expressed by several of them. It felt right. And this made it possible for a set of eight organizations from completely different backgrounds to not only understand but also to immediately jump into using user-centered approaches, to a point that exceeded expectations (e.g. starting to apply them to their regular organization process and to other projects).

Better in person.

- The fact that the team members were based at different locations led to its own challenges: an appropriate time for coaching calls was difficult as time differences spanned over twelve hours. Additionally, internet connectivity, and particularly lack thereof, often led to having to reconnect several times during a call or postponing altogether. In this sense, while the team considered the first phase of coaching and research of strategic importance and overall the calls were the most suitable tool for a global project, pre- and post survey evaluation ahead and after the workshop in Istanbul, give us reason to believe that the end results have benefited from the in-person training. Grantee partners not only had the opportunity to develop their own solutions but also were able to connect, collaborate and find inspiration in the work of others, which in some cases changed the direction of solution.

New partnerships.

Exploring these areas has also provided increased partnership opportunities for the Fund. Prior to this initiative, the FGE did not have technical partners with its traditional grantmaking programme. This experiment allowed the Fund to work with academia (Parsons School of Design), inter-agency mechanisms (UN Behavioral Insights team), sister UN agencies (UNDP Innovation) and strengthen internal UN Women connections. Finally, this experience has been the basis for the Fund to embark on a new design-driven pilot in partnership with two researchers from the Parsons School of Design to test new ways for UN Women to support women's organizations in a way that better responds to their needs to become more resilient and sustainable. This work is ongoing and will conclude in the Fall of 2019.

Figure 5: Participants at FGE workshop in Istanbul in September 2018 developing personas and a causal map. Source: UN Women's Fund for Gender Equality 2019

Challenges

As with any project, there were certainly challenges — some within the team's control and others not. For example, three partners based in the Arab States each faced contextual issues: the partner in Yemen was unable to travel to Istanbul nor implement the activities due to restrictions. In Algeria, a government agency restricted the partner to access its funds due to internal approval processes. And in Palestine, as noted previously, the partner was unable to implement its solution because of political sensitivities concerning project activities from national and international stakeholders.

Another challenge derived from the fact that the FGE team tried to assume a double role in this project - one as facilitator and another as participant. The team aimed to learn about social innovation processes in an experiential way; to help solve important challenges; and to help develop more peer-like dynamics with its grantee partners. As such, FGE worked on a challenge of their own to bring to the workshop, hoping to be able to learn from the sessions and apply design methods to find a possible solution to test. Unfortunately, the highly time-consuming nature of personalized facilitation both prior, during and after the workshop made it hard for FGE to find the time to work on its own challenge. A less ambitious challenge, higher team

commitment to this aspect of the experiment and a more structured process for the team could be elements to improve in future similar exercises.

However, the main challenge is sustainability: as the project ends, FGE will not be able to continue its support as grantee partners continue to iterate and implement their solutions; additionally, it will be difficult for the Fund to track and asses the ultimate impact and potential ripple effects of this intervention. While this was foreseen from the inception and grantees were given the flexibility to incorporate their solutions into their ongoing projects, including by deriving some of the available funds to them, the team hoped that by the end of the experiment they would have had the chance to iterate a few times their solutions; yet, time was limited.

Working on future projects of similar kind, therefore, the team hopes to provide its partners with more long-term support throughout implementation and build an initial research and testing phase.

Conclusions

While implementation and analysis of impact are still underway, this project has provided us with initial findings supporting evidence on potential benefits - such as tailored approaches centered around the needs of beneficiaries through initial investment in design research - resulting from applying design to gender equality programming. Furthermore, design in the context of participatory processes functions a social process as designers, donors and participants interact on an eye-to-eye level as well as external stakeholders questioning long-held power dynamics in the field of international development.

Applying a design process, therefore, allowed FGE staff to completely change its approach with its grantee partners and delve deeper into projects with greater effort placed on the learning process and how organizations internalize this; consequently, the FGE's own knowledge and awareness of different types of understanding, planning, implementation, and evaluation approaches of development programming grew significantly over the course of this project. Using co-creation and blueprint tools, the Fund was able to critically re-examine together with the grantees its own processes and systems, drawing lessons e.g. to simplify their reporting templates, improve communication with grantee partners and streamline financial reporting.

In the light of ever more complex and highly interconnected human development challenges design, therefore, seems to be a promising tool to shift from linear "problem-solution" models toward more comprehensive analyses of realities and iterative processes with room for failure and learning allowing us to accelerate progress towards the 2030 Development Agenda keeping women and girls furthest behind at the center.

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Research Perspectives IN THE ERA OF Transformations

Applying Equity Design to Address Oakland's Homelessness Human Rights Crisis

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In this case study, we present a project of Reflex Design Collective, an experimental social equity design consultancy based in Oakland, California. Since founding Reflex Design Collective four years ago, we have reimagined the role of "designers" to transform relationships structured by oppression. To illustrate this reimagination, we present a case study of our work as ecosystem-shifters. In 2017, we facilitated a co-design innovation summit where unhoused Oakland residents led collaborative efforts to alleviate the burdens of homelessness, with city staff and housed residents serving as allies instead of experts. Our approach to design facilitation differs from a typical design thinking process by pairing our clients with those on the front-lines of social inequity in a collaborative design process. Specifically, we elevate the importance of democratized design teams, contextualized design challenges, and ongoing reflection in a design process. We highlight successes of our design facilitation approach in the Oakland homelessness summit, including outcomes and areas for improvement. We then draw higher-level key learnings from our work that are translatable to designers and managers at large. We believe our approach to equity design will provide managers and designers an alternative mindset aimed to amplify the voices of marginalized groups and stakeholders.

Keywords: Social equity, homelessness, design, detoxify, liberation

Introduction

Reflex Design Collective is an equity design consultancy in Oakland, California. We help clients partner with beneficiaries in mutually empowering ways. Instead of a typical design thinking process led by a small team of "expert designers" who design for passive "users," we facilitate a co-creative design thinking process pairing clients with those on the front-lines of marginalization to build solutions that address social inequities. By positioning technical experts and experts with lived experience as peers, solutions emerge from transformed relationships between institutions and the communities they serve.

In this paper, we present a case study of our equity design approach. We discuss how we worked as design facilitators to detoxify the fraught relationship between unhoused residents in Oakland and the city government that represents these residents.

Theory of Change

Design is a flexible, transdiciplinary approach to create unique solutions in complex environments (DiRusso, 2016). Applications of design are not limited to financial market-driven topics; institutions have leveraged design towards various social issues, including international development (IDEO.org, n.d.), youth empowerment (YLabs, n.d.), global health (D-Rev, n.d.), and more.

In this latter class of applications, however, there are often fundamental flaws in the approach of designers working for "social good." Within "social innovation," it is generally the power of design tools themselves -- practices of empathy, creativity, prototyping -- that is celebrated as the change-making force (Brown and Wyatt, 2010). However, Timothy Mitchell (2002) and Tania Murray Li (2007) note that complex social ills, like poverty, have as much to do with social power dynamics as they do with technical problems that can be solved with technical expertise alone. The practice of presenting technical tools as the sole remedy for systemic ills -- which are fundamentally generated by differences in structural power -- limits the effectiveness of social design, at best. At worst, this mismatch of problem and approach contributes to the invisibilization of privilege and oppression, which serves to protect the inequitable status quo (Janzer and Weinstein, 2014; Booth, 2015).

In response to these critiques, there are movements of designers shifting their practices to align with holistic, power-aware frameworks for social change. The Design Justice Network, for example, has developed principles that interrogate the definition, role, and positionality of the "designer" in ways that challenge Western colonialist hegemonic knowledge and expertise, which delegitimizes the experience of those on the front-lines of oppression (Design Justice Network, n.d.; Costanza-Chock, 2018). These principles demand an intentional subversion of oppressive power dynamics, including centering the agency of structurally-disempowered communities, to facilitate a shift towards liberation (Design Justice Network, n.d).

Reflex Design Collective was founded in alignment with these perspectives. Our theory of change holds that designers have greater potential to affect the roots of complex social issues working from the role of the facilitator, rather than as the lead creative expert. Design facilitators bring stakeholders together to engage in collaborative design processes. As facilitators, we leverage design to transform power dynamics between marginalized communities and influential institutional partners (Staton et al., 2016).

adrienne maree brown (2017) offers a natural analogy to illustrate the impact facilitators can have as transformative, connective tissue. brown observes that community-building lessons can be gleaned from mycelium, a fungus that consumes toxins, converts them to nutrients, and connects organisms to create supportive networks. Like mycelium, facilitative designers may enter contentious spaces and use generative tools of creative problem-solving to transform toxic relationships into collaborative connections. If trust is formed between influential stakeholders and grassroots communities, the former group may benefit from added "nutrients" such as increased perspective, and the latter may gain access to social capital, credibility in influential circles, and tangible resources to support their work. Through facilitated design efforts, all parties move closer to equity and liberation through radical collaboration.

In the spirit of Paulo Freire's notion of praxis (2000), Reflex Design Collective's equity design approach connects theory and practice to sustain the work of radical design facilitation. We draw on our professional experiences in design and civic engagement and our lived perspectives as women, people of color, and queer people to develop tools and skills to foster radical collaboration. To structure subversive design engagements, our core practices include: building upon pre-existing work of grassroots innovators, prioritizing decision-making power of those closest to the problem, and framing design challenges around oppressive systems that generate social problems. We distill our adaptations of traditional design thinking to three spaces: democratization, contextualization, and reflection throughout the equity design process. The following case study demonstrates this approach.

Context and Opportunity Area

In Fall 2017, we launched an initiative with an Oakland City Councilmember to address the homelessness emergency within District 3. The San Francisco Bay Area is in a housing affordability crisis (UC Berkeley's Urban Displacement Project, 2019). Oakland has experienced dramatic increases in housing prices following the 2008 financial recession. Between 2012 and 2017, median rent increased 51.1% -- the second highest increase of any city nationwide (Weidner, 2018) -- to $2,950 per month. With a median household income of just $63,251 from 2013 to 2017, it is easy to see why many Oaklanders have experienced burdensome housing costs and outright displacement as a region-wide housing policy has not kept pace with the booming tech economy in the surrounding Bay Area.

Predictably, this housing crisis has played out similarly to historical trends of structural racism, disproportionately affecting communities of color. UC Berkeley's Urban Displacement Project (2019) found that a "30% tract-level increase in median rent (inflation-adjusted) was associated with a 28% decrease in low-

income households of color" while "there was no significant relationship between rent increases and losses of low-income White households."

Conservative estimates indicated a 39% rise in homelessness in Oakland from 2015 to 2017 (EveryoneHome et al., 2016; EveryoneHome, 2017). This phenomenon became increasingly visible on Oakland's streets in the form of makeshift shelters on sidewalks and in parks. These settlements, called "encampments" by city officials and "curbside communities" by local activists, have been a source of political and social tension (Figure 1). Unhoused residents of these communities have protested subhuman living conditions and forced removals without suitable housing alternatives, while housed neighbors, local business owners, and the city itself have raised concerns to public health and safety attributed to the presence of these settlements (Roth, 2017; Villalon, 2019). In lieu of alternatives, activists have advocated for curbside communities to be sanctioned and provided with sanitation services. The contentious situation persists today, despite a flurry of activism (Brinkley, 2017; Drummond, 2017), legal challenges (BondGraham, 2018; Veklerov, 2018), government action (AB-932, 2017; Katayama, 2017), and a United Nations report condemning Oakland for inadequately addressing human rights violations presented by the living conditions in curbside communities (United Nations Secretary-General, 2018).

Figure 1. A 2017 "curbside community" or "encampment" in Oakland. Source: Wikimedia Commons.

The District 3 Councilmember shared a vision with Reflex Design Collective to bring creative minds together for a "hackathon" design sprint to devise short-term solutions to suffering in curbside communities. "Hackathons" are typically gatherings of technologists who rapidly plan, build, and test solutions to a challenge over a matter of days. This conversation created an opportunity for us to share our alternative vision of equity design that centered the needs and agency of those most directly impacted by the problem: in this case, unhoused Oaklanders.

The Narrative

Instead of a "hackathon," Reflex Design Collective engaged in a five-month process to build relationships, learn about sociopolitical context, and host an innovation summit to develop creative solutions to the homelessness emergency impacting District 3. We sought to foster equitable partnerships between front-line leaders and influential stakeholders to create solutions to human rights violations in curbside communities.

Democratization

We began our work by partnering with community organizers and unhoused leaders. Our first attempt at forming these relationships involved hosting two meetings at City Hall, but this proved inappropriate and ineffective. Fortunately, through connections to a local Homeless Advocacy Working Group and with the guidance of two seasoned activists, Genevieve Wilson and Talya Husbands-Hankin, we were able to better build relationships by meeting unhoused people on their terms. This included months of 1-1 meetings with

community leaders and guided visits to curbside communities to connect with unhoused folks, provide support during forced removals, and learn about opportunities for allyship.

Instead of approaching front-line experts to simply learn from them, we presented our opportunity to participate in an innovation summit and asked how, or if, our resources could support their movement. We took a stand for grassroots power by holding ourselves accountable to their invitation and consent: if they were to have no interest, we would have abandoned the project. By honoring their agency, committing to transparency, and following through, we established trust via reciprocity rather than extraction.

Our grassroots partners were co-designers of the outreach and innovation summit planning process. Their perspectives provided an understanding of historical and political dynamics that we leveraged to facilitate a multi-stakeholder design engagement tailored to the needs of unhoused residents. Their input informed who we brought into our co-design process, how they should be included, how we framed the challenge, and how we co-developed solutions.

Contextualization

Although we were tasked by the Councilmember with hosting a design summit, our outreach and our partners indicated the need for the event to fill a different role to add value to unhoused folks, given their pressing day-to-day survival needs. At their direction, we leveraged our summit as a resource drive, which resulted in donations of over 160 mylar sleeping bags.

The City of Oakland and community organizers held highly contentious relationships: at open city meetings, city staff and organizers would occasionally engage in public shouting matches. Misunderstandings were commonplace, and controversial decisions were made by city officials that significantly harmed unhoused residents. For example, earlier in 2017, a self-governing village of unhoused folks living in tiny homes and receiving community-sourced services was evicted via bulldozer from an unused plot of public land due to enforcement of city regulations.

To foster collaboration between groups, we needed to design a space that was responsive to past harms and distrust, building a foundation for new relationships. This was accomplished using multiple tactics, including kicking off the weekend-long innovation summit with dinner at a church in District 3. Participants shared stories, discussed the pain and challenges of being unhoused, and learned about how folks survive on the streets. This set the foundation for more trusting interactions the next day when organizers, city staff, unhoused and housed residents, developers and nonprofit workers came together for an interactive co-design process.

Trauma-informed facilitation allowed harms to be addressed, and our acknowledgement of systemic violence created an affirming environment for unhoused leaders to vulnerably share their wisdom. With help from a community organizer who provided 1-1 emotional support, we created space for trauma and healing. These strategies proved essential for bringing people together across divisions and would not have been possible without our community partnerships and contextual understanding.

Reflection

We began our equity design process during the innovation summit by guiding participants to understand their positionality and how to foster authentic connections rather than status quo power dynamics. During a guided personal reflection exercise using the Paseo Protocol (School Reform Initiative, 2017), participants identified elements of their identity that either benefit from or are harmed by systems of oppression. They then unpacked in pairs how their identities could create barriers for connection with others, and what they might do to counteract this.

We leveraged systems thinking (Meadows, 2008) to allow participants to reflect on the connections between power, policy, and the material realities of homelessness. Therefore, participants identified leverage points for subversive and reflective, rather than superficial, intervention.

Co-Design

During the innovation summit, after participants reflected on their identities and the systemic nature of the problem, we guided them through a co-design process to collaboratively develop ideas to address challenges of homelessness.

We led a power mapping activity to acknowledge and subvert oppressive relational dynamics. Participants worked in teams to map out who has relative institutional power and who does not. They considered who is harmed and who benefits from the homelessness crisis. By visualizing these power dynamics, participants were able to identify who is exploited and has lived experience in the homelessness crisis. Equipped with this understanding, participants could identify who they needed to be designing with outside of the summit, and they created a plan to continue co-designing after the summit.

As participants began exploring generative possibilities for solutions, they engaged in a resource-sharing activity that surfaced the resources present in the room, whether they be social connections, specialized expertise, or physical assets. Equipped with this knowledge, participants tailored their solutions to leverage the resources they now had access to.

Outcomes

The summit resulted in nine proposals for the Councilmember, ranging from tactical solutions (e.g., Figure 2) to community building programs.

Figure 2. A participant in the innovation summit shares an idea for a schedule for folks in curbside communities to safely take showers. Source: Reflex Design Collective.

Each proposal was a comprehensive *vision* complete with physical prototypes, logistical details, roles for multiple stakeholders, and next steps for expansion. For example, one group created a program for local businesses to provide passports to up to four unhoused neighbors to use their restroom facilities, along with a sticker campaign publicizing those contributions on participating storefronts and elsewhere.

Beyond the solutions, participants reflected positively on the collaborative dynamics achieved within the room; following the summit, one unhoused participant partnered with the Senior Policy Director in District 3 for a number of months to co-develop supportive programming for unhoused residents.

The Key Learnings

This case study has several key learnings for the broader design community:

- We must look inwards to examine how we can shift our organization to embody the change we seek to bring to our clients' ecosystems;
- We must view institutions as embodiments of their values;
- We must work to address roots instead of symptoms of problems.

Look Inwards to Understand Transformative Change

How organizations operate is dependent on the values built into the organization, whether these operational tendencies are intended or unintended. In this case study, our ability to create equitable outcomes was dependent on our organization first functioning internally in an equitable manner.

While designing and presenting the summit, we leveraged our internal non-hierarchical structure to make logistical and organizational decisions, to collaborate on research and summit development, and to facilitate the summit. By implementing our organizational priorities of honest collaboration, leveraging capacities, and democratic decision-making, we developed psychologically-safe spaces for members of our team to contribute on concrete parts of the summit, instead of establishing rigid hierarchies that extinguish voices and recreate privileged experiences.

To Build Equity on the Ground, Shift Institutions from the Inside

We know that not all institutions share our values or vision. In pitching the "hackathon," the Councilmember emphasized a *tabula rasa* approach to developing housing solutions. Instead, we dove deeper to find out what had been done before and what tensions existed. This deep dive emphasized prior work of the unhoused community instead of brushing it aside.

For better or worse, institutions like city governments embody societal values that reveal themselves as implicit and explicit culture, policies, and financial decisions. Therefore, we focus our energies on understanding how we can shift internal values so institutions can develop community partnerships more equitably. Like mycelium, we infiltrate toxic networks and transform their internal workings, in turn transforming their external engagements.

Shifting institutions from the inside is a difficult, yet essential task towards building long-term change. When we enter a project, we must examine how clients may be embodying inequitable values that will prevent them from continuing to form equitable partnerships after the project ends. We are learning how to transform the different layers of an institution to explicitly embody anti-oppressive values, understanding that these explorations will be essential in understanding how our organization can create sustainable change.

Systemic versus Symptomatic Issues

We choose to address the underlying roots of problems instead of focusing on visible symptoms of these problems. When we started the project, the Councilmember intended to "hack homelessness," attempting to leverage the hackathon movement for innovative new ideas. As we conducted community outreach, two insights were revealed: (1) unhoused residents were offended and exhausted at interventionists bringing solutions without their voice, experience, or power; and (2) communities already had innovative solutions ready to implement in Oakland. Instead of hosting a design sprint, we developed a space that recognized stakeholders' dynamic complexities, healed existing tensions, and productively collaborated towards holistic solutions.

Conclusion

In this case study, we presented Reflex Design Collective's work with an Oakland City Councilmember, including the role we played as design facilitators, our successes and areas of improvement, and our key learnings.

We share our case study because we believe the design community can learn from how we have reimagined the role of designers.To design for social change and rectify oppressive systems, we must interrogate design practices to ensure we are not unintentionally deepening inequity. Instead of centering one's own creativity, we call for designers to create collaborative connections with people on the front-lines of oppression so that power, creativity, and equitable outcomes can be built and shared by many. In our Oakland innovation

summit, we functioned as facilitators rather than lead designers, allowing us to create space for collaborative innovation between unhoused folks and city officials.

We call for designers to critically examine design briefs they are given, and direct their efforts towards creating relationships and processes that center the agency of historically-underinvested folks with lived experience in oppression. We call for the design industry to apply critical thought into how design can contribute to grassroots movements, and identify what radical shifts must take place in design practice to avoid perpetuating oppression.

By shifting our collective understanding of what design is, we can begin to transform oppressive relationships, mindsets, policies, and systems. Our equity design approach of including space in the design process for democratization, contextualization, and reflection is one way to begin transforming these systemic and marginalizing systems.

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Workshops

Workshops Introduction: A review

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ADIM 2019 witnessed a diverse and eclectic range of workshops that explored the many different facets of design, through both a strongly theoretical and practical means of enquiry. As such, these were testament to the emergent and dynamic nature of design within a highly globalised and transitional set of contexts.

Dave Wood workshop provided a series of mini workshop exercises that took a strongly constructionist approach to facilitate the participants understanding of how design can be improved through the application of semiosis theory. **Melanie Woods** and co workshop drew upon design thinking tools and methodologies to actively engage and work with communities across Europe who are currently monitoring soil in real time across a range of geographic and climatic areas. As such, its primary purpose was to test and reflect upon assets and materials that could enable other researchers and practitioners to better understand climate service innovation. Workshop led by **Bertil Lindenfalk** provided a unique conceptual lens of pace layers, and a system of temporal, spatial and socio-cultural indicators. A pace layer model was used to frame the outcomes and guide the participants through a series of individual activities. Pace layers postulated that different socio-technical superstructures move and change at different speeds. At the end of the session, participants created a pace layer visualization of processes, with the aim of having an organically built representation of what tasks, activities, opportunities and challenges reside in or across what layers when designing at scale. **Rael Glen Futerman** workshop aimed to critically investigate how innovative organisations build cross-functional teams around projects. As such, diverse perspectives drawn from personal world-views and organisational roles contribute to radical collaboration across traditional boundaries of work. Through this highly interactive session, participants tested rapid team activities in which they could align core values of the team and embed these within innovation learning cycles. **Joanna Boehnert** workshop explored the means to build capacity to respond more effectively to global environmental challenges by exploring the politics of design with discourse mapping. This workshop investigated some of these difficulties by focusing attention on the politics of design. It was set against the backdrop of an increasing awareness within the design research community of the many ways political and economic dynamics influence the potential for the design of sustainable transitions. Liv **Merete Nielsen** and co workshop found ADIM 2019 as an excellent means to use the workshop session to establish a Design Literacy International Network. For this purpose, it aimed to bring together a group of international scholars attending ADIM who are interested in exploring an emerging area of Design Literacy. With increased production and consumption rising at a rapid rate, they argued that it is increasingly imperative that citizens develop an understanding of how these products and services are produced and consumed. Workshop 468 led by Andrea Augsten and colleagues, critically interrogated the role of design and designer within the frame of designing organizations. Increasing numbers of designers are becoming involved in strategic projects in the context of organizational change, such as creating a more creative, design-driven work attitude, bringing a human perspective into existing processes and acknowledging employee's individual diversity. The workshops aimed to explore and answer the following questions - do designers feel prepared for that? Are they aware of the organizational design narratives of companies? **Felix Bendito** and **Pablo Bris** workshop was to show how a set of techniques from a DDI approach focused on service design projects and how to apply them in a disaster context to enhance current practices in shelter management. Their primary aim was to establish a direction for the ideation of a new meaning of post-disaster shelter through the unique

perspective of the participant through an ongoing value co-creation process. Workshop hosted by **Angele Beausoleil** was focused towards engaging design researchers, scholars and practitioners in exposing the epistemological challenges and opportunities associated with 'design thinking' in management and leadership contexts. The participants were carefully guided through a series of visual thinking and design techniques to develop concept maps and a visual thesaurus for 'design thinking' and design-related terminologies within the management discourse. Findings arising from the workshop reflected a multidisciplinary understanding of the subject for knowledge translation and possible future research initiatives.

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Research Perspectives IN THE ERA OF Transformations

Design for Climate Services: A Co-Design Approach

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Introduction

Droughts, floods and other climate-related hazards present critical challenges for communities across the world. Design is well-placed to respond to such wicked problems (Buchanan, 1992) however a user-led approach to the development of climate services is rare (Christel et al, 2017). Instead, scientists and governments rely on research and innovation between science and industry to develop climate services for early warning systems and decision-making. The design community is uniquely placed to contribute to such developments, particularly in proposing new perspectives where citizens are themselves potential users of such services and at the forefront of change-making practices.

Workshop purpose and aims

This workshop introduced delegates to the concept of Citizens' Observatories (COs), and, moreover, the GROW Observatory and its communities across Europe who are monitoring soil in real time across a range of geographic and climatic areas.

The purpose of the workshop was threefold:

1. To test and reflect on assets and materials currently in development for a CO Toolkit
2. To ideate services that enable other researchers and practitioners to better understand climate service innovation
3. To present climate scenarios and data from real communities facing critical environmental challenges.

Theoretical relationship

COs represent new developments in social innovation where citizens and communities are gathering environmental data on issues that matter to them and innovating with them (Schartinger et al, 2017). Many of these projects are driven by design thinking and methods that support action-oriented outcomes for communities to transform these matters of concern themselves (Woods et al, 2018). We propose large-scale climate services can be developed using design approaches, and in collaboration with citizens whose livelihoods and communities are affected by extreme events, such as forest fires, drought and flooding.

Workshop approach:

The workshop had three main phases:

1. An introduction to a) the workshop objectives and b) COs with a focus on soil moisture as a dataset for climate change adaptation, and an outline of related critical environmental issues e.g. drought, flooding, forest fires and heatwaves.

2. The group were presented with a toolkit comprising post-its, pens, an empathy timeline, and the ‘climate services’ deck of cards (figure 1) which included:

Personas: representing the roles as well as concerns and motivations of typical stakeholder groups

Places: information about a country, such as natural assets, climatic profile and main agricultural activities

Data: climate and environmental data relevant to the personas, place and scenario

Scenarios: emerging climate related critical issue

Figure 1 Climate Services Cards

In groups, each member selected a persona and data card, and collectively chose a country and scenario card. Participants were instructed to adopt their persona role and, using an empathy timeline (see Figure 2) respond to their emergency scenario. Groups discussed and recorded inputs and outputs of data from the perspective of their personas ‘needs’, using sensors, observations and other information required for decision-making and action. Subsequently, teams extended the timeline to consider the scenario in ‘pre and post emergency’ periods for prevention and recovery monitoring respectively.

Figure 2 Example Empathy Timeline

Groups ideated a climate service based on their scenario and data and shared the results. Using a 'dotocracy' of red and green dots, participants offered feedback on the method and resources used.

Results

The primary objective of the workshop was to test and evaluate the co-design method and tool, the workshop approach and activity is demonstrated by visual evidence of co-design and sharing in figures 3 and 4.

Figure 3 Group Sheets showing a critical environmental issue on the empathy timeline

Figure 4 Group Presenting their service to the room

The scenarios and service outcomes were judged as particularly successful and so we report on those in Table 1 which shows groups 1 to 3, with a brief description of their chosen scenario and service proposition. Feedback on the method and tool was gathered, attendees requested more information such as 'country' context, and details in the 'data' cards.

Table 1: *Results of the co-design session by group*

Group	*1*	*2*	*3*
Title	Rain Check Service	Agropoli 4.0	Ration My Water Tank
Climate Scenario	Flooding in a rural area of the Netherlands, 100 day rain non-stop and health outbreaks	Long term soil degradation in rural Greece with huge socio-economic impacts	Long term drought in Greece/Portugal
Service Proposition	An Observatory receiving and providing a wide range of information, from evacuation details to capturing excess for later use.	CO system to foster cooperation between stakeholders and a transition to a regenerative agricultural system.	Smart water tank that allows owner/user to monitor and ration litres available with peer to peer dimension.

Takeaways for the participants

There were two main types of takeaways for participants as part of the project:

Theoretical:

- The introduction to COs and the data driven business opportunity;
- Underlying value creation in relation to climate change regarding design innovation;

Methodological:

- A practical method and tool based on gamification and role play to support co-design of service innovation based on observatory data was tested, with high level outcomes.
- Groups valued succinct and background information that supported rapid understanding of the topic.
- A design process and resources can help groups of different stakeholders understand the premise, adopt roles, create scenarios, understand data flow and ideate a service in a constraint time.
- The purpose of the card set is to create dialogue, rather than to provide a highly accurate representation of a current or preferred reality.

Reflections

There were two main types of takeaways for participants as part of the project:

Quality of service propositions generated: The methodology allowed groups to generate high-level prototype services in a short session. One of the groups ideated a service for which GROW had already begun to develop the scientific basis within the project.

Trans-disciplinary approach: We validated and reinforced the CO approach through an integrated stakeholder response, and highlighted the contribution that designers offer to co-create climate services.

Potential for climate services: A sustainable observatory system can be a long-term powerful contributor to disaster management, prevention and monitoring recovery.

Empathy design (Gasparini, 2015) and design for emotion (Desmet and Hekkert, 2009): The persona cards and role play encouraged an empathetic response to stakeholders' concerns and motivations. The tool was also designed to generate engagement through emotion: rather than designing a service chronologically, starting with prevention, teams were placed in the scenario, a crisis situation, triggering an intense response to relate participants to a call to action more easily; teams then considered pre and post crisis event scenarios.

The introduction of the tool in the emergency phase of the timeline created a powerful narrative to which teams were able to respond in role.

Next steps: GROW will iterate the tool and workshop with a diverse audience including the categories of personas presented and with communities experiencing the scenarios in real life. This will be achieved through future sessions that 1) provide more time, 2) build on the stakeholders' expertise, and 3) acknowledge a deeper complexity likely when working with a community that is 'threatened', in order to generate deeper insights.

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A Semiotic Rosetta Stone Workshop: Enhancing visual communication through design semiotics

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Workshop purpose and primary aims

In this 90-minute design semiotics workshop, ADIM delegates will learn how the quality of user-participation can be enhanced by improving the visual communication within designed outputs. The workshop's aim is to provide a direct, hands–on experience, to explore how iconic, indexical and symbolic semiotic representation can improve design's message, concept or affordance. It will complement the conference sub-track 5.e Seeking signification in transformational times: design semiotics and the negotiation of meaning.

Theoretical relationship

Over 90-minutes through two exercises and a plenary, the workshop will explore how C.S. Peirce's pragmatic semiotic theory of Semiosis can be synthesised into design practice. The triadic nature of Semiosis focuses on the inter-relationship between the design concept, how this is visually represented, and how this representation affects how the intended meaning is finally interpreted. The workshop exercises take a Constructivist approach to facilitate participants' own revelation as to how design outputs can be improved through applying the triadic relationship of Semiosis.

Ethical Issues

As the proposed workshop will be an 'opt in' attendance for participating, an ethical informed consent agreement form will be issued before the workshop begins. Only the work of those participants who sign and consent to their workshop outputs will be used in any ongoing analysis or reflection in the report or future papers.

Workshop approach

The approach for the 90-minute workshop would follow this structure:

00:00 Welcome, workshop aims, semiotic audit (@ 20 mins)

- Welcome message
- Projection of a semiotic audit form and explanation:
    - Participants will have a paper copy of a semiotic audit form
    - They will complete first section before workshop begins
    - This captures the initial level of pre-existing understanding of semiotic theory
- Then an overview of rudimentary Semiosis and its triadic relationship between concept, its representation, and the role of interpretation in the context of designed artefacts.

00:20 Exercise 1: Symbolic representation in designing effective visual communication (@20 mins)

- Using print outs of existing design campaigns, products, etc. participants will discuss in small group the principle of the symbolic representation of the concept present in the design example.
- Using scissors/markers/etc. participants will indicate what they believe is the symbolic representation visually communicating the intended message in the design example.
- Participants will then be asked to connect the designed connotation to the basics of Peirce's semiotics using their own design terms.

00:40 Exercise 2: Indexical and Iconic representation in designing effective visual communication (@20 mins)

- Again*, using print outs of design campaigns, products, etc. participants will discuss in small group the principle of the indexical, and then the nested iconic representations of the object present in the design example.
  *each table will have several versions of the design examples so that multiple passes at analysis can be made by the designers
- Using scissors/markers/etc. participants will indicate what they believe is the indexical representation in the design, and then break the design down further into its iconic elements that help visually communicate the intended message or affordance.
- Participants will then be asked to connect these to the basics of Peirce's semiotics.

Figure 1: Example of plenary session with displayed worksheets

01:00 Plenary and Completion of semiotic audit (@30 mins)

- The results of exercise 1 & 2 can be displayed by group on a wall (see Figure 1), and feedback their assumptions which can then be discussed. Through this plenary phase participants can begin to understand how much of their tacit knowledge can be mapped to pragmatic semiotic theory, and how they can seek more theory to increase the effectiveness of their visual communication within designed artefacts.
- Participants will also complete the 2nd section of the designer semiotic audit form.
  - This captures their level of desire to understand more Peircean semiotic theory, and to ask how they would like that to happen.

01:30 Workshop Ends

Takeaways for the participants

The workshop participants will work together in small groups using handouts and an A3 worksheet. On this worksheet, they will annotate their emergent understanding of the inter-relationship between the design concept, how it is visually represented and interpreted. Then in the final plenary part of the workshop, the participants will discuss in their own words how they understand how the manipulation of iconic, indexical and symbolic representation affords different levels of meaning.

Strategy to capture content and results

The final plenary session is important to the Constructivist approach we take, as from a pragmatic position the participants' understanding emerges from the acts of engaging in the process of unlocking theory within existing design practice. Participants can opt into supplying their emails to be kept informed of the ongoing research.

Results and final reflections for consideration

The completed worksheets (or photographs of them), plus completed semiotic audits, will provide the workshop team with valuable sensory data to be further analysed as part of continuing Semiotic Rosetta Stone research. This ultimately is to define more designer-centric methods of disseminating Peircean theory into design practice.

Space requirements

A digital projector for our Mac laptop, in a room with flat tables and wall space for display will suffice.

Maximum number of participants

A maximum of 20 participants (5x groups of 4).

Big Design – Designing at Scale

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Introduction

Large-scale transformation projects have so far rather consistently embraced a dirigist, technicistic perspective. Their outcomes are on the other hand meant to be experienced by communities in a direct, engaged manner that is embodied, spatial and temporal. For processes meant to radically transform the lived experience of people, they have so far been strategically unconcerned with any human-centric view.

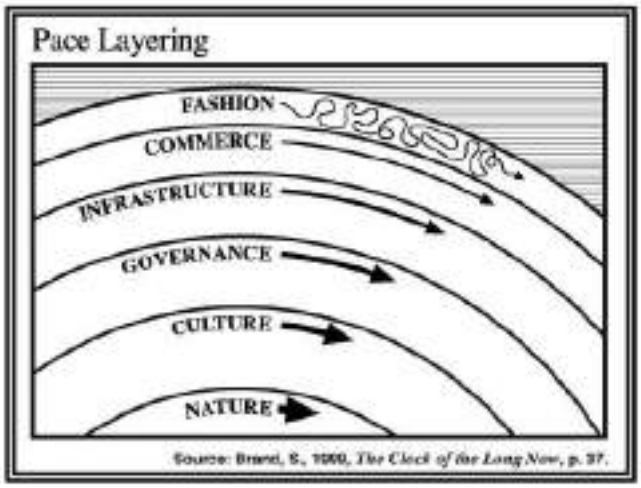
Workshop purpose and aims

The workshop intends to suggest a necessary shift in perspective through the conceptual lens of pace layers and a system of temporal, spatial, and socio-cultural indicators: place-making, power and plasticity, and proxemics, and discuss the role and responsibilities of design in the production of large-scale systemic change. Questions that will be addressed during the workshop include:

- When scaling up to regional level, does the design discourse belong? If so, when, where, how?
- What role and responsibilities for designers?
- Are designers comfortable with the level of abstraction these projects comport?
- Are current design processes useful or fit for the task?
- Is designing at scale designing for people?

Theoretical relationship

The pace layer model will be used to frame the outcomes of the workshop and guide the participants through the individual activities. Pace layers postulate that different socio-technical superstructures move and change at different speeds.



Participants will be asked to reflect on and formulate how the individual activities relate to the pace layer model. At the end of the session, groups will create a pace layer visualization for their processes, with the general aim of having an organically built representation of what tasks, activities, opportunity and challenges reside in or across what layers when designing at scale. Participants will be asked to consider that:

- in layers with high variability, adaptability should be maximized;
- in layers with low variability, structures should be stabilized;
- if changes happen too fast in a low-variability layer, their effects can become systemically detrimental as they negatively impact other layers.

These points will be recalled at wrap-up to foster reflection, frame the workshop, and further the conversation.

Activity 1: Placemaking

A dimension often overlooked in large-scale transformation projects is that addressed by placemaking. A core concept in city planning, placemaking centers on the necessity of designing environments that feel human and that speak to our sense of presence and belonging. While large-scale projects naturally work at the geographical scale, they seem to ignore the general need to meaningfully anchor infrastructure to human activities and the placemaking of the new digital/physical environments they create.

Activity 2: Power and plasticity

In cultural terms, power may be considered as control and the expression of biases in choices. Such control may be culturally explicit or tacit. Any call for large-scale transformation is a reflection on whether such efforts should alter or maintain the status quo. Human-centric approaches favor the individual and local bottom-up angle: strategic, policy-driven approaches favor the top-down, collective view. When designing at scale, as we abstract local needs upwards, can top-down structures provide enough plasticity to support cultural variance? What role does design play in avoiding technocratic approaches sidelining social and cultural needs?

Activity 3: Proxemics and public spaces

Proxemics is a cultural approach to understanding and representing how people experience space and spatial components and suggests a scalable framework that conceptualizes different interactions through methods of distance-setting. Using De Waal's three conceptual constructs for exploring proxemics at the level of the public space, the private, parochial and public domains, this activity will have groups figure out the how proxemics can contribute to make large-scale processes more human-centric.

Workshop approach

This is an activity-based workshop for 15-30 participants. After an initial welcome moment, the facilitators team up attendees in groups. These groups work on three distinct activities framed through large-scale design problems: the facilitators provide the practical and theoretical framing, a fictional hands-on case, supervision for the duration of the workshop, and finally coordinate the room for take-aways and reflections.

- 00:00 - 00:20 Welcome, introduction
- 20:00 - 35:00 Framing: Pace layers

- 35:00 - 75:00 Activity #1, #2, #3
- 75:00 - 90:00 Reflections, wrap-up

Takeaways for the participants

Participants will learn how to:

- define the role and responsibilities of design when designing at scale;
- recontextualize the role of technology in large scale transformative projects;
- systemically relate human-scale indicators to large-scale priorities.

Results and final reflections for consideration

The workshop provides attendees with a more mindful, human-scale approach aimed at re-centering large-scale transformation projects around the human elements. Final group reflections will center on how to:

- reduce the gap between the reality of large digital transformation projects and the current research framing and understanding of the problem space;
- challenge the current technicistic top-down approach, and disseminate a more rounded, humanistic way-of-doing that centers on socio-technical, spatio-temporal complexity;
- kickstart a process of aggregation of perspectives, cases, approaches, and results, and gauge current interest in post-conference dissemination and networking efforts.

Building Adaptable Teams for Co-configuration

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Summary

In innovative organisations we are seeing an increase in cross-functional teams being built around projects. The diverse perspectives of collaborators draw from personal world-views and organisational roles, which contributes to radical collaboration across traditional boundaries of work.

This hands-on workshop aims at testing a rapid team alignment activity in which teams propose core values and align these to the innovation learning cycle, synthesising them into foundational work practices for each phase. These are then reframed as the teams' innovation narrative.

Workshop Purpose and Primary Aims

The purpose of this workshop is to test an activity aimed at contributing to the meaningful formation of new teams. Increasingly we are seeing teams form and reform throughout the product/service development lifecycle. These responsive teams are often cross-functional in nature, bringing together multiple perspectives into each phase of product/service design.

These purpose-driven teams often have to find alignment quite rapidly, so time is a constraint. Misalignment can lead to dysfunctional teams, resulting in longer product development, and innovation lifecycles. This in turn diminishes knowledge development of teams. Purpose-driven teams need to be rooted in a set of common values. The espoused values of the team should in turn be grounded & aligned to foundational work practices.

The primary aims of this workshop are to:

- Test an activity aimed at bringing new teams together rapidly
- Bring potential users of this activity into the design process
- Provide an interactive platform for participation and collaboration
- Generate insights around rapid-team alignment

Theoretical Relationship

Co-configuration, an emerging customer-centric mode of work, "involves building and sustaining a fully integrated system that can sense, respond, and adapt to the individual experience of the customer" (Victor & Boynton, 1998, p195). In practices of co-configuration there is a need to go beyond conventional teamwork or networking to the practice of 'knotworking' (Engeström, Y., Engeström, R., & Väläaho, 1999). Knotworking, the emerging interactional core of co-configuration, is where separate actors can quickly come together and "*tie a knot*" and work together and solve a problem or design a task in the most efficient way possible (Engeström, 2012).

Knotworking, Engeström (2008, 196) claims,"poses qualitatively new learning challenges to work communities." Critical to knotworking and the functioning of constantly changing participant configurations is rapid negotiation and improvisation (ibid).

The changing configurations of teams happen over time, specifically "the entire life trajectory of the product or service" (Engeström, Puonti, & Seppänen, 2003). The life trajectory of products/services is framed as expansive design thinking and aligned here with the iterative, innovation-learning process (Figure 1) (Beckman & Barry, 2007).

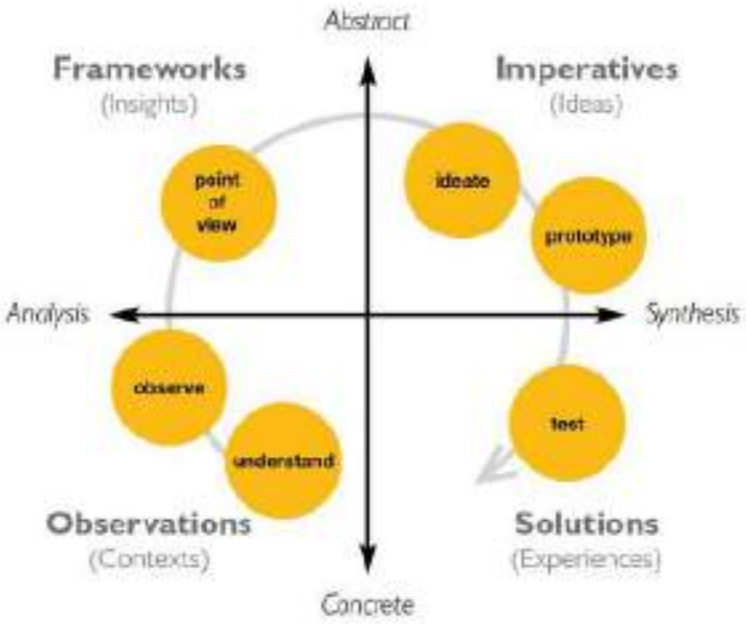

Figure 1: Innovation Learning Process. source: adapted from Beckman & Barry, 2007, p30

This diversity in collaborators and temporality of team configurations, based on objective/motive of the project at a specific time, can present challenges around cohesion, alignment and synchronicity.

Foundational work practices, that is, the enacted values of a team change with each iteration. These foundational work practices are rooted in the personal values of each individual and espoused as team values. With rapidly changing teams, the misalignment between espoused and enacted values can create tensions, which can hinder or derail a team's efforts.

Workshop Approach

This interactive, hands-on workshop will see participants form teams and develop foundational work practices for each phase of the innovation learning journey, that is, how they will embody and enact their team values dependent on where they are in the innovation cycle. This will be done through a guided, scaffolded approach moving from personal sharing personal values to collaboratively defining team practices.

This workshop embraces the activity-driven mind-set of design thinking and participants will each produce a personalised guide for future work, in the form of a lo-fi booklet.

After a brief introduction to the teams outlining how the workshop is structured, participants will co-create in teams of five, moving through the 6 stages presented in Figure 2. There will be intermittent instructions at each phase of the process.

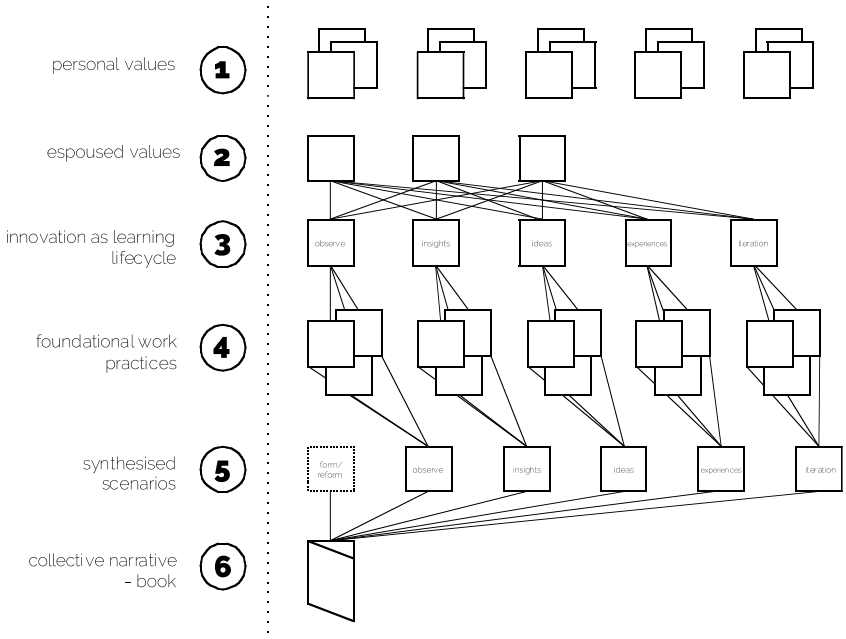

Figure 2: Workshop Phases. source: Authors Own

Takeaways for the Participant

Participants will each leave with a prototype of their team's co-created work guide in the form of a small booklet (stage 6 in Figure 2), which they will each produce.

After workshop findings have been synthesised, they will also be provided with the refined workshop outline and templates (via email) to carry out this activity within their organisations.

Results and final reflections for consideration

The results of the workshop will go toward refining the activity further.

Specific feedback I aim to capture is:

- What worked,
- What didn't work so well,
- New ideas/suggestions that emerge, &
- Questions that still need answering

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Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

Discourse Mapping: Navigating the Politics of Sustainable Design

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Workshop Purpose and Aims

This workshop will create a space for discussion on environmental politics and its impact on design for sustainable transitions. It will help participants identify different sustainability discourses; create a space for reflection on how these discourses influence design practice; and consider the environmental and social implications of different discourses. The workshop will do this work by encouraging knowledge sharing, reflection and interpretative mapping in a participatory space where individuals will create their own discourse maps.

This work is informed by my research "Mapping Climate Communication" conducted at the Centre for Science and Technology Policy Research (CSTPR) in the Cooperative Institute for Environmental Sciences (CIRES), the University of Colorado, Boulder. With this research project I developed a discourse mapping method based on the discourse analysis method of political scientists and sustainability scholars. Using my own work as an example, I will facilitate a process that will enable participants to create new discourse maps reflecting their own ideas and agendas.

Theoretical Relationship

Discourses are shared ways of understanding the world. Political scientist John Dryzek's *Politics of the Earth* describes how discourses are ways of framing a problem that provide the basic terms for analysis and define what is understood as common sense and legitimate knowledge (2013, 9). Diverse values, vested interests, critical perspectives and insights are embedded within discourses. These both reflect and construct attitudes towards the natural world and create a foundation for design transitions for sustainability. Discourses frame problems. Framing is a means of navigating complexity and part of the problem-solving process in design (Dorst 2011, 528). Discourses can be understood as both diagnostic and prescriptive. Environmental discourses are a foundation for theories of change on issues of sustainability and prescriptive action.

The "Mapping Climate Communication" project identified five dominant climate discourses (these are plotted on a matrix in Figure 1). The following figure (figure 2) illustrates associated diagnostic/prescriptive concepts.

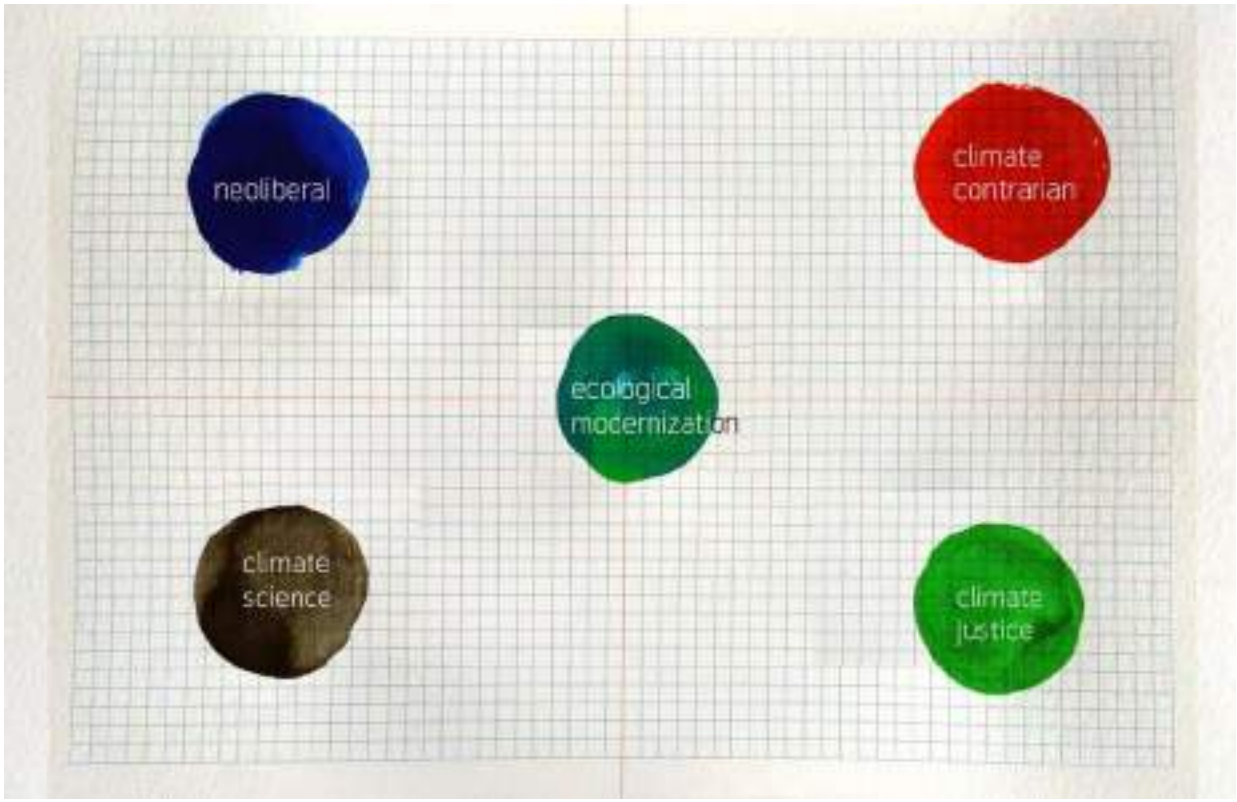

Figure 1: Five Climate Discourses. Boehnert, 2014.

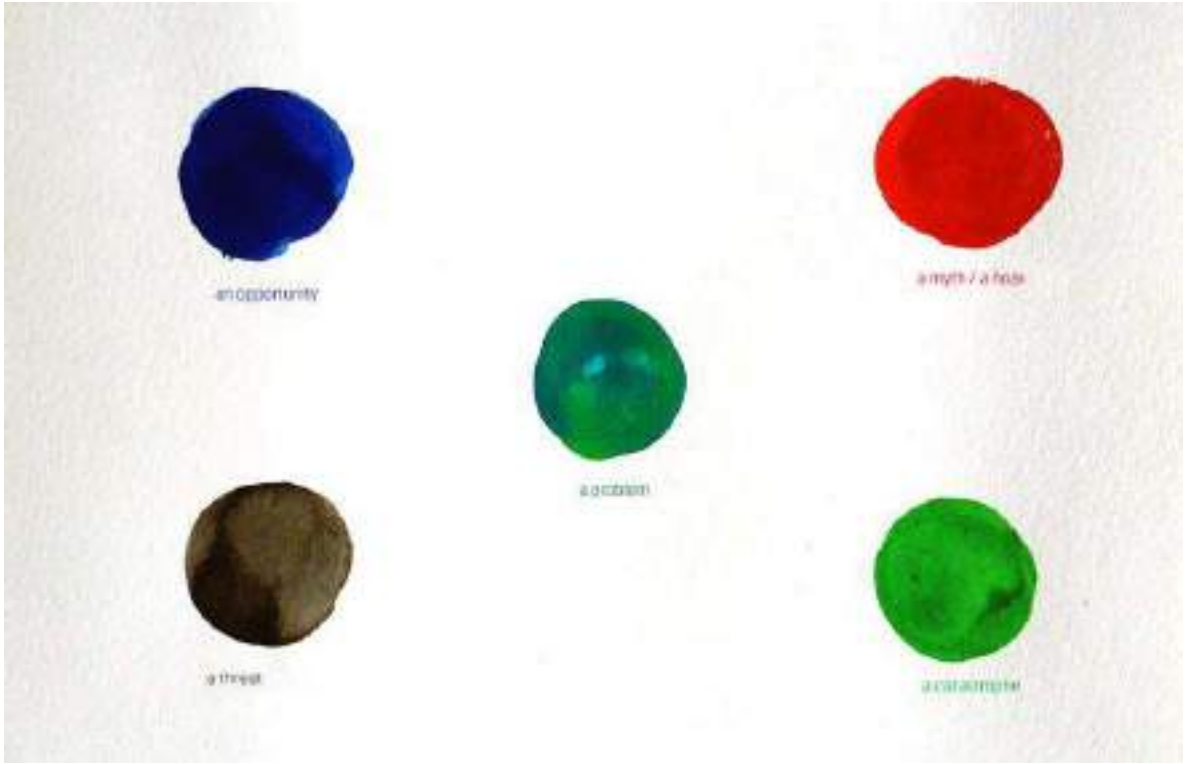

Figure 2: Five Climate Discourses – diagnostic/prescriptive concepts. Boehnert, 2014.

Summary of Five Climate Discourses

1. **Neoliberalism**. Within this discourse environmental considerations are subordinated to macroeconomic policy "imperatives". As a mode of governance, neoliberalism is characterized by privatisation, deregulation, financialisation and austerity (Peck 2010).
2. **Contrarian**. This discourse holds that environmental issues are not serious problems and/or if they do exist, they must not be prioritised over other concerns. The contrarian position seeks to continue unrestrained use of the Earth's fossil fuel reserves.
3. **Ecological Modernisation**. This discourse holds that environmental problems can be addressed within the current capitalist system and that low emissions and other benefits can be achieved with market mechanisms, clean energy and policy innovations.
4. **Physical Sciences**. This discourse relies heavily on the physical and material sciences. It looks to science as the way to address issues of sustainability with technocratic solutions. This discourse does not theorise either power or human motivation.
5. **Environmental Justice**. This discourse aims to create new forms of governance that support distributive and regenerative economies. It looks to support socio-political transitions to radically decentralize power, increase democracy and address injustices.

These discourses relate to the work of other environmental discourse theorists such as Dryzek (2013), Nisbet (2014) White, Rudy, and Wilber (2015) as illustrated in Figure 3. Within the "Mapping Climate Communication" project these discourses were used to categorise events in *The Climate Timeline* (figure 4) and 'actors', i.e. institutions, organisations and individuals, in the *Network of Actors* (figure 5). More recently, other environmental discourses have become prominent (including eco-fascism), and the maps presented here should be updated to reflect contemporary circumstances.

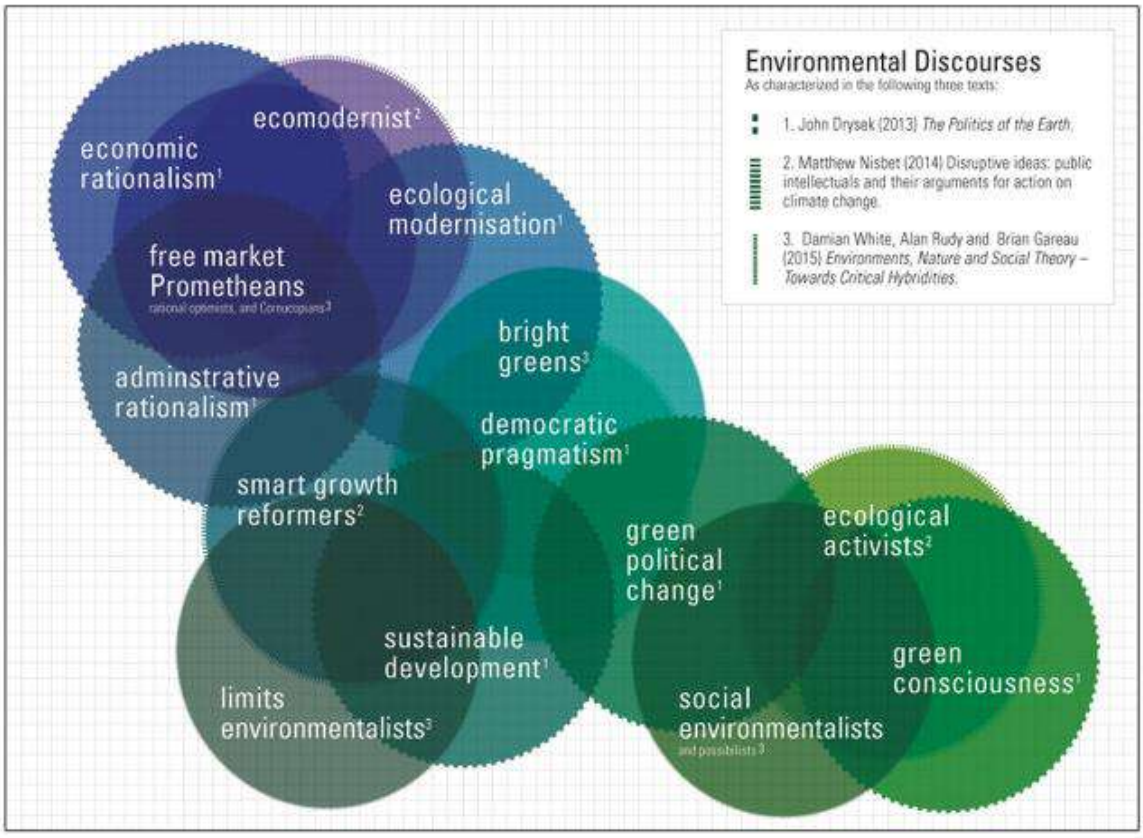

Figure 3: Discourses of different environmental theorists. Boehnert, 2014.

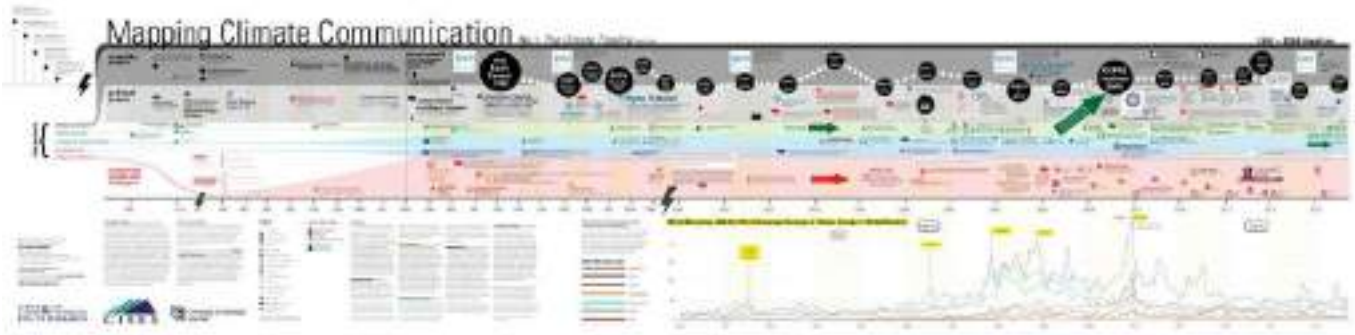

Figure 5: Mapping Climate Communication: No.1 The Climate Timeline. Boehnert, 2014.

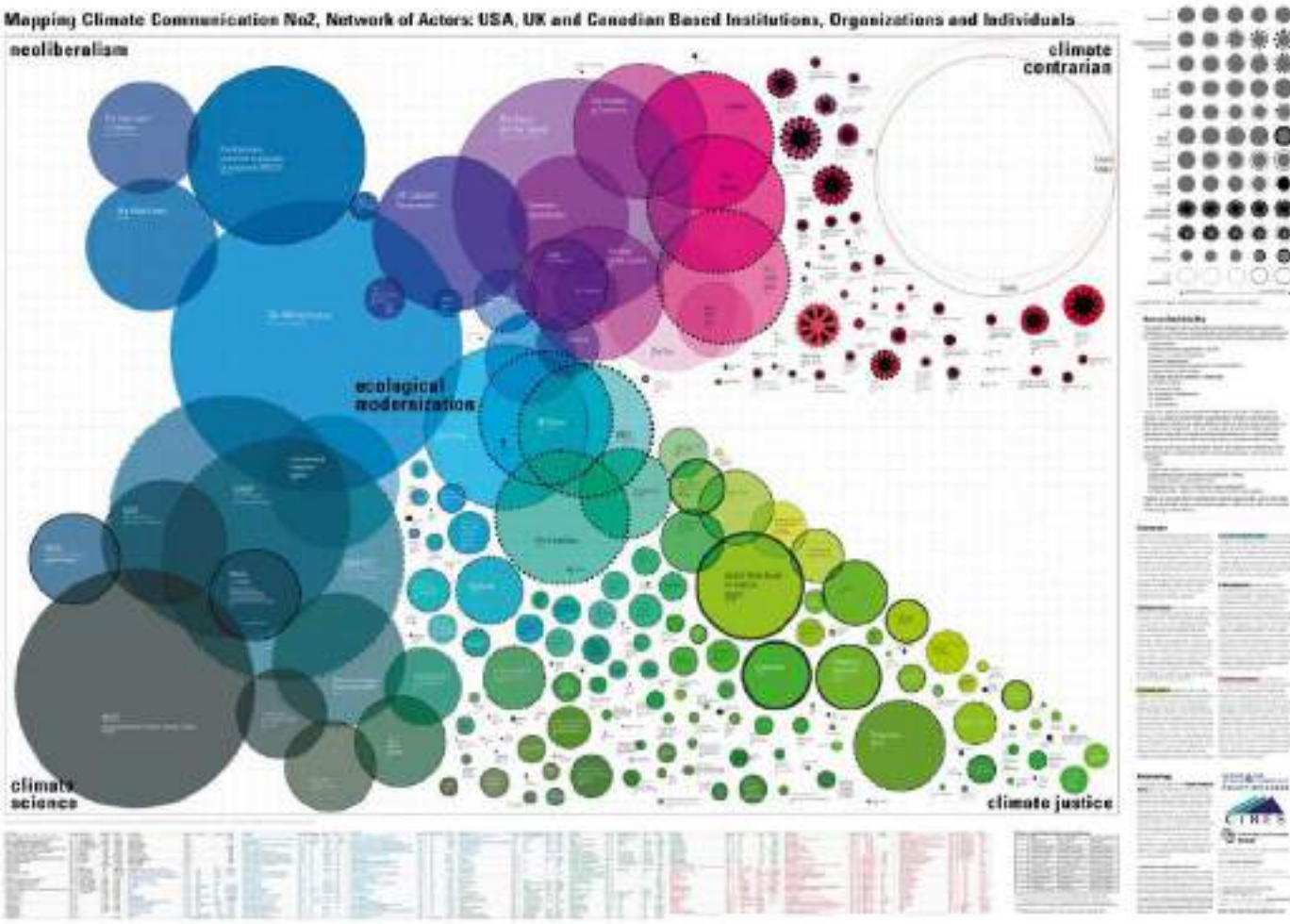

Figure 4: Mapping Climate Communication: No. 2 Network of Actors. Boehnert, 2014.

Workshop Approach

This project will offer participants a space to explore how environmental problems and sustainability agendas are understood. We will start with a theoretical presentation that will include my own discourse maps. I will then facilitate a group discussion on sustainability discourses in design industry. The group will identify dominant discourses and dynamics. I will lead a facilitated process to enable the formation of small groups based on alignments of theoretical positions (this process is central to the success of the workshop). Smaller groups will then have space to use mapping techniques to illustrate how events, actors and strategies are conceptualised within or between the discourses they identify as important. Discourse mapping will be

employed in this workshop to reveal environmental politics in the design industry, design education, design research and the design press.

Takeaways for The Participants

Participants will benefit from an introduction to discourse mapping and an opportunity to put this method into practice by mapping environmental discourses and what they reveal about various debates, events, strategies and actors in sustainable design.

I will photograph the workshop and all the maps at the end of the workshop (I will ask permission to photograph).

Results and Final Reflections for Consideration

Discourse mapping offers a means to interpret the politics associated with the design of sustainable future ways of living. This method informs the work of design educators and researchers as they develop capacities for sharper political analysis. The newly created discourse maps could potentially be used as educational resources.

Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

Discovering design narratives to humanize organizations

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Workshop Purpose and Aims

Human-centered design approaches have emerged in business organizations since the rise of service design and design thinking. As a consequence, designers have been shifting their role from pure aesthetics towards innovating. Thus, in this workshop, we look at the role of design and designer in the frame of designing organizations. Lots of designers are becoming involved in strategic projects in the context of organizational change, such as creating a more creative, design-driven work attitude, bringing a human perspective into existing processes and acknowledging employee's individual diversity. But, do designers feel prepared for that? Are they aware of the organizational design narratives of companies?

Mostly, the introduction of new practices labeled as design thinking or service design is not adapted to the organizational circumstances, company values, habits, beliefs and experiences. However, we believe that each company would benefit from emphasizing its design narrative while introducing employees to new design practices in order to exploit its full potential and stay healthy as an organization.

Especially identifying solutions that fit both to the needs of users and to the organizational environment is challenging. Here, the lack of communication about an organizational design narrative challenges the work of a designer. Rather, the use of design activities is seen through new initiatives, such as labs, workspaces and innovation projects that aim to disrupt the organization towards more human-centric culture.

We, the workshop convenors, did a conceptual literature review to explore the topic of *humanizing an organization* by building upon co-created dimensions that have been developed with design scholars and practitioners in 2018. We identified four aggregated themes around management, design and organizational change. Each theme describes one aspect relevant to *humanizing an organization*.

During the workshop, participants use the two dimensions of pre-text and context of organizational design narratives as a basis for creating future scenarios for strategies to humanize an organization. The workshop aims to raise awareness for an organizational design narrative, to strengthen participants sensibility for organizational design practices and to deliver hands-on methods for experiencing and exploiting the approach.

Through a practical workshop approach, we are positioning and exploring the phenomena of humanizing organizations in design research by linking historical roots with complex issues currently arising in the context of design management and organizational change.

Theoretical Relation

The idea of reflecting and being aware of the organizational design narrative is firstly claimed by Junginger and Bailey in 2017. According to them (2017, p.39), a design narrative *aligns the design pre-*

text and the design context of an organization with other narratives and *reconstructs the organizational journey, the design practices, design principles and design methods*, as well as fosters its resilience.

Workshop Approach

Through the interactive workshop concept, we introduce a design framework built through a selection of tools and methods to help participants first to identify an organizational design narrative, and second, to create future scenarios with strategies for fitting the organizational design narrative to design activities for a more humanized organization.

The workshop structure is built through three main parts:

1. **Introduction:** The workshop topic is introduced by the convenors through synthesized results of the literature review in a presentation of maximum 20 minutes at the beginning of the workshop. The presentation also includes the introduction of the workshop agenda.
2. **Interactive team work:** After the introduction, the participants are divided into groups working on the given main themes identified in the literature review.
    a. The teams are given a description of their theme, as well as a predefined organizational context as a basis for the exercise.
    b. After getting familiar with the material, teams are guided through an exercise to (1) recognize and complete the dimensions of *pre-text* and *context* of the design narrative, and to (2) create a future scenario for humanizing the organization.
    c. All materials are provided as paper-based templates.
    d. Convenors are guiding the teams through the exercises step by step ending up in a block of 45 minutes in total.
3. **Wrap up:** At the end of the workshop, each team will present their results, sharing learnings and reflections utilizing the working templates as their structure. The presentations are filmed as short video clips for documentation purposes. (20 min)

The maximum number of participants for the workshop is 30 people. The participants will be divided into groups of maximum five people in each.

Takeaways for the Participants

The workshop exercises will result in narrated future scenarios of humanized organizations. The outcomes serve as a framework for the participants to take design actions in their own or their client's organizations for more humanized practice.

Results and Final Reflections for Consideration

The workshop facilitators are building the workshop upon a literature review in the context of humanizing organizations through design. By transferring the theoretical results in practical exercises and presentable design narratives, the fields of research and practice are linked in a collaborative format. The workshop results will be documented as a workshop report building on the literature review through the notes of the teams on paper templates accompanied by photos and short videos of the presentations.

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Academy for DESIGN INNOVATION MANAGEMENT Conference 2019
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Research Perspectives IN THE ERA OF Transformations

Shelter after disaster management. New approaches by design driven Innovation

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Workshop purpose and aims:

Despite several stakeholders involved in the shelter after disaster management, like academia or the private sector, are focused on the introduction of new products and on direct action, Innovation in shelter after disaster is today more likely to be concerned with improvements in process and more related with facilitation.

Design driven innovation (DDI) is increasingly applied on services, changing realities on individual, organizational or societal levels. It has clear potential in shelter after disaster management to lead the sector on interesting and important new directions, achieving breakthrough innovations and transforming the meaning of shelter as a product into a user's centered service.

The purpose of the workshop is to show a set of techniques from the DDI approach focused on service design projects and apply them in a disaster context to enhance current practices in shelter management.

The aim of this workshop is to establish a direction for the ideation of a new meaning of post-disaster shelter through the unique perspective of the participant through an ongoing value co-creation process.

Theoretical relationship:

Disasters occurs and causing destruction and homeless people in the need of shelter. With the aim of assist victims that have lost their homes he first thing that comes to mind is the delivery of thousands of tents or prefabricated units. But post-disaster shelter should be more than this.

Post disaster shelter is one of the most important sectors in Disaster Management. There is a large number of actions, activities and measures that must be carried out before, during and after a disastrous event, including emergency actions in order to save lives in the aftermath of the disaster, and recovery activities once the situation is stabilized- But it also has to include endless measures and activities of mitigation and preparedness, developed with the aim of decreasing vulnerabilities and increasing capacities, trying to reduce the consequences of the disaster. These procedures are interrelated and require a great deal of strategic planning.

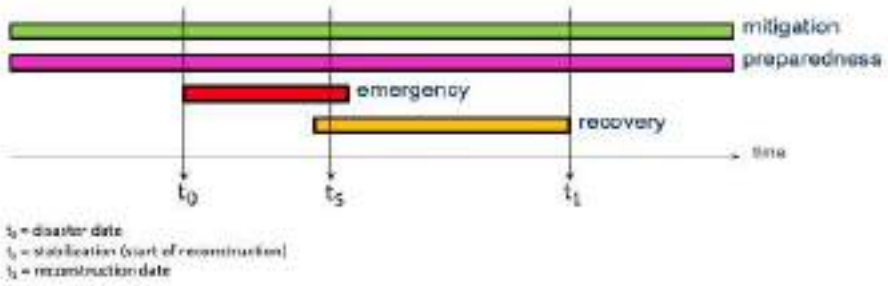

Figure 1 Disaster management diagram

When a disaster strikes, post-disaster shelter strategies begin with the implementation of emergency plans. Usually, they consist of moving homeless people from an affected area to a safer one, either sheltering them in existing structures: such as public buildings, schools, civic centers, sport facilities, and so on, or in new shelters such as tents, small structures, plastic covers, etc...

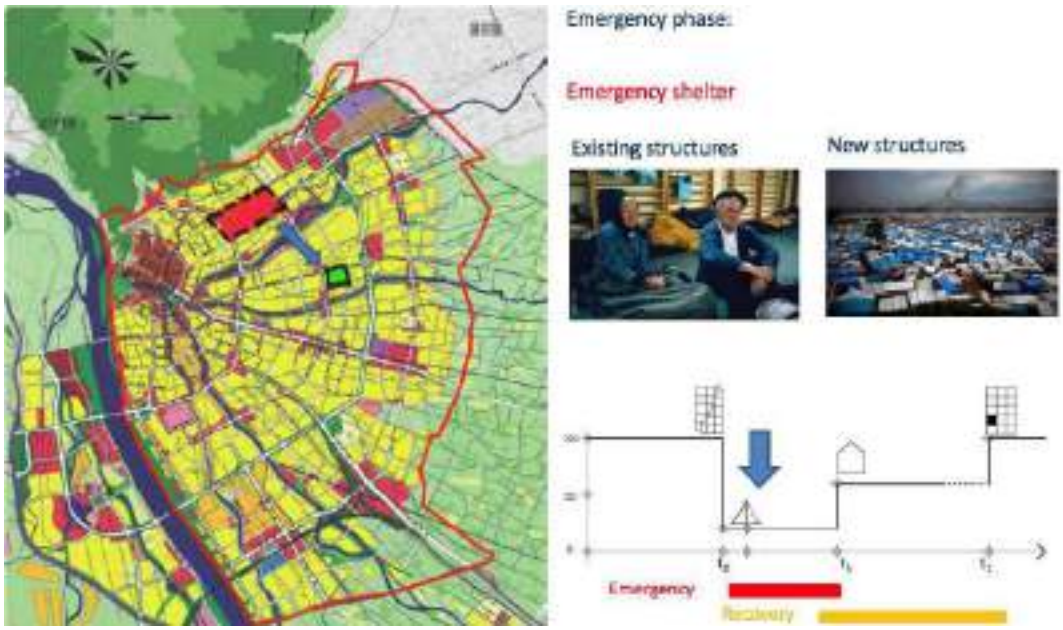

Figure 2 Shelter strategy during the emergency phase

Once the situation has been stabilized the recovery activities can start. Destroyed houses must be rebuild, and damaged ones repaired. This period may last long time. At least 2-3 years, but sometimes it can last more than ten. During this period, homeless people can't remain in an emergency shelter because living conditions are very limited; there is not enough privacy, comfort or security and its useful time is very short. It could be months, even weeks. Another kind of provisional shelter is needed to fill the gap between emergency and reconstruction. A temporary housing program offers a more durable solution and better living conditions than an emergency shelter. There is a wide range of temporary housing solutions; lodging, rental, prefabricated units, etc...

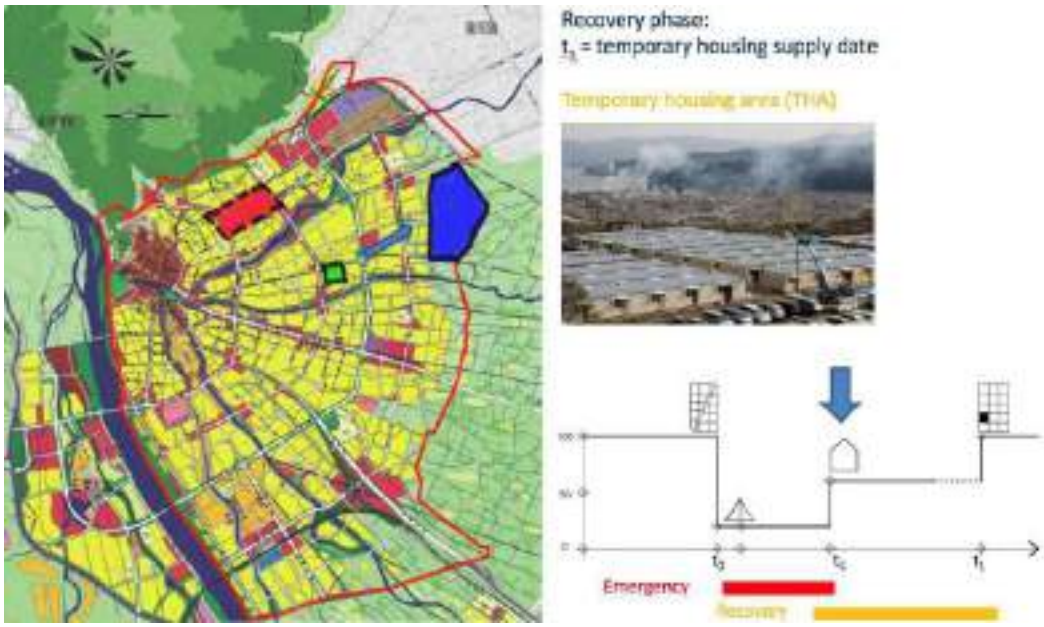

Figure 2 Shelter strategy during the recovery phase

The provision of temporary housing is crucial for an effective recovery process. It can provide not only physical protection, but also a certain sense of stability from a psychological point of view. It allows people to regain control over own lives. People are less vulnerable, and the community can increase their capacities, thus becoming more resilient. From this base point, the community can begin the reconstruction tasks, reducing the recovery time. Once the reconstruction is finished, people can return to their rebuilt permanent homes.

Unfortunately, most temporary housing strategies do not work properly, and this is the real problem in post-disaster shelter management. There are common failures in temporary housing programs:

- In most cases the recovery strategy hasn't been well planned. The housing plans are made during the emergency period without enough time, instead of being made in advance as part of the preparedness activities.

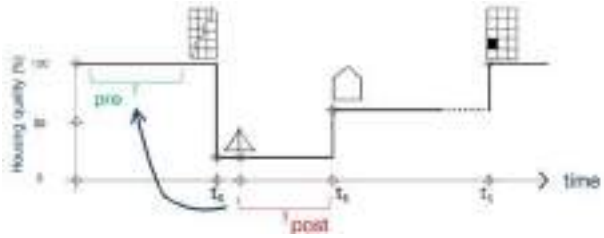

Figure 3 Post-disaster planned strategies enlarge the emergency period

- Many times, decisions are made in a very limited context, with only a few stakeholders, in a top-down approach, without any involvement of the people affected.

Figure 4 Top-down approach

- Usually, the quality and quantity requirements of shelter are based on feasibility and viability standards, such us lifespan, cost, m2, transport and assembly speed, etc., regardless of desirability, speaking in terms of human feelings or emotions.

Figure 5 Technocratic approach

- Most designs try to find a universal solution to adapt to any place, without taking into account contextual aspects such as the physical, economic or socio-cultural.

Figure 6 Universal approach

- Finally, the housing strategy generally consist in the delivery of a product or artifact, mainly a prefabricated unit designed to fit in a production chain, that hardly contributes to improving the recovery process.

Figure 7 Product approach

Losing our house is one of the most traumatic experience we can have. Homeless people are a risk group for mental illness such as depression, PTSD and even alcoholism. Experience shows that units designed as permanent houses, with the highest quality standards, are not enough for affected people to resume their normal lives. That is because they need more than a place to live. They need a home to build or rebuild relationships with other people and with the environment. They need to regain hope.

Post-disaster shelter management requires an innovative human centered approach to overcome the old technocratic approaches. We are talking about bottom-up participation processes, about standards based on requirements of desirability in terms of feelings and emotions, about designs adapted to different socio-cultural contexts and, finally, we are talking about temporary housing strategies that contribute to the community recovery process.

Design methodologies are comparatively different from technocratic in content, process and tools.

- In design, innovation becomes the centerpiece of strategy.
- Commensurating the feasibility, viability and desirability dimensions, design process can achieve a comprehensive picture of what a user really values in products and services, proposing new value configurations to create or innovate meaningful experiences.
- Design process and its tools emphasize innovation by collaboration, facilitation, argument and a multiplicity of views.
- Design can break through established boundaries and reconceptualize models, questioning existing assumptions, to frame things differently.

Design innovative methods are seen as a powerful toolset to deal with such wicked problems. Applied to shelter after disaster management, they can change realities at the individual, organizational or societal, and therefore strategically, helping the sector to satisfy the user desires throughout the recovery process in an integrated user experience.

Workshop approach:

This workshop proposes the change of meaning of housing in disaster management, reframing the context from the pre-disaster situation to a post-disaster situation.

In a first step, participants investigate the original context where the product (the house) is normally used. What a house is, front the user's point of view (how is it perceived), how the user interacts with it, with other people and with the environment, and why it is really necessary for the user.

Decomposing the house into the activities developed in it and analyzing the user behavior, we will try to discover the user's real desires in terms of feelings and emotions.

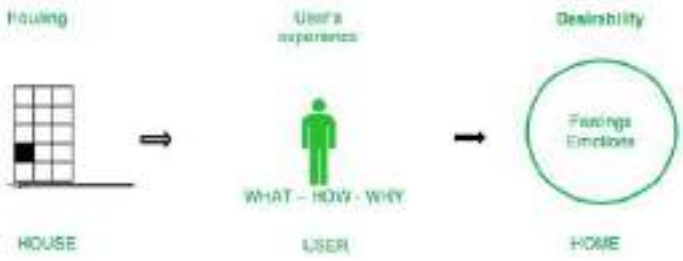

Figure 8 Stage 1; understanding the primary context

In a second step, participants try to unveil the underlying abstract values that make the user feel at home and then try to find the most important values to maintain the sense of home in a post-disaster situation (new context).

Figure 9 Stage 2; Reframing the context

In the last step, participants try to redefine, from this value conceptualization process, the meaning or purpose of temporary housing in the new context frame. Once the context has been reframed, it is possible to think about how to satisfy the user desires (not as a product, but as a service) and, therefore, define what kind of service should be provided to improve the user experience.

Figure 10 Stage 3; Redefining the mining

Takeaways for the participants:

Despite the brevity of the workshop, participants become aware of the complexity of the shelter sector in post-disaster management and realized the potential of design methods to generate innovative approaches to solve this kind of wicked problems.

Participants see how design can involve many stakeholders from different fields and with different points of view, expanding the context from which the problem arises, looking for new insights.

An interesting finding by the participants is how, taking into account the users' point of view, desirability becomes a key piece in the puzzle solution.

Another interesting finding is how feelings and emotions can be verbalized through the process of conceptualization and abstraction, so that deeper values can be uncovered, and users' true desires can be achieved.

Participants also realize that, in order to understand user behavior and discover new meanings, it is not so important what people do or how they do it, but the why of what they do.

Finally, through design-driven innovation and its powerful toolset, participants can develop their own vision of a possible alternative solution that can be proposed to people.

Figure 11 Participants acting as interpreters

Results and final reflections for consideration:

Houses shape and configuration are very different all over the world, depending on the climate, culture, local resources, the economy, the level of development, etc. The number of rooms, dimensions, windows or facilities depends on local customs. A house also hosts many functions such as resting, eating, sleeping, playing, working, protecting, cooking, caring for children, maintaining family unity or facilitating contact with family and friends. But housing context changes after a disaster and also housing requirements. To reduce the traumatic consequences of disasters other concepts come to mind more related to people's feelings and emotions and the feeling of being at home. Safety, security, love, sharing, sense of belonging or self-realization are strong desires related to why people need to establish relationships with each other and with the environment.

> *"Recovery is neither revival in economy, nor rebuilding houses. (…)*
>
> *What shape the recovery processes are relations: relations between human being and nature, relations between people, relations between ourselves and those we lost, including our ancestors, relations between our lives and local cultures and histories*."
>
> Uchiyama, 2011

In conclusion, the basic function of temporary housing should be to facilitate relations between people and between people and their environment, so that their desires can be satisfied. It should not simply be a product, but a human-centered service, capable of improving the user experience during the recovery process

This is an interesting starting point to obtain significant outputs in the definition of an innovative strategy in post-disaster shelter management

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Research Perspectives IN THE ERA OF Transformations

Establishing Design Literacy International Network

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The aims of the workshop where threefold:

a) establish an international network on Design Literacy,

b) articulate how network membership might support personal goals,

c) share information regarding how the participants might contribute into the network in terms of research expertise, funding, networks.

The workshop gathered a group of 21 international scholars who were interested in exploring the emerging area of the Design Literacy. Production and consumption are very much tight around human designed and made systems – how can citizens become aware of their vital role in shaping the world and support a better tomorrow for both people and planet? How does the uptake of design literacies evolve across diverse field of education (both universities and K12), policy development and commercial organisations?

Figure 1. Design Literacy workshop participants

A majority of the workshop participants had presented papers in the paper track 6b: Design Literacy enabling Critical Innovation Practices. Different perspectives on Design Literacy was presented during the four sessions of track 6b and proved a valuable point of departure for further discussions in the workshop. Two papers from the track were awarded TOP III at the conference: Úrsula Bravo for best student paper and Eva Lutnæs for best paper. In her paper, Lutnæs' raise the question of what it means to be design literate in a context of critical innovation and suggest the following definition:

> *Being design literate in a context of critical innovation means to be aware of both positive and negative impacts of design on people and the planet, approaching real-world problems as complex, voicing change through design processes, and judging the viability of any design ideas in terms of how they support a transition towards more sustainable ways of living (Lutnæs, 2019, p. 9)*

The definition was displayed on screen and the concept of Design Literacy debated. How is Design Literacy different from other types of literacies, such as visual literacy? Is it vital to be able to address the negative impacts of design? How could the concept be kept wide and open to evolve? What is design illiteracy? How could indicators of design literacy be developed rather than a definition?

After a plural session, the participants worked in groups and encouraged to articulate how network membership might support their personal goals, articulate research ideas and expertise. This is an important aspect as we envisage developing a proactive network that support international colleagues with diverse career paths and visions. Thus, recognising that members' context and diverse agendas will play an important part of how the Design Literacies will be taken up. Identifying the diversity provide a tipping point to succeed in the development of rich resources that can be adopted by the Design Literacy International Network members to develop specific research funding applications with a goal to produce tangible impact.

The workshop successfully established the Design Literacy International Network and a webpage for sharing information on members, papers, articles, conferences, applications, funding, grants and positions was regarded the next step. The webpage for the Design Literacy International Network will need to find its form. The address of the webpage is: www.designliteracy.net

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Research Perspectives IN THE ERA OF Transformations

Co-creating a visual thesaurus for the role of design thinking in management decision making

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Introduction and Aim:

The workshop will engage participants to co-create concept maps and a visual thesaurus associated with 'design thinking'. For design researchers, scholars and practitioners this workshop aims to expose the epistemological challenges and opportunities associated with 'design thinking' in management and leadership contexts. Concept mapping is a tool and technique that aims to enable visual thinking and knowledge organization skills. It offers a way to externalize understanding of complex topics (i.e. design thinking) in terms of both intra- and inter-personal relationships (i.e. within the management domain). A visual thesaurus displays semantic connections using pictures or images, not words. It aids in recognizing visually similar events or visual synonyms. Workshop participants will be guided through a series of visual thinking and design techniques to develop concept maps and a visual thesaurus for 'design thinking' and design-related terminologies within the management discourse. The outputs generated from the workshop will reflect a multidisciplinary understanding of the subject for knowledge translation and identify future research goals.

Outline and Format:

The 90-minute workshop will engage participants in an active design research session. The facilitators will:

- first present a set of proposed theories and practices associated with design thinking and its role within a mixed economy system (30 min);
- then present a series of design prompts and probes to critically explore and capture the participants' diverse visual and semantic views on design thinking in relation to management resulting in a series of concept maps (30 min); and,
- guide participants to co-create a visual thesaurus of 'design thinking' (30 min).

Participant Benefits:

Participants will benefit from contributing their a priori knowledge of design-related terminology, to the workshop resulting in two co-designed artefacts – a visual thesaurus and a summative concept map. They will be introduced to visual thinking techniques such as concept mapping and visual thesaurus making. Participants will receive a final graphical representation of the collective output generated from the workshop.

Workshop Relevance:

This workshop proposes both an active learning experience and action research framework, to gain a deeper understanding of design thinking's perceived meaning and value in relation to managerial decision-making. Furthermore, the artefacts (i.e. visual models) generated from this workshop aim to inspire more research on the use and value of visual models in design-based decision studies.

Figure 1 Basic Concept map https://thesweetsetup.com/wp-content/uploads/2015/04/4-basicmindmap.jpg

Figure 2 Sample Visual Thesaurus using photographic data sources https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcT50QioJS-cukiVO4I2lv2CG6SAIunpH8t99j46i7qoAgvuRXBBxQ

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