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The individuality of metrical engagement: describing the individual differences of movements in response to musical meter

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Abstract. Evidence behind theories about musical meter and rhythm is based on averages across empirical sets of data. Theory is also commonly forged from general observations of music practices. Ethnomusicology describes rhythm and dance based on patterning characterizations inside cultures. Without neglecting the value of that knowledge, so far we know very little about how individuals´ bodies respond to music. Derivation of common laws from controlled experimentation may have obfuscated the understanding of differences between individuals, their music, movements and dance. How large are these differences as expressed, and how our bodies map these idiosyncrasies are questions that still need answers. In this paper we carry out two case studies of individual involvement with music, bringing a detailed account of the peculiarities arising from their free movement responses to music. Using the state-of-the-art motion capture technologies and a set of analytical techniques we describe the participant´s metric embodied experience, and the idiosyncratic differences in their responses to music.

Keywords: movement, rhythm, meter, embodiment.

1 Introduction

Most of the evidence behind the theories about musical meter and rhythm is based on averages across empirical sets of tapping data. Tapping in synchrony with music has been and is still considered a canonical task to gather knowledge about meter encoding in music cognition, under the assumption that meter perception is related to the listener´s sensitivity and manual responses to time regularities [1]. Therefore, theoretical and/or idealized hierarchies of accented musical structures [2] can be scrutinized by means of entrainment, that is, the ability to keep time with the music [3]. Data collection of beat responses in laboratory research environments is thus assumed to account for the experience of time structure during perception [4, 5] and is intended to show the way sensorimotor synchronization with time takes place in performance [6].

However, tapping may offer a constrained rendition of metric experience. According to recent developments in cognitive science, the estimation of metric experience by means of tapping may not take into account the complexities of the whole body involvement with music. Under the umbrella of new insights in the science of mind [7, 8] authors such as Leman [9] helped to develop an embodied perspective for the study of music, namely the embodied music cognition. According to this view, engagement of the whole body in movement with music is an unavoidable component of music cognition, whose complexity requires the analysis and proper description of movement including the complexities of cultural, naturalistic, ecological and scientific settings. These complex environments of study include, for example, real musical performances and dances (see for example [10, 11]), which are considered ideal scenarios for embodied cognition research. In addition, in the last years, data collected from intelligent experimental setups using new mediation technologies became a reliable strategy to uncover relationships between movement and music (see for example [12, 13, 14]).

The fields of ethnomusicology and cognitive neuroscience have also dedicated combined efforts to describe the comparative and biological bases involved in rhythmic and dance engagement. Pulse salience is posited as a cognitive process intrinsically related to beat structure, as it appears hypothesized in music cognitive systems theory [15]. But in order to keep track with the beat or tactus (often considered the most salient metric level, present both in theories of musical meter and entrainment) the models of cognitive processing sometimes shape metric experience aligning experimental data on human movement to the temporal corset of the metrical grid. Expected regularities within and between individuals help to both build generalizations on the musical experience and to visualize the connections between musical and socio-cultural practices. Meanwhile, the anthropological perspective challenges experimental knowledge with new insights on the same matter. It has been suggested that (i) constraints of scientific procedure, (ii) the relevance of socially created significance, and (iii) methodological alternatives proposed in humanities and cultural studies should be taken into account. Geertz [16], for example, insists on the idea of approaching people as individuals, and trying to understand why they do what they do [16]. The direct implications of this viewpoint leads to better understanding on what is exact, universal, and decontextualized and what is culturally situated.

So far, the current knowledge about differences between individuals and how their individual bodies respond to music is very limited. The necessity to derive common laws from controlled experimental results may have obfuscated the importance of understanding the range of individual differences between real people in real contexts where music, movements and dance take part. How large are these individual differences, how they are expressed and how our bodies map these idiosyncrasies are questions that still need to be approached.

In this paper we look into the details of the experience of two subjects responding to music with free movements, which resulted from exploratory movements of the body with few spatial limitations and no musical or stylistic instructions. The subjects listened to Argentinian Chacarera music and their movements responses were analyzed with the aim of describing the emergent connections between movement, space and music at the individual level, from an ethnographic perspective. As such, this investigation combines the explorative and descriptive nature of ethnography with the possibilities of computational representation and movement analysis. The subjects listened to Chacarera music and were asked to “move with music”. In this context, in spite of eventual stylistic constraints and/or individual learned motor responses to music, we consider participant´s movements as free movement (without any imposed stylistic guidance or any other imposition). We capture participants´ movements using the state-of-the-art motion capture technologies associated to a set of recent analytical techniques, in order to highlight different idiosyncrasies enculturated in the embodied experience of metrical cues in music.

2 Method

2.1 Stimulus

2.1.1 General description of Chacarera music. Chacarera music is, along with *zamba*, *milonga*, *malambo*, and of course *tango*, one of the most representative rhythms of Argentina. Although it does not have a fixed instrumentation, instruments most frequently reported are Spanish guitar, *bombo* (a kind of percussion instrument like a drum made of wood and leather), violin and voice. The accompaniment texture is generally performed by guitar and *bombo*. In the stimulus used in this study, instrumentation consists only of a *bombo* percussion and clapping hands. The *bombo* percussion is distinguished by two timbres: sounds produced by hitting the wood ring and sounds produced by hitting on the leather patch, both with sticks. Thus, the rhythmic structure of Chacarera is the result of the combination of sharp sounds matching the ring hits and marking the ternary meter (6/8), and low sounds matching the patch hits and marking the binary meter (3/4) that overlap. The hands clap a quarter-eighth note pattern.

Chacarera music exhibits clear Western metrical features, such as a steady beat (tactus); however, the rhythm basis forms a polymetric structure of crossed binary and ternary meters (6/8-3/4) (see an abstract scheme in Figure 1). Timbral differences account for the crossing meters: sharp sounds correspond to 6/8, while low sounds correspond to the second and third time of 3/4. They are relevant in communicating the typical sound of Chacarera [17].

2.1.2 Description of the stimulus The stimulus used in the present study is a 60 seconds length acoustic audio fragment [18]. In this excerpt, the musical phrases are organized in periods of 2 bars (4 ternary beats / 6 binary beats) (see Table 1), played at 158 BPM (6/8) or 105 BPM (3/4).

The instrumental arrangement is set according to the typical Chacarera genre (see 2.1.1 above).

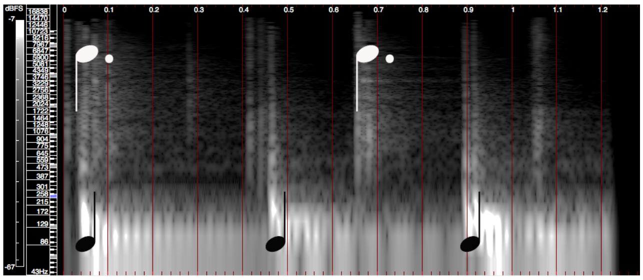


Fig. 1. Spectrogram analysis and overlapping music notation of a bar extracted from the rhythmic base of *Chacarera* used in the study. The two lines overlapped show the 6/8-3/4 textural pattern of the crossing meter. Ternary beats appear on top and binary beats on bottom, respectively. (X axis= Seconds; Y axis= Hertz; Grey shadows=Decibels)

12/8 cues	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3
3/4 cues	1.1a	1.2a	2.1a	2.2a	3.1a	3.2a	1.1b	1.2b	2.1b	2.2b	3.1b	3.2b
	1st bar						2nd bar					

Table 1. Equivalences between metrical segments for 12/8 and 3/4 in *Chacarera*. As to interpretation of data analysis, one of the two metric grids will be used to present results in the way that is most convenient.

2.2 Participants

Two participants (1 Brazilian [P1] and 1 Argentine [P2]) were selected for 2-case studies, out of a dataset of 12 participants recorded in Brazil and Argentina (for a full description of the main cross-cultural study see Naveda *et al*. in this symposium). Although the analysis of the subject's movements make use of scientific and computational approaches, the study itself does not intend to present a classical statistical inference that traces statistical generalizations from the data collected. Instead, both subjects were chosen as a purposive sample, selected to illustrate the largest range of socio-cultural differences across subjects familiar with the Chacarera music. Despite their belongingness to two different cultural environments, both subjects reported, nevertheless, familiarity with Chacarera music. The motion pattern of both participants showed consistency in their metrical adjustment while deploying different morphologies of movement.

2.3 Apparatus

The movements of the participants were recorded using a motion capture system (OptiTrack) composed of 6 infrared cameras and a control system (PC). Before the experiment, 4 rigid-body groups of markers were placed at the torso (4 markers), head (4 markers), left (4 markers) and right (4 markers) hands of the participants, totalizing 16 markers. The participants were asked to move freely, remaining within the boundaries of the motion capture area (signalized on the ground). The stimulus was played through one speaker connected to a sound card and a computer. The stimulus was synchronized with video and mocap recordings by means of sync markers in the audio, mocap and video. Video recordings were realized only for reference purposes.

Pre-processing of mocap files involved the preparation for synchronization, basic filtering and cleaning using the software Motive (Natural Point). Further processing, normalization and feature calculation were realized using algorithms and tools from Mocap Toolbox [19] and Samba toolbox [20] for Matlab (Mathworks).

2.4 Procedure

The participants performed two tasks that involved responses to the musical stimulus. In the first task they were required to try free and spontaneous movements in response to the music they heard. As mentioned before, the indication of “free” or “spontaneous” responses is taken as a broad generalization that indicates responses that are not strongly limited by over-specification of tasks (e.g.: tapping to the beat) or measuring techniques (e.g.: pressing a key). However, we acknowledge elsewhere the relevant physical and psychological limitations that the experimental setup imposes to the subjects. So far, no other orientation, limitation or task was given and both participants were free to move around the motion capture area.

In the second task the participants were asked to choose the best movement strategy experimented in the first task, and to continuously perform it until the end of the musical stimulus. This procedure has the effect to increase the number of observations and help to build a profile of tendencies and variabilities of the participants’ performance. Although the second task involves less freedom it may be evident the attempt to use the experimental design as a way to select representative samples across open strategies. All the tasks were performed individually.

2.5 Movement analysis

Movement analyses were applied to the results of the second task. The analyses aim at describing cross-modal relationships between metrical cues of the musical stimuli and free movement responses. But how these relationships unfold across the series of movement profiles?

We opted to look at three available approaches that reveal emergent connections between music and movement descriptors: the movement velocities across metrical structure, the changes of gesture directions across metrical structure and the metrical structure across gesture space. All theses approaches have the advantage to clearly represent variability and flexibility of free movements and are able to support correlations between modalities (movement and music). The option to approach cross-modal relationships is rooted in the assumptions that (i) movement and music share metrical properties, and (ii) that each individual enacts an idiosyncratic configuration of relations between movement and sounds. Descriptors are only computed for hand-related movements in this study. The analyses offer two forms of data visualizations of the cross-modal relationships: (1) the visualization of musical information represented in the structure of movement trajectories; and (2) the visualization of movement information in the (metrical) structure of music. In what follows, a brief description of the analytical techniques employed is provided:

1. *Movement information represented in musical structure:*

(i) **Level of Accumulative Velocity (LAV)** [21] - This analysis provides an account of the accumulated velocity in every metric level The approach takes into account the relationship between energy and the dynamics of the instantaneous velocity. The profile of accumulative velocities is represented as a box-plot for every structure of the musical meter, which is correlated to the velocity by means of annotation of stimuli and, naturally, synchronization mark between recorded movement and stimuli. As such, the visualization uses movement descriptors projected onto the representation of musical structure.

(ii) **Density of Directional Change (DDC)** [21] - The approach collects changes of directions organized across coordinates after PCA analysis. The PCA has the practical effect to rotate orientation system to the best “viewpoint” of the movement trajectories. Application of PCA process involves a linear transformation of the three-dimensional vectors into components that best explain the variance in the movement trajectories, whose orthogonal components are aligned to the overall “shape” of the trajectories. The identification of changes of direction in each component uses zero-crossing detection, applied to the component ´s velocity, which reveals the time locations of changes of directions. The time locations are normalized to each cycle of the metrical segment (e.g: every first beat is considered as time 0), which allows to represent a distribution in the form of a histogram across the metric levels annotated in the stimulus. Again, the visualization uses movement descriptors projected onto the representation of musical structure.

2. *Musical information represented in movement structure:*

(iii) **Topological Gesture Analysis (TGA)** [12] - In this approach the representation follows the inverse path. The classes of metric levels annotated across time points in the stimuli are projected onto the 3D representation of movement trajectories. The accumulation of these classes represented by points in space create “point-clouds”. The analysis of these point-cloud relationships in the space makes possible to visualize the regions around the body where music properties accumulate over time. Therefore, in TGA representations the music structure is represented across the spatial structure of the subject's movement.

These methods are not used in this study to assess statistical validity or generalizations for an universe of study larger than the participants. Instead, they help to uncover how music properties are encoded in the space (topology) and form (morphology) of the participants movements. In this perspective we explore the range of differences often hidden in traditional statistical inferences over groups of subjects. We borrow from computer science and systematic musicology the possibilities of analyses and visualizations that are used to drive observations in cultural studies and ethnography. In what follows, the analyses are applied to two case studies, involving detailed account of each participant´s movement responses to the properties of Chacarera music.

3 Case Studies

3.1 Case 1.

Case 1 is a 27 year-old Brazilian male that works as a DJ and dance teacher. He is a dancer and reported being familiar with Chacarera music. His experience as dance teacher provided a close contact with traditional Argentinian dance styles including Tango. Most of his professional experiences with music and dance are connected with Afro-Brazilian styles and ballroom dances.

Participant 1 has responded to the music using a large, symmetrical movement of both arms, which involved a mirrored use of right and left hand [23]. Therefore, for the sake of simplicity, only the results for the right hand will be presented here.

3.1.1 Level of Accumulative Velocity (LAV). The results displayed in Fig. 2 show two contrasting velocity patterns. Segment 1 starts at 3.2b (before the downbeat at 1.1a), and ends at 3.2a; segment 2 starts at 1.1b, keeps pace at low velocity, and ends at 3.1b. From there on, the pattern re-initiates and repeats similarly 12 times, until the end of the sequence (Fig. 2). Segment 1 shows an increased/decreased organization that may be best interpreted as responding to a binary division of the metric structure (3.2b-1.1a; 1.2a-2.1a; 2.2a-3.1a; 3.2a/1.1b). Inference from this analysis suggests that the participant organizes his hands movements synchronizing with a 3/4 meter.

3.1.2 Topological Gesture Analysis (TGA). Figure 3 shows the classes of metrical cues (represented as different colors) projected onto the trajectories of both hands. The use of the Euclidean space as a visualization of metrical levels (introduced in [12]) shows how the subject qualifies certain regions in space to be synchronized with certain metric levels. For repetitive movements the point-clouds formed by metric cues are also able to reveal patterns of variability and consistency.

The organization of color point-cloud sets and trajectories (Fig. 3) complements the results of LVA analysis (Fig. 2) by illustrating the distribution and shape of metrical properties in the space. The participant produces a "L" shape gesture on both hands [23]; the extremes are populated by 1st and 3rd binary beat cues. The space in between is populated by the remaining beat levels without clear organization. Since 1st and 2nd beats occupy different regions in space, the topology of the music-gesture corroborates the emergent 3/4 metrical structure visible in the previous results (LAV, Fig. 2).

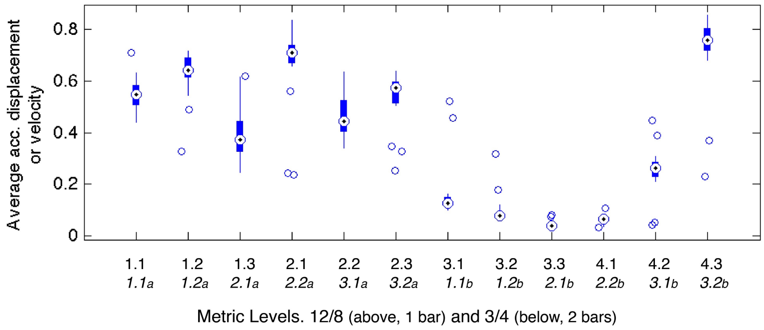
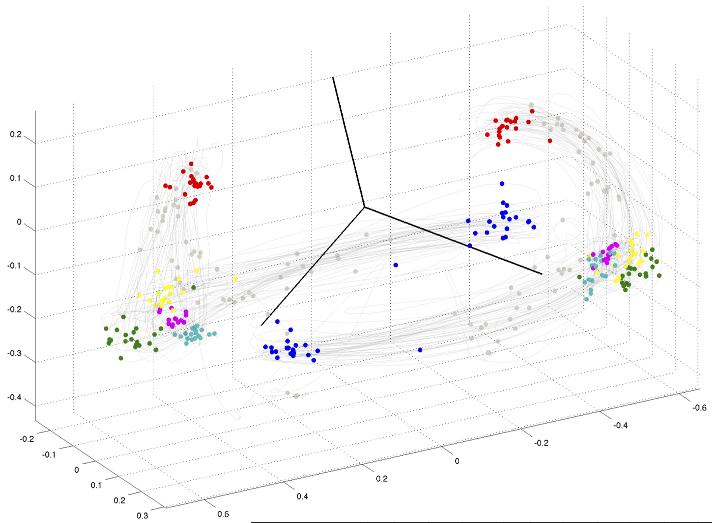


Fig. 2. Levels of accumulated velocity for participant 1 (Brazilian), right hand. Stimulus: Chacarera music (N=12).



12/8 Cues 1 Bar	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3
3/4 Cues 2 Bars	1.1a	1.2a	2.1a	2.2a	3.1a	3.2a	1.1b	1.2b	2.1b	2.2b	3.1b	3.2b
Color Cues - S5	blue		green		red		cyan		magenta		yellow	

Fig. 3. Point-cloud representation in the 3-dimensional space showing the trajectories (after normalization) of participant 1 (right hand), with metrical categories projected on it.

3.1.3 Density of Directional Change (DDC). Figure 4 displays the histograms of changes of direction distributed in time, or metrical time, during the stimulus. The first 3 graphs show the changes of direction on each component, which means the changes in each of the 3 orthogonal directions in a 3D space. Note that the first component accounts for 83% of the total variance and the second component 14%. In other words, the longer component of the "L" shape of the trajectories spreads over a region that is more than 4 times the size of the shorter component of the "L" shape. Consequently, changes in this component might be interpreted as more relevant than the others. The profile of the peaks in the histogram of the first component (chart 1 of Fig. 4) shows peaks at 1.1, 1.3 and 2.2. Note that peaks are slightly anticipated, including the preparation for 1.1 position (located at the rightmost border of the chart). We expected to find a peak at 3.1, but in that location, events appear distributed across a flexible time region, denoting lack of consistency between metric levels and changes of direction . This trend contrasts with 1.3 and 2.2 positions, where a higher event density is observed, conveying participant´s precision and synchrony along the pattern recurrences.

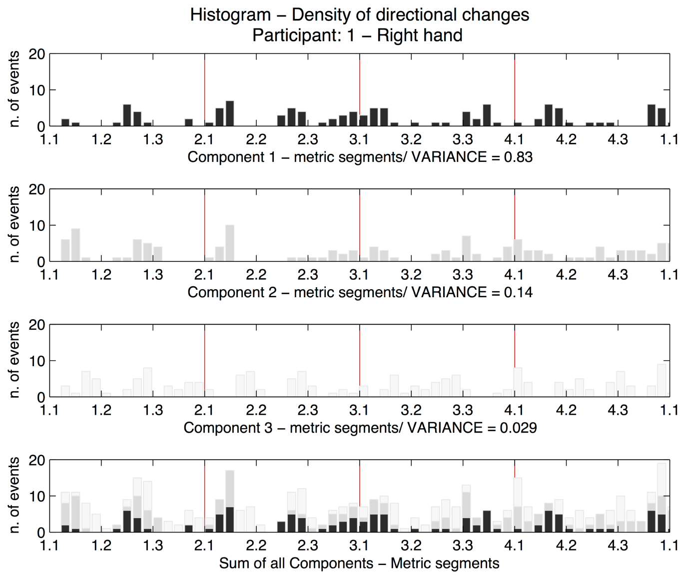


Fig. 4. Density of directional events across 1 bar of chacarera (12/8), for participant 1. The shades of gray indicate the proportion of events associated with each PCA components. (Graphs 1 to 3 shows isolated PCA components; Graph 4 shows the sum of components).

Previous analyses showed that the second 3/4 bar (3.1-4.3) registers very low profiles of accumulated velocity (Figure 2). This means that the participant rests his hands during 1 bar, which explains the cues concentrated in one region. While the hands are resting, any sort of accidental or intentional movement of the trunk and hands will generate changes of direction, resulting in changes that are likely to be unintentional. In this specific case, points will spread randomly along the "resting" time positions.

3.2 - Case 2

Case 2 is a 50 year-old Argentinian female. She is a pianist, reports high familiarity with Chacarera and frequently plays and dance this music. She also informs competence playing the bombo (see 2.3 above).

Participant 2 has responded to the music using an asymmetrical movement of both arms, which involved an opposite use of right and left hand. Therefore, the results for both the right and the left hand will be presented here.

3.2.1 Level of Accumulative Velocity (LAV).

Left Hand. The results displayed in Fig. 5 show repetition of the velocity pattern every 3/4 bar. 1.1a and 1.1.b (1st binary beats) show the lowest velocities, while 3.1a and 3.1b (3rd binary beats) show the highest ones. 1.2a, 2.1a and 2.2a are also high, probably due to sharpness of the performance gesture. 3.2b shows low velocity, probably due to lack of activity at 1.1a.

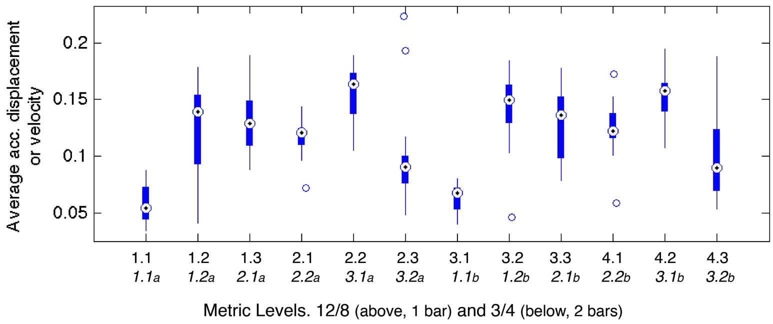


Fig. 5. Levels of cumulative velocity for participant 2 (Argentinian), left hand. Stimulus: chacarera music (N=12).

In sum, the left hand velocity pattern seems to synchronize with the sonic performance of the *bombo* (see Fig 1), where 1st beat is muted and 2nd and 3rd beats are articulated in percussion. An alternative interpretation might be to consider 3.1b as the beginning of the velocity pattern. According to this interpretation, the velocity pattern encompasses four groupings, each containing three descendant metric units (3.2b, 1.1a, 1.2a, etc.), in agreement with a ternary organization of the velocity pattern. Subsequent observation of the video recording [24] prompted the first interpretation. However, it is interesting to emphasize that, somehow, the polyrhythmic cues of Chacarera metric profile emerge from the velocity profile.

Right Hand. The results displayed in Fig. 6 also show repetition of the velocity pattern every 3/4 bar. Segment 1 starts at 1.1, and ends at 2.3; segment 2 starts at 3.1 and ends at 4.3. At 1.1 and 3.1, high velocity levels are consistent with a percussion trill gesture that was observed in the video recording [24]. High velocities at 2.2 and 4.2 reveal coincidence with the typical energetic accent of bombo percussion that occurs at every 3rd beat of 3/4 meter.

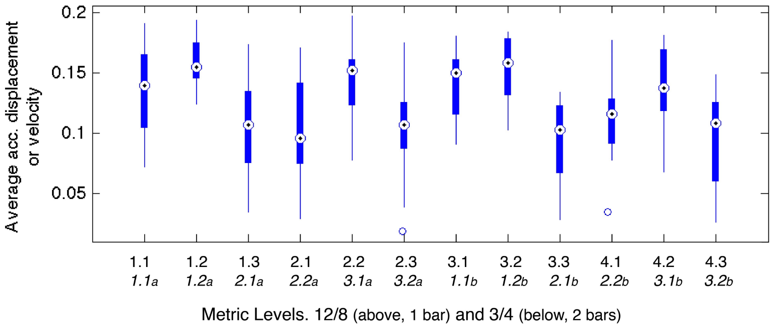


Fig. 6. Levels of cumulative velocity for participant 2 (Argentinian), right hand. Stimulus: chacarera music (N=12).

3.2.2 Topological Gesture Analysis (TGA)

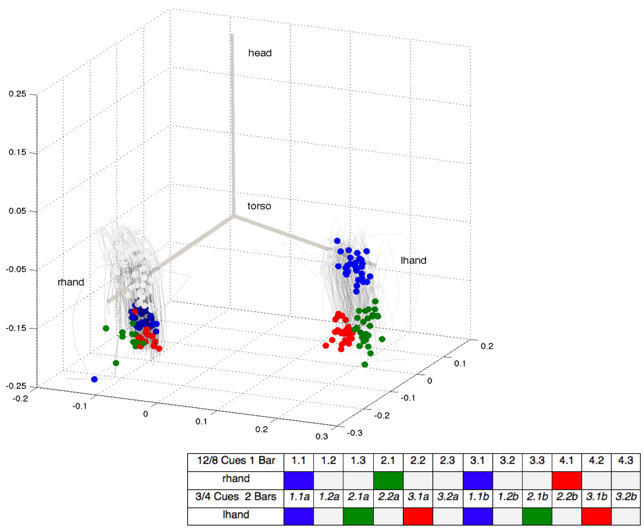


Fig. 7. Point Cloud Representation in the 3-dimensional space showing the trajectories (after normalization) of participant 2, with metrical categories projected on it.

Right and left hand. Figure 7 shows the classes of metrical cues projected onto the trajectories of both hands (see 3.1.2). The organization of color point-cloud sets and hand trajectories complements the results of previous analysis (Fig. 5 and Fig. 6) and video recording observation [24] by illustrating the distribution and shape of metrical properties in the space. The participant produces a line-like gesture on both hands. Based on previous analysis, we adopted two color-cue visualization criteria according to the point-cloud hand-related metric engagement, as follows: i) left hand: 3/4 binary organization; and ii) right hand: 6/8 ternary organization.

Left hand: the upward extreme is populated by 1st binary beat cues, while the downward extreme is populated by 2nd and 3rd binary beat cues.

Right hand: the downward extreme is populated by 1st and 2nd ternary beats.

Therefore, the topology of metrical cues in space provides a consistent visualization of the emergent 3/4 metrical cues in the left hand and the 6/8 metrical cues in the right hand.

3.2.3 Density of Directional Changes (DDC)

Right hand. Figure 8 displays the histograms of changes of direction distributed in time, or metrical time, during the stimulus. The first 3 graphs show the changes of direction on each component, which means the changes in each of the 3 orthogonal directions in a 3D space. Note that the first component accounts for the 88% of the total variance and the second component 0,079%, defining the linear shape of the morphology.

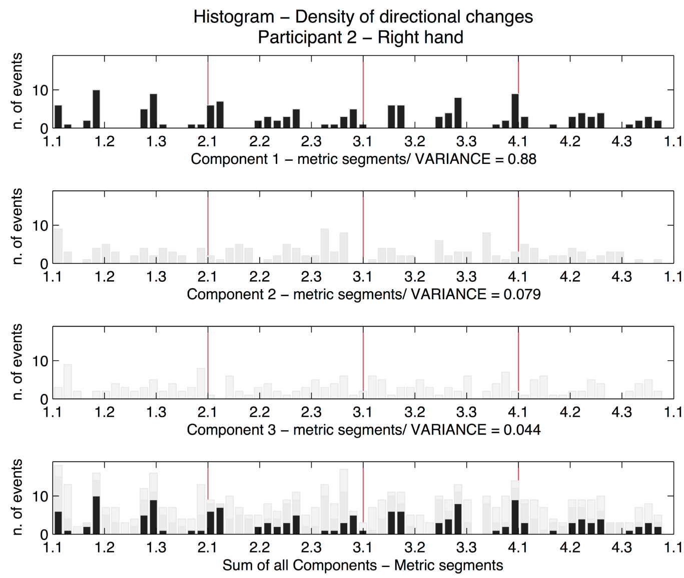


Fig. 8. Density of directional events across 1 bar of chacarera (12/8), for participant 2 (right hand).

The peaks profile in the histogram (chart 1 of Fig. 8) shows activity at every eighth-note. On the one hand, higher event´s synchronization is observed at segments [1.1, 1.2, 1.3] and [3.2, 3.3, 4.1]. On the other hand, lowest event´s synchronizations is observed at [2.2, 2.3, 3.1] and [4.2, 4.3, 4.1]. Second component analysis suggests some kind of reinforcement at 1.1, 3.1 and 4.1. In sum, the peaks profile shows a main synchronization at the metric level of ternary beats.

Left Hand. Figure 9 displays the histograms of changes of direction distributed in time, or metrical time, during the stimulus. The first component accounts for the 72% of the total variance and the second component accounts for the 20%, defining also a linear shape in the morphology of movement.

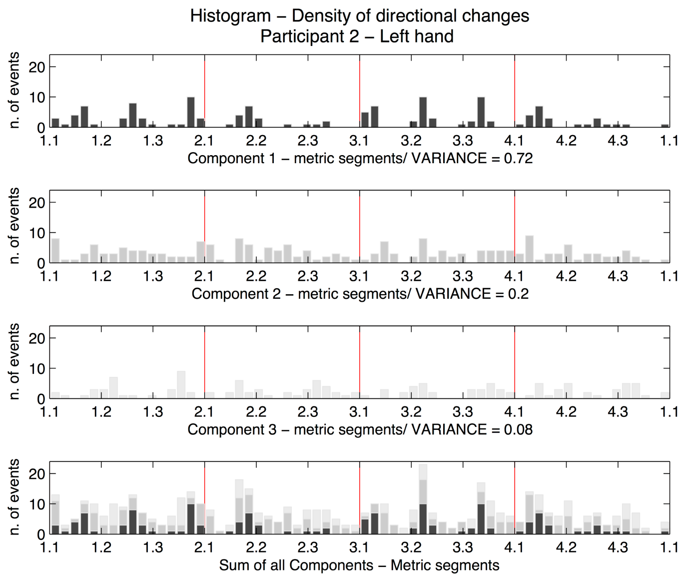


Fig. 9. Density of directional events across 1 bar of chacarera (12/8), for participant 2 (left hand).

The peaks profile in the histogram (chart 1 of Fig. 9) shows activity at 1.2, 1.3, 2.1 and 2.2. Also similar activity is verified at 3.2, 3.3, 4.1, 4.2. Following results of TGA analysis, these peaks in the histogram are correlated to the ascendent/descendent trajectory that characterizes the left hand movement.

Taking into account the various analyses that were realized, we interpret the left hand motion as an accented pattern that articulates on the 2nd and 3rd beats of the 3/4 binary meter. Two features characterize this pattern: a *metric* feature related to the articulation of the binary beat, and a *movement* feature that involves the changes of direction (ascendent/ descendent).

Another feature comes from the analysis of the second component in the histogram, and is inferred from the focus on peaks at 2.2 and 4.2. Somehow those peaks can be related to the intention of emphasizing the 3rd beat in the binary meter, in agreement with stylistic peculiarities of Chacarera music.

4 Discussion

Three analytical strategies have been applied to the study of the idiosyncratic elements of individual responses to music. Instead of looking at ill-defined generalizations we opted to investigate the extent of the individual differences, as a way to understand how and if generalizations can be traced in a larger universe of study. The interest was placed on two cases of study involving two musicians (one Argentinian and one Brazilian) who were asked to respond to music with free spontaneous movements.

Our analytical approach employed the state-of-the-art motion capture technologies. The accomplished analyses face, on the one hand, a number of challenges and, at the same time, offer a window of inquiry that helps to look further into the peculiarities and idiosyncrasies of the individual experience of music and dance within culture. The analysis of all kinetic and kinematic variables that define topological and morphological features of movement, requires careful attention to the translations between modalities and components involved.

The reported results inform about:

1. Inference of the polyrhythmic structure of Chacarera music, emerging from the kinetic configuration of velocity patterns in both hands (P2)
2. Organization of accented structures, based on the increment and/or decrement of energy (P1)
3. Establishment of the interrelation of dimensional components (PCA components) in the articulation of metric stress (P2)

Each participant belongs to a different cultural environment, however they reported familiarity with Chacarera music. Familiarity of the Brazilian participant is evidenced in the participant´s entrainment to the beat. The movement profile emergent from DDC analysis of P1 is hidden (not evident) in the movement profile of the Brazilian dataset of the global cross-cultural experiment [21] out of which P1 data was taken.

The morphology of movement conveyed by the Argentinian participant reveals a metrical complexity that is typical in Chacarera music; such complexity was not evidenced by the Brazilian participant. This particular stylistic feature is related to the combination of binary and ternary metric organization in the temporal structure of the rhythmic fragment. It seems that in the process of enculturation, familiarity is a necessary but not sufficient condition to account for the complexity embodied in gestural action-oriented ontology of stylistic communication. Gesture seemed more related to communication of other structural and/or stylistic components rather than just to a precise synchronization to the beat.

Therefore, accomplishment of case studies is, together with other inquires in the field of systematic musicology, a useful tool to gain further knowledge on the embodied cultural practice of meaning in music.

Application of these strategies, to the extent that they represent third person analytical tools, is useful to tackle the challenge of understanding the non-propositional embodied meanings that can be combined with methodological perspectives of first and second person descriptions, in order to reach a more comprehensive account of human experience of movement in music.

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