HEAR THE STARS

AN ACOUSMETRIC JOURNEY ACROSS THE CONSTELLATIONS

by Francesco Rampichini

THE PROJECT

What is

A journey across Zodiacal (and other) constellations, their myth, prejudice and reality, that involve astronomy, poetry and music, through **Acousmetry®**, a new language that allow to translate in sounds the constellations maps, in a kind of "auditory sheet".

Innovative aspects

Hear the stars conjugates the intents of a definitely new enterprise, addressed to the large public, which includes **blind people**, whom we want to say:

the light is sound, listen to it.

Thus offers a new, original and sensible way for the knowledge of constellations, that send us their light radiation after travelling immense distances.

Since the speed of light in vacuum is approximately 300,000 km/sec., the Moon we see, at an average distance of 376,000 km, is of 1 second ago, the Sun of approximately 8 minutes before, and Proxima Centauri, the closer star after the Sun, is already 4 years ago (40,000 billion km).

The Hubble telescope has photographed galaxies whose signal has started 8 billion years ago: for this, looking at the sky, we penetrate not only the space, but also the time.

Implementation

The narrating voice introduces the acousmetric code and lead the exploration of the constellations, transformed into sounds and animated (fig. 3), in an alternation of poetic melodrama on original texts ("*Well known Stars and new*").

Program Interface

A special section is dedicated to approach the acousmetric code, and to create an acoustic image of the spherical space.

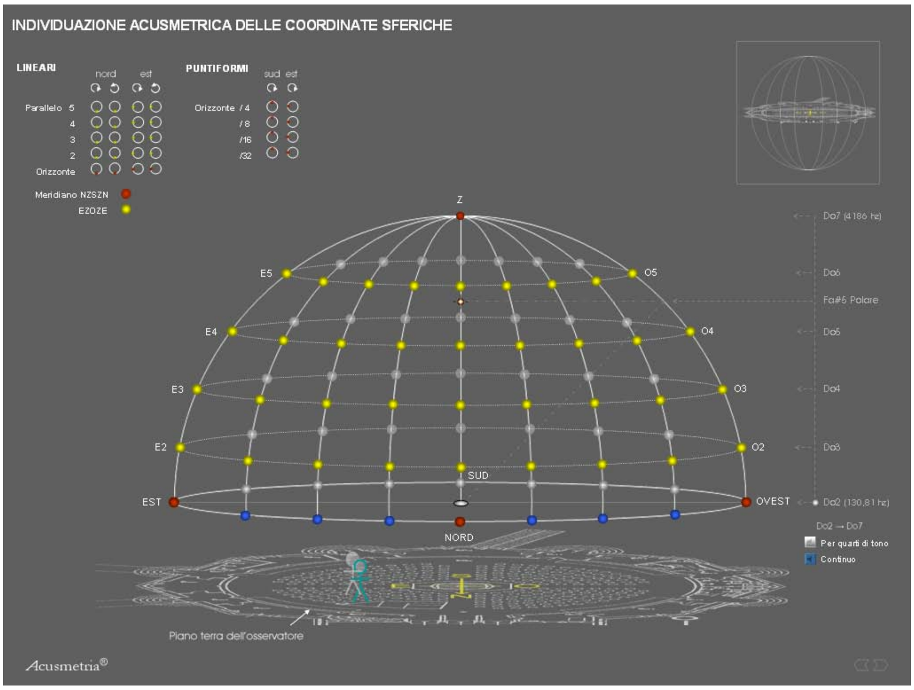


Fig. 1 - Acousmetric spherical coordinates window.

From the home page we can start the constellations tour.

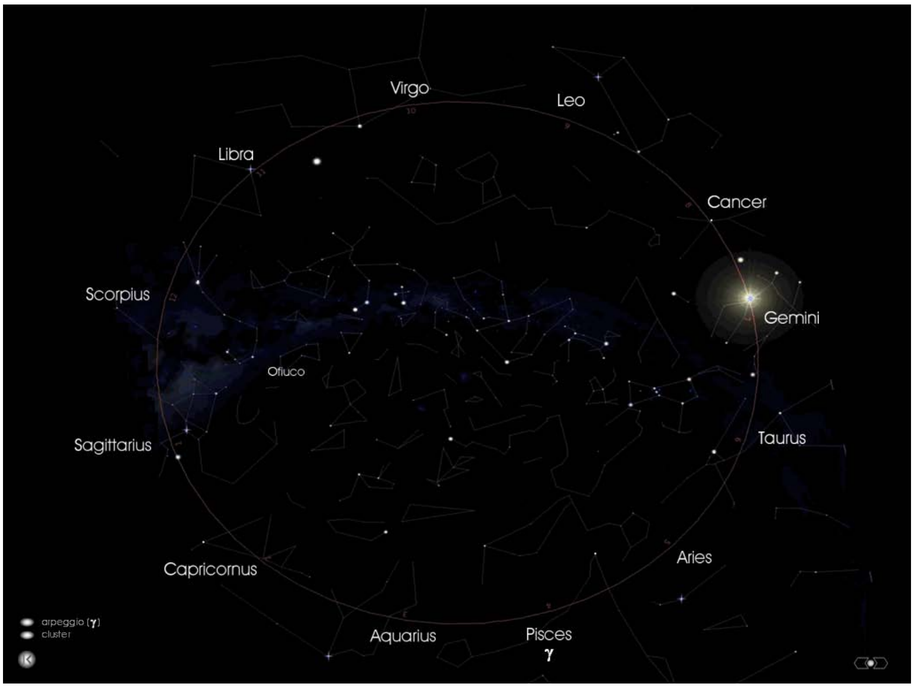


Fig. 2 - Home page.

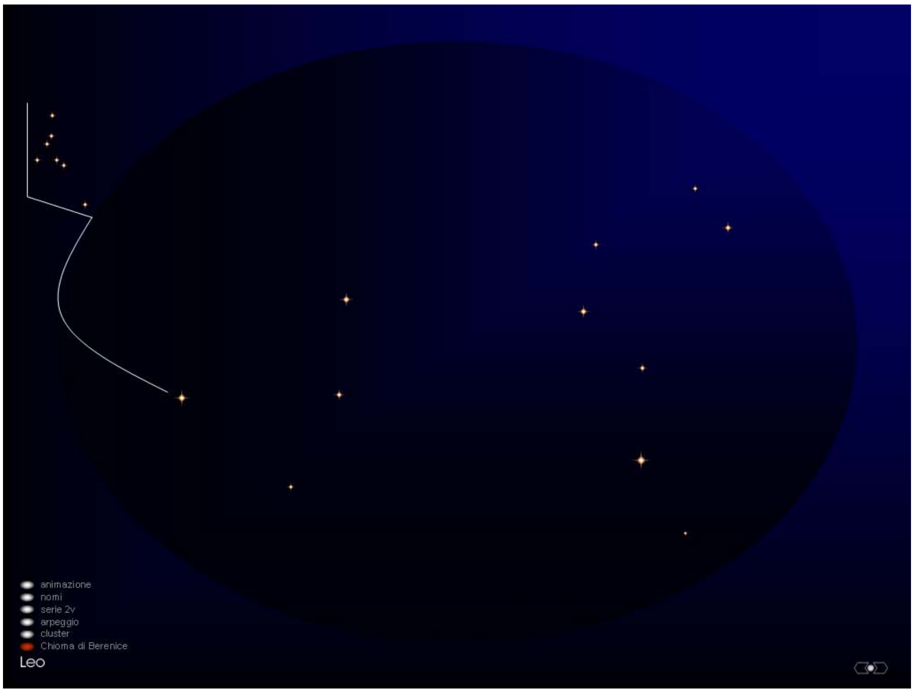


Fig. 3 - Example of Leo’s section.

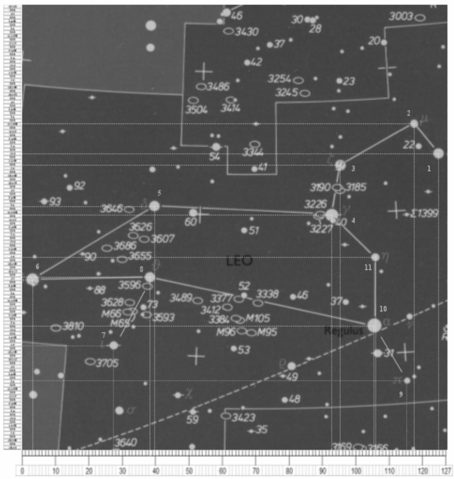


Fig. 4 - Example of Leo’s acousmertric map.

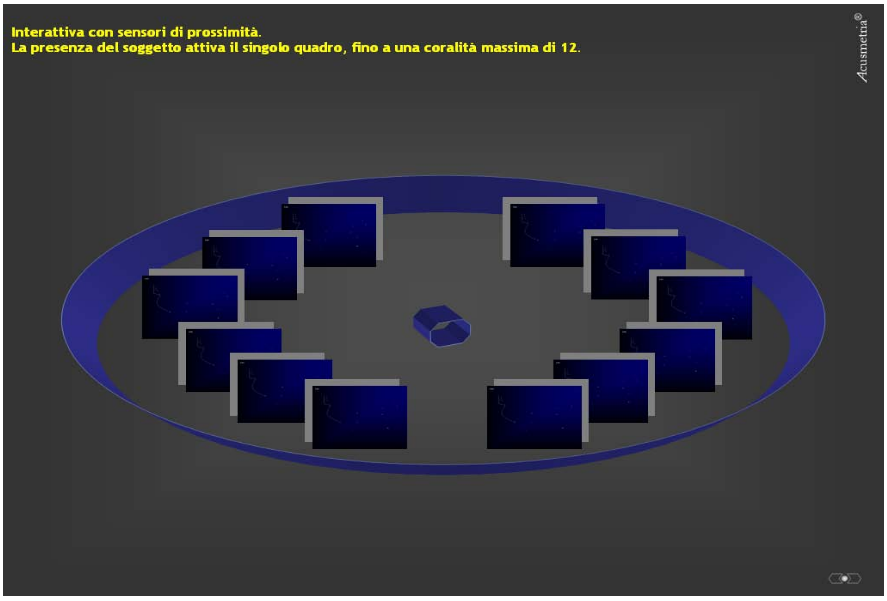
Fig. 4 - Examples of Capricornus section.

Brief Informations

Activity Type	conference / interactive installation / performance.
Objectives	educate, entertain.
Public	scientists / scholars, students, teachers and the general public, **including blind people**, media.
Scheduling	conference: 1 hour 30 minutes; installation: some days / permanent.
Budget	depending on the versions of project and sponsors (see below “FOUR POSSIBLE SETTINGS - *examples*” p. 5).
Space and location	planetarium, indoors or outdoors theatre, square, gallery, space to adapt for a video projection.
Requirements	one to twelve big projection screen, or a big surface for projection (a wall); a Pc; a stereo hi-fi amplifier with 4 / 8 loudspeakers, a mixer, 1 / 2 microphones.

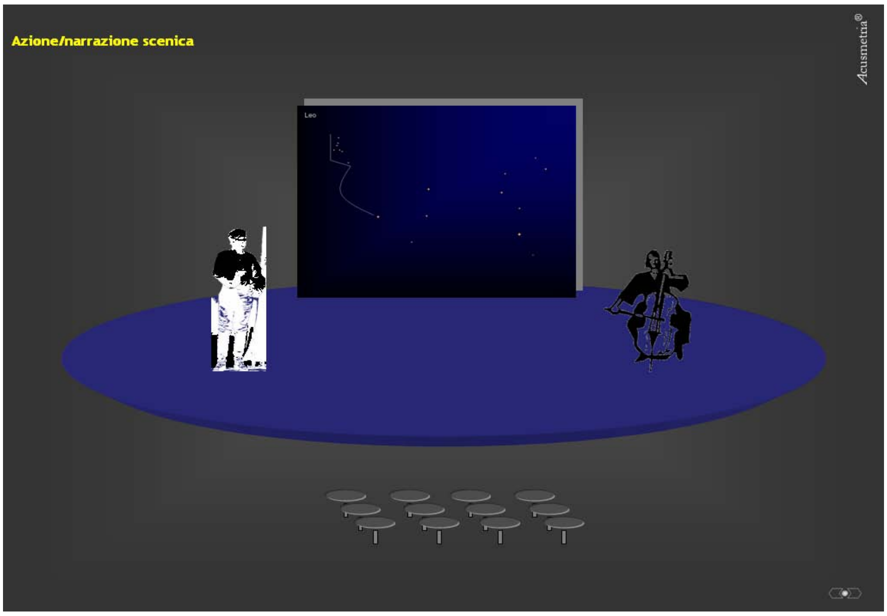
FOUR POSSIBLE SETINGS (*examples*)

1. *Little Stonehenge* – Interactive installation.



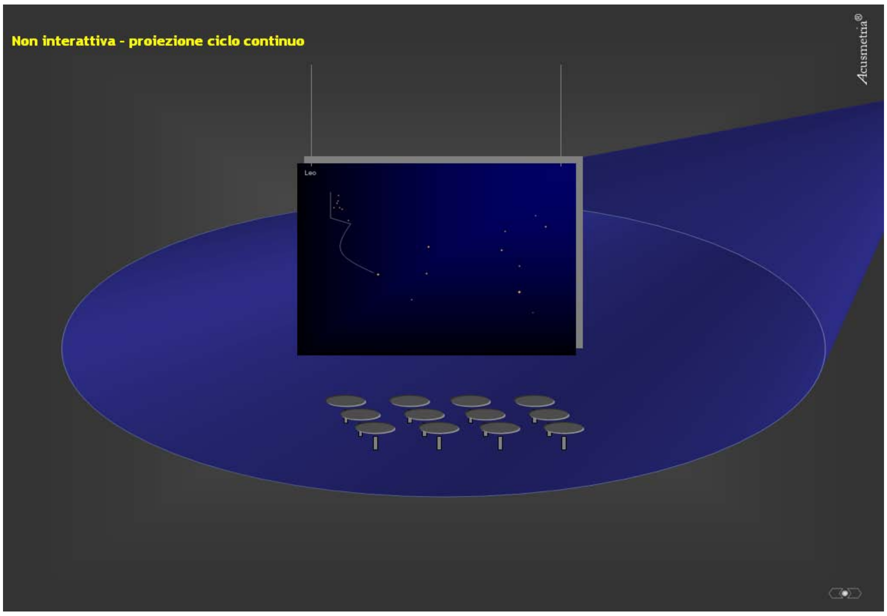
Interactive route with proximity sensors. The presence of the visitors activates the single constellation panels, up to a maximum chorality of 12.
Facilities: 12 plasma screens, or 12 projection screens; 12 notebooks, or 12 projectors (in case of projection screens instead of plasma); 24/48 small speakers.

2. On stage – Performance



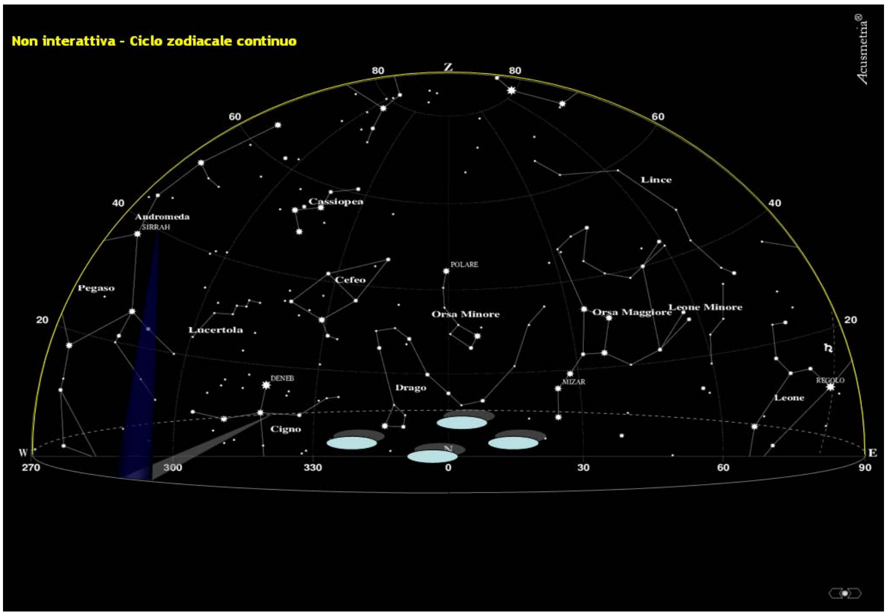
Includes: 1 actor-narrator, 1 musician, live electronics, projection.
Facilities: 1 projector, 1 transparent projection screen in the centre of an hall (or non transparent against a wall), 1 PC, 1 stereo sound system with 4/8 speakers; 1 mixer; 1/2 microphones.

3. *Simple projection*



The complete Zodiacal cycle is projected, with poetic narration of myth and melodrama on original texts, recorded in an independent video version.
Facilities: 1 projector, 1 transparent projection screen in the centre of an hall (or non transparent against a wall), 1 notebook, 1 stereo sound system with 4/8 speakers.

4. Spherical projection



Foresee a "pipe flow" composed of sort of a small portable planetarium, which can accommodate 15 people at a time. The complete Zodiacal cycle is projected, accompanied by the narration of the myth and poetic melodrama on original texts.

ACOUSMETRY - perceiving spaces and shapes through sound
by *Francesco Rampichini*

DEFINITION

Acousmetry n. (from Greek *akouō*, to hear, and *metréo*, to measure). Neologism created in 2002 by F. Rampichini. A. is the discipline of perceiving geometric proportions by hearing; it uses sounds properly organised to draw dots, lines and surfaces in a spatial perspective, and works tuning three fundamental parameters: sound dynamics (near/far), pitch (high/low), stereophonic balance (right/left).

ACOUSMETRIC THEORY

As geometry is the art of measuring the land (*gea*), and, in a broader sense, the science of proportions and measures (lines, surfaces, solids), Acousmetry is the discipline of proportions and measure of the acousmetric shapes.

Acousmetry arises from a gesture, a simple one such as to draw with a pencil, transposed into sounds.

It studies the relationships between the properties of heard sound models and the corresponding geometric shapes, analogically evoked by listening. The analogy is based on the ratios between parameters in sound and geometry: loudness vs. distance, pitch vs. height, stereophony vs. right/left position.

As the drawing gesture can be different in time to execution, acceleration or stroke thickness, the same apply to the sound parameters, f.i. in pitch rising time, in left to right movement speed, and so on.

Those correspondences are presumably synaesthetic phenomena, evoked by listening, and supported by the visual perception experience.

The Acousmetric shapes (*As*) are sound objects conveying geometrical shape recalls, to induce the visual perception of dots, lines, geometric forms moving in the space.

We don't ask to the listener "what do you hear?" but "what do you see?": their perception activates comparisons with a knowledge not related to sounds. The sound becomes a sign referring to a sense: we are not simply listening acoustic objects, but interpreting a language.

The time determines the capability to the listener to catch the sound points and to gather them mnemonically in order to perceive a form.

"High/low", "ascending/descending" describe the pitch of a sound and its modulation speed; "volume" indicates the loudness; other musical terms speak about "position", "interval", etc.; all the above examples show how much the two perception area are analogically contiguous.

Acousmetry can be applied to many fields, such as musical composition, communication, psychology, industrial design, and architecture.

Our perception activity is possibly constrained by some structuring rule we cannot override: one of them determines the acousmetric synaesthesia; the *As* copy the gestures required to draw the homologous graphic shapes,

letting our short term memory to maintain the picture, in place of a paper sheet.
We experienced that the few information provided about the "sound sheet"1, *As* such as dot, line triangle, square, pentagon are easily recognised and graphically reproduced by the listeners.
As any other code, Acousmetry requires a learning phase (in this case really short). Children learn to recognise a triangle, to distinguish between an "A" and an "I" and to reproduce different sound as correspondences; we learn foreign languages through laborious mnemonic exercises; a musician can recognise a 7thdim chord after a heavy and long training of the musical code; all these examples impose a linguistic context as a common reference.
We are verifying the acousmetric perception through tests submitted to statistical analysis: the tests consist of listening sample *As*, and of drawing the corresponding graphic shape on a paper; the data presently available are under process, but the high percentage of positive results already can convince that everybody can perceive *As*, and that the phenomenon is general.

BASIC FUNCTIONAL PARAMETERS

Right-left. The diffusion of stereophonic recordings made us used to perceive sound on a left or right side; a continuous shift of the balance from left to right is felt as a sound dot moving in the same direction.

Front-back. The perception of the depth (near-far) with two loudspeakers appeals to linguistic metaphors and to experiential interpretations, and two mechanisms apply for still or moving sources.
Still sources: our experience says that weak signals come from far sources; more we have a model describing mathematically the phenomenon: the intensity of the perceived signal decreases with the square of the distance; we can control the loudness of a signal following the above law, in order to represent the required spatial distance.
Moving sources: for low speeds, the above considerations on still sources apply; for fast speed, the Döppler effect can be used, increasing the frequency of the sounds coming toward us and decreasing it for sources going away from us.
The mechanisms are in the hands of the acousmetric composer: if the goal is the representation of a central far source approaching fast the listener, he will provide a central sound, initially weak, becoming louder and louder while increasing in the pitch.
Possible ambiguous representations shown that the listener chooses the simpler to be interpreted [2]:
F.i., in with two loudspeakers a central weak sound grows in volume and pitch till a maximum for returning then to initial volume and pitch, a listener

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[1] This analogy with graphics goes further on isologically: as for the drawings on a paper, symbolic three-dimensional representations are based on metaphors and codes, and perceptive paradoxes maintain their validity.
[2] Similar behaviours can be recognised in some visual perceptions, such as the principles of similarity, continuity, symmetry, etc. ruling the interpretation of figures.

positioned in the mid point between the two speakers could interpret it as a sound dot coming from far and returning back or as coming from far and going far behind him.
According to a principle of continuity, the listener prefers feel the second solution.
The parameters of such a sound can be physically modelled as shown in fig.1, supposing a listener centred between the speakers and looking toward the front part:

> at T_0 the source starts to give out a weak sound; the weakness induces the interpretation: either weak in itself or far;
>
> at T_1 the volume starts to grow, while the pitch becomes higher; the only convenient interpretation induces to feel a far sound approaching;
>
> at T_2 with the maximum volume the phenomenon reverses; the interpretation suggests a source going away; the smooth change in volume suggests continuity, and the listener interprets se sound as going behind his shoulders;
>
> at T_3 the volume and the pitch returns at the initial values, allowing the interpretation that the source stops. A listener in the same position but looking in the backward direction will feel the same phenomenon: the sound coming from far in front to him and moving away back.

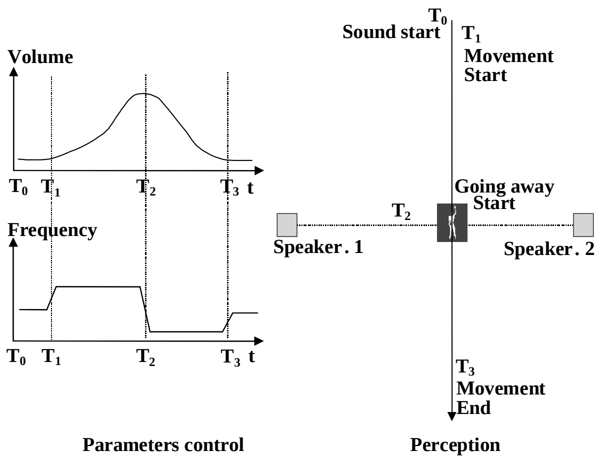


Fig. 1 - Depth perception through Volume and Pitch control.

While the perception left-right corresponds to the real physical phenomenon (the sound comes from left or right, or the ears process the position according to the average of the intensities coming from left and right; we can measure in meters the distance between the speakers and express in meters the position of the sound), the perception far-near, coming-going are ruled by "state variables": they are meaningful only in a comparison[3].

High-low. The use of two speakers only allows the perception of high and low position through metaphoric linguistic mechanisms. The terms "high" and "low", "up" and "down", are really powerful in the day by day communication: we go down the stairs or up at home (real physical interpretation), but the stock exchange is going up or down, we say "up with the people", "I'm down today", and so on.
The same metaphor is used in music, with sounds going up (pitch) and becoming high, or goes down becoming low. A sound coming from the left speaker increasing continuously its pitch is interpreted as dot spatially rising on the left party of our sound sheet. The reverse for dots moving down.
Acousmetry formalises the correspondence sound – shape; f.i. we could model the gesture of a diagonal segment from the lower left corner to the upper right as a couple of coordinates changing in the time:

$$x = kt \qquad\qquad y = kt$$

and the corresponding acousmetric shape will map x on the speakers balance, and y on the pitch. The process is invertible (in a mathematic sense, and an acousmetric shape generated starting from a geometric one can be examined to re-generate the original gesture.

[3] Various experiments shown that different listener perceived the same shape, but often with different sizes when the loudness parameter was involved, as well as when the last one, of the pitch. We suppose this is related to the linguistic metaphorical nature of the interpretation.

BIOGRAPHICAL NOTE

Francesco Rampichini was born in Milan, Italy, in 1960. Musician, composer and researcher, he obtained his Degree from the "L. Marenzio" Conservatory of Brescia (I), taught by C.R. Conti. He attended composition master classes held by F. Donatoni, A. Clementi, L. De Pablo, J.C. Risset and H. Dufourt.

Since early in the 80s he has been devoting himself to electronic and informatic music; in 1988 he founded with G.B. Zotti the independent label *musikAtelier*, receiving a precious critical contribution from M. Abbado to their musical productions.

As a professor at the Polytechnic of Milan (1999-2005), he contributed to introduce the *sound* as a project subject in the Design Degree Course.

Inventor of *Acousmetry*®, that he defines as *"a code of the geometric proportions perceived through the acoustic depiction of a space perspective"*, in 2004 he published - with architect Ettore Lariani and physicist Marco Maiocchi - the book *Acusmetria. Il suono visibile* (Franco Angeli), describing the basic principles and the typical processes of this new language.

He has composed music for exhibitions, theatre, dance, multimedia art, conceiving a wide range of interconnections between sounds and images, where the outcomes of his research on the isomorphisms between the two fields find their ideal application.
The cooperation with the architect-painter G. Riva has given rise to the work *A quattro mani*, completely composed through a multimedia language syntax.

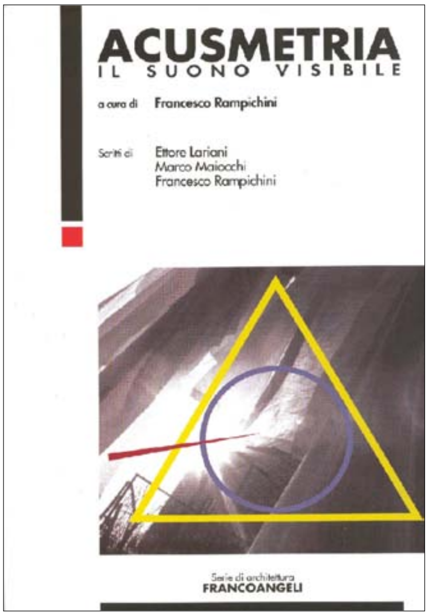
He published several CDs (Rdc, Emi, mkA, Cadalo) and musics (Bèrben, GI-MA, Sinfonica); he is co-author of the volumes *Museo Sensibile* (Franco Angeli, 2002) and *Archestesie* (Spirali, 2004).

Besides his activity as a concert performer, he has been working as a journalist and critic in the music editorial area, for the magazines "Chitarre" (as editor in chief during a decade), "Seicorde", "Suonare News", "Internet & Musica", "Il mordente", "Midi Songs", "Tribuna Stampa" and other.

He has been a guitar, informatic music and harmony teacher at the Civic School of Music of Milan and Opera, at the "Ateneo della Chitarra" and at the "Istituto Musicale Europeo" of Milan. Currently he teachs at the CPSM in the "G. Verdi" Conservatory in Milan and at the Musical Lab. in Locate T., Milan.

He was President of the Jury for the "Django D'or" International Award, sponsored by the French Embassy in Rome (1999), of the "Princess Cristina Trivulzio di Belgioioso" opera competition, of the Intenational Guitar contest "Rocco Peruggini", as well as of the Ar.Me.S. Cultural association (Art Media Science).

He has composed the music for the permanent multimedia installations of the Roman Theatre at the Chamber of Commerce of Milano, for the dramas *Me, Charles Darwin* (Philosophy Festival, Auditorium Parco della Musica, Roma, 2007) and *Max Perutz, a Nobel narrates itself* (Bergamo Scienza 2006, Auditorium), "Staminalia - A dream and a Trial" (Gulbenkian Foundation 2010), and he exhibits his work at the multimedia exposition "Téchne 05" (Spazio Oberdan, Milano) *Capriccio Spaziale*, acousmetric room, staged with *media_formasuono* with E. Lariani and M. Maiocchi.



Cover fo the book *Acusmetria il suono visibile* (Franco Angeli 2004)

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