I Commentaries

1.

"Just as the 20th century made musical timbre a priority value in the construction process of a work, displacing even in hierarchy the fixed orders of pitch and rhythm, the following years will arrive at an explanation of the importance of the acoustic dimension of space, and temporal notions derived from it’s utilization in the artistic areas and scientific-technological linked disciplines ". Oscar Edelstein, 1980.

2.

What we call musical space is the perceptive consequence of the overlaying that the notions of pitch, rhythm, timbre, dynamics, density, and so on, have as a common factor acting on a field delimited by distances and times.

3.

The acoustic space can be considered as a new generator of structures, forms and musical discourses that actualizes notions and parameters, which since Monteverdi or the acoustic devices used by the Venetian masters - and up to the orchestral space in three dimensions raised by Stockhausen, keeps intact its capacity of dialogue with the scientific thought of the era. The musical art that is able to anticipate using this first option - usually experimental - can be shared with science.

The areas of study and the fields of application of the artistic - musical knowledge derived from these concepts and proto-theories will develop in the future to a point not easy to conjecture. Also it is probable that timbre, the acoustic space (with its respective dimensions and parameters), and the time dimension (considered as a informing totality) shapes a new network of technologies, procedures and cognitive mechanisms, and that these could be written with a new and relatively simple symbolism. (The three-dimensional notation)

II The Acoustic Theater:

The Positional and The Abstract (Oscar Edelstein)

I lay out two large fields to construct – I could also say imagine, think, name and code - the musical space; the Positional or Theatrical (bound to fixed sources of emission and the experience of the scene), and the Abstract (considered as the result of the design of movement between diverse sources, and the generation of textures, structures and speech in the created environment).

The positional field takes into account the musical tradition of the West, with its different fixed elements, and also the possible measurements of distance generated between fixed, semi-fixed and mobile sources.

To shape a universe of sound represented from the point of view of the imaginary, it is necessary to rely on fixed sources

that permit the measuring of limits in the created environment,
and to perceptively evaluate the different movements or actions between the fixed points.

Transference, modulations, or displacements must be measured with the rigour of a scale, taking into consideration the physically real distances, the spectral type of displacement, and the resultant curves of intensity, but above all, relying on a mechanism that regularizes at the level of the symbolic system, the totality of the elements in play and the boundary where they develop.

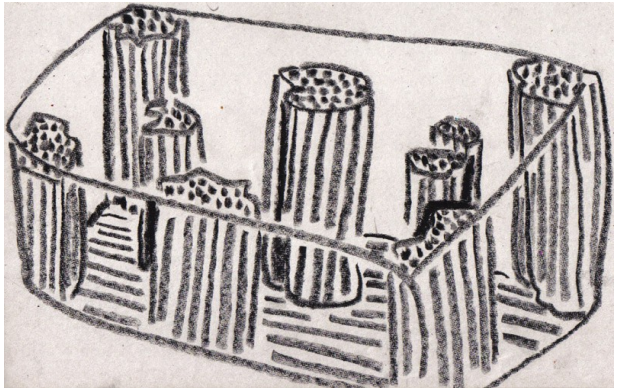
The Abstract system – because it belongs to the universe of sound images more complete and expressed in multiple types of distances – involves the measurement of concrete intervals situated in a physical plane (real) that must incorporate the perception and valuation of interdependent magnitudes of the evocative or metaphorical power that makes possible the imaginary and symbolic function.

The Abstract field is seemingly more intricate and first requires the dominion of the positional order. Also the second level (abstract) retains strict syntactic correspondence with the positional order and implicates rules of signification that interpenetrates the first.

Both systems, the positional and the abstract, almost always occur in connection. Their division is only operative because the first stage permits the comprehension and the application of the second.

Without symbolic representation and perceptive evaluation of distances - including those that we call metaphorical - the space is an empty function without musical content.

The Acoustic Theatre uses distinct variations of scales, or restricted intervals, to define the constructive processes and the study of the different grades of signification that they imply.



Law One: Without fixed sources of reference there is no space in the constructive sense.

Law Two: All distances can be considered as an interval and from there adapted to a Scale that interprets the different fields: Real, Imaginary, and Symbolic.

III Dialog between Oscar Edelstein and Manuel Eguia

- It is a matter then of seeing if it is possible to crystallize the idea of the fixed and mobile sources of the Acoustic Theatre by means of some physical appliance that allows play with the different intervallic scales, spatial, timbrical and time based. OE

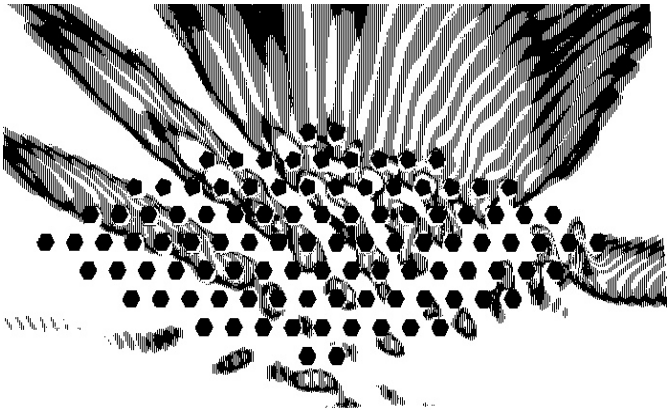
- Yes, the ideal thing would be to find the way of controlling the positioning and displacements of sources to which you refer using purely acoustic means. Working on the emitters and the room acoustics it is possible to generate a sound environment much more life like than across systems of distributed speakers. ME

- Will it be possible to design a kind of lens or sound projector that permits the generation of displacements and solves every problem of movement separately?

- It occurs to me that first we ought to test what are the reaches of a system of diffractors in a room. The room itself is responsible for creating the field of perceptive representation in a very robust form. I do not know how much we can alter this by means of purely reflective or refractive appliances.
- But if we make each of these diffractors or lenses sound separately, like one more fixed source, I believe that we can generate a field of reflections and diffractions that can turn out to be musically disquieting.

- It's true, in addition, that we are working with a new kind of acoustic material, and we do not know exactly which type of

representation that it will evoke. We can recognize the resonator of an instrument or room, the multiple reflections of a staircase or series of columns, but we do not know the effect that can be produced in a listener, by a system of multiple diffractions such as this one.



- If an echo disconcerts us, or a nearby reflection, what is reasonable to expect from an appliance that multiplies these effects around the whole room? I believe that we might even test displacements in different intervals, not only spatial, but we could also say, timbrical and, why not, symbolic?

-There is another topic on which I would like to comment. It examines the relationship between the different intervals: spatial, timbrical, temporal and dynamic and their eventual code or three-dimensional notation.

- Interestingly, displacements in one dimension produce suitable re-arrangements in others - as you said, certain musical intervals provoke apparent spatial displacements ...

- And even temporal, from the symbolic point of view ...

- They are totally overlapping. But I do not imagine how this can be represented; at least I do not yet see how we can enter the physical space in the score.

- For the control of the space, I approach it by imagining that I am inside a stratified grid where every interval, timbre and intensity is marked close to the distances that they potentially cross. Then, I design a system of notation in the form of a grid...something more or less like this... (See figure)

-Here, does time run towards the right?

- Yes, and in the vertical dimension I incorporate distances and displacements in the scene. But I can make the time run downwards and represent the totality of the movement vertically...

- And I suppose that the colours represent the musical intervals and the timbrical shades?

- Yes, a unified system of notation still does not exist, but I believe that at some point it is possible to formalize it.

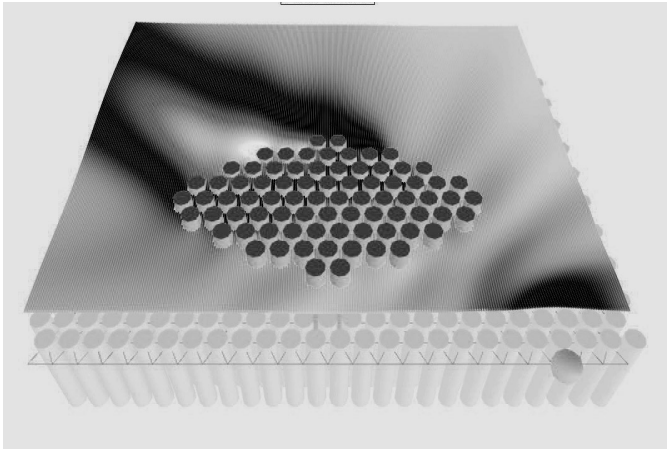
IV Acousmonium (Manuel Eguia)

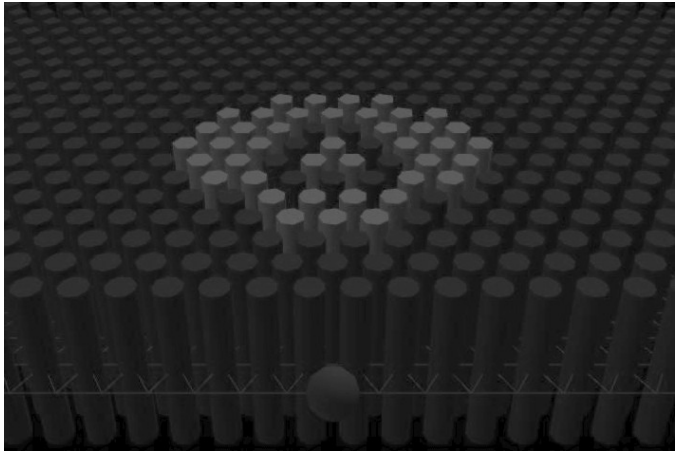
For historical reasons, the term acousmonium refers to an “orchestra of loudspeakers”, upon which one can design trajectories and displacements of sound objects and shape a three-dimensional sound space by purely electronic means. Our acousmonium, in turn, is based on exploiting spatial inhomogeneities and the controlled treatment of diffraction in order to re-create a full three-dimensional sound space in a similar way to which the subjective sound space is built.

Hence, this project develops in an opposite direction to traditional treatments of room sound. While these last ones look for the greater space, spectral homogeneity and a precise control of the room, our project intends to multiply the possible sources of echoes and spatial inhomogeneities, adding them like a new real-time parameter of control in the music performance.

V Sonic Crystals

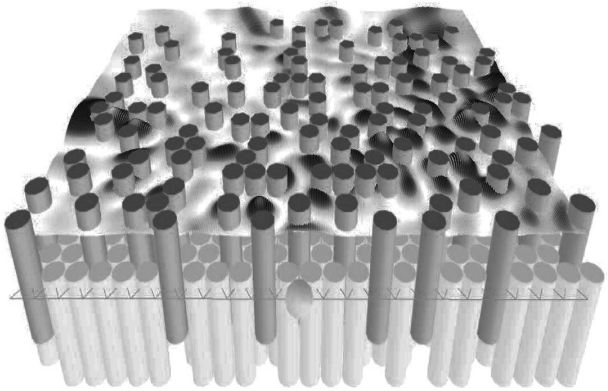
Sonic Crystals are systems made of multiple diffractors, regularly ordered, as in a crystal. Instead of atoms or molecules, we have rigid cylinders with high acoustical impedance and sized large enough to scatter sound waves in the audible range.





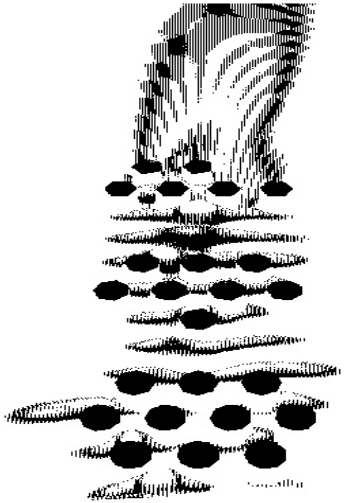
A typical crystal can occupy about three cubical meters and employ several tens of tubes. The crystalline array is usually hexagonal and can include vacancies,

defects and inhomogeneities in the arrangement or diameter of the cylinders.



If a disordered array is used instead, we have a Sonic Glass, and with a slow modulation in the lattice parameter we obtain a

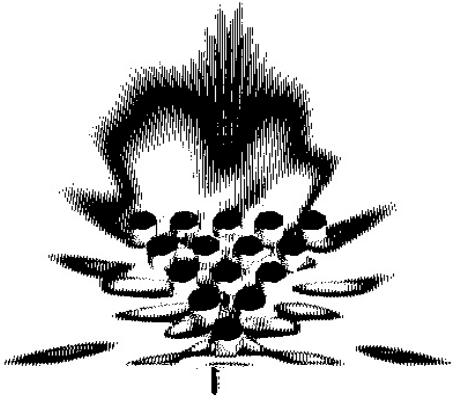
Sonic Quasicrystal.

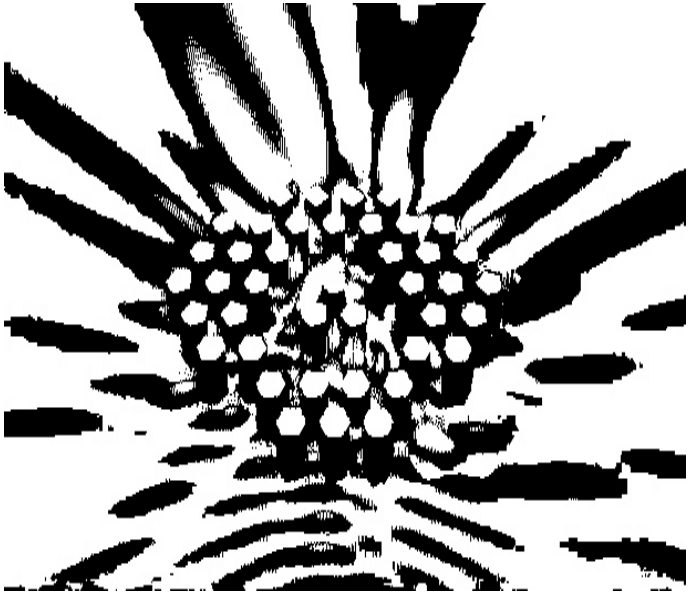


By means of the controlled use of these acoustic devices it is possible to construct sonic lenses, highly selective acoustical filters, narrowband wave guides and reflectors.

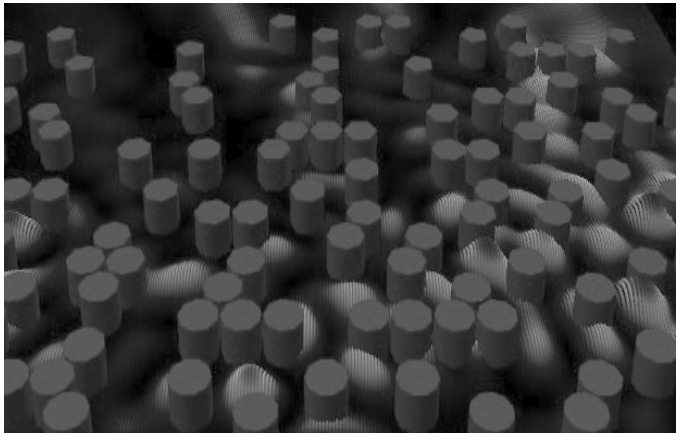
Special purpose sonic crystals of rigid cylinders of different sizes and complex geometries are designed via genetic algorithms. Their free-field acoustic field can be calculated exactly using scattering theory and its actual sound quality in real environments simulated by specialized

software. Once the desired acoustic field is obtained, a sonic crystal slab can be constructed and tested with relative ease.





Starting from each one of these sonic “cells” we intend to construct a first prototype of Acousmonium, or sonic crystal – room. By completely covering walls and ceilings of an auditorium with cylinder diffractors, for example, it is possible in principle to get rid of some volumetric and surface attributes of the enclosure, and to immerse the audience in a complex but highly controlled acoustic environment, similar to that occurring inside a sonic crystal.



By means of this apparatus it is also possible to create “grains” of sound of size comparable to the interaural distance, which allows creating unique sound images for each listener.

VI Afterword

"Leibnitz's profound originality," Couturat says in his Logique,
"consisted of representations for appropriate signs, notions and operations for which, till then, notation did not exist." It could also have been said that a sign is more useful when nearby it is the thing represented.
If, as suggested in Couturat and in other diverse arguments, Leibnitz's "characteristic" stamp comes as a whole from the theatrical traditions of the memory, then it is possible to deduce that when it translates to the mathematical symbolism, this - the search of the image of the things - gives as a result the discovery of new and better mathematical notations, which make possible new kinds of conjectures.