

# HUMANITIES, ART AND SCIENCE IN THE CONTEXT OF INTERACTIVE SONIC SYSTEMS – SOME CONSIDERATIONS ON A CUMBERSOME RELATIONSHIP

Pietro Polotti<sup>1,2</sup>

<sup>1</sup>Department of New Musical Technologies and Languages  
Conservatory “Giuseppe Tartini”, Trieste, Italy

<sup>2</sup>Interaction Research Unity  
IUAV University of Venice, Italy  
pietro.polotti@conts.it

## ABSTRACT

The theme of this conference, “creativity rethinks science” involves a radical epistemological challenge with respect to a classical view of science and it is an extremely hot topic of speculation within the scientific community, at least for what concerns computer sciences. In this paper, we propose some considerations about the role that artistic research could have within science, where science is meant in the wide sense of *knowledge*, including, thus, humanities as a one of the partners together with natural sciences. After a more general discussion focused mainly on the field of Information and Communication Technology (ICT), we will restrict the scope to the case of sound art involving new technologies and sound design for Human Computer Interaction (HCI), namely Sonic Interaction Design (SID). In our discussion, the concepts of design have a particular relevance, since they provide a connection between fields traditionally far away one from the other such as natural sciences, art, engineering and humanities. In the last part of the paper, we provide some examples about what we mean by doing artistic research guided by a design practice. We envisage this as one of the possible ways to make a dialogue between artistic research and scientific research more feasible at a methodological level.

## 1. INTRODUCTION

In this work, we discuss our point of view about the role of art as research activity in relation to scientific research. We conceive art as a way for discovery and definition of new perspectives of comprehension of reality. We think as well that artistic investigation and the “artistic means” can give an original contribution to knowledge and collaborate with science in terms of construction of evidences, study cases, counterexamples and criticisms to

*Copyright: © 2011 Pietro Polotti. This is an open-access article distributed under the terms of the [Creative Commons Attribution License 3.0 Unported](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.*

questioned ideas. In particular, we take into consideration the fields of HCI and SID by tackling the concept of interaction as an exemplary point of reference. In our opinion, interaction provides a privileged subject for a dialogue among humanities, art, science and technology. We also believe that the adoption of design methodologies in art could be an effective way to facilitate a dialogue between art and science in order to bring them closer together.

The paper has the following structure. In Section 2, we recall how computer sciences and HCI in particular are undergoing a process of inclusion of knowledge and ways of thinking that are not strictly based on scientific inductive methodologies. In Section 3, we consider this aspect for the particular case of the argumentative thinking as complementary to the deductive/inductive reasoning proper of natural sciences. Section 4 is devoted to the recovery of a temporal dimension in science and the consequent relativization of a visual paradigm of knowledge as opposed to an acoustic one. In Section 5, we propose some issues about the contribution that art could give to an overwhelming technology development. In Section 6, we envisage the integration of design methodologies in the artistic practice as a way of making artistic research more systematic and closer to a scientific research praxis. In Section 7, we expose some brief considerations about the modalities of a dialogue between artistic creativity and science. In Section 8, we concentrate on the particular case of sonic interactive arts and SID, and we briefly review some team works by the author with different artists and researchers in order to provide some examples of application of the points discussed in the paper. Section 9 is devoted to a final discussion, in which we draw our conclusions.

## 2. HCI EPISTEMOLOGICAL REVOLUTION

In order to face the new challenges stated by the ICT society, the necessity of promoting a wide scope interdisciplinary effort ranging from the humanities to the natural sciences is clearly emerging (see for example [1]). The epistemological revolution introduced by HCI [2] and Artificial Intelligence (AI) [3] provides examples in this

sense. When technology was employed only within the scope of the industrial revolution under the epistemological framework of natural sciences, the complexity of the human psychology could be almost neglected or oversimplified. On the contrary, with fast-evolving digital means and the computer “tool” undergoing what Brey calls the passage from an epistemic role to an ontic role [2] a conception and development of a “psychologically and anthropologically ergonomic” technology becomes necessary. In his paper, Brey argues that “contemporary computer systems perform two broad classes of functions: epistemic functions and ontic functions. Epistemic functions are what have traditionally been called information processing functions,” however “the computer is no longer just a cognitive device, it is now also a simulation device” and “the functional role of computer systems in their role of simulation devices may be termed ontic, because their role is to generate or represent objects and environments that form an addition to the physical world.” In other words, digital technology is not just a tool for knowledge but something rather related to being.

In this sense, it is also remarkable as the name of a discipline born in a purely computer science environment, such as HCI, is gradually changing its denomination with Interaction Design (ID), dropping the term “machine” and introducing a term that is not easy to define as “design” [4], [5]. Design can be thought of as a discipline, which is in between natural sciences and humanities, technology and art. As Stolterman says [6] “interaction design research has for some decades developed theoretical approaches, methods, tools, and techniques aimed at supporting interaction designers in their practice” and “many of them have intellectual roots in other academic areas, such as science, engineering, social science, humanities, and in the traditional art and design disciplines”.

In the debate within the HCI/ID community one of the questions that people ask themselves is if a quantitative validation of the results is always non-renounceable and even meaningful for the kind of studies and subjects involved by the discipline. For example, talking about GOMS (Goals, Operators, Methods, and Selection rules), a popular evaluation methodology in HCI, Rogers [7] asserts that “A problem with predictive models, ..., is that they can make predictions only about isolated, predictable behavior. Given that individuals often behave unpredictably and that their activities are shaped by unpredictable external demands, the outcome of a GOMS analysis can be only a rough approximation and may sometimes be inaccurate. Furthermore, many would argue that carrying out a simple user test, such as heuristic evaluation, can be a more effective approach and also require much less effort.” In general, if we need to rehabilitate qualitative and heuristic evaluation, it becomes meaningful to go beyond the strictly logic thinking peculiar of natural sciences and to take into consideration humanities research paradigms, as discussed in the next section.

### 3. ARGUMENTATIVE THINKING AND THE NEW RHETORIC

Heuristic thinking and a holistic approach mainly based on qualitative argumentation find more and more space in the scientific world beside a strictly logic, deductive and/or inductive thinking (see for example the foundational text by Perelman and Olbrechts-Tyteca [8] on the subject of argumentation theory and the work by Jekosch [9] for what concerns the SMC field specifically related to product sound design). The reductionistic paradigm inherent physics research, pursuing the definition of general and simple (simplistic?) models and the reproducibility of results as grant of objectivity, shows its relativity as soon as the object of study and its environment involve human factors either psychological, social or cultural. Examples of this crucial issue can be found in the dialectic relationships between neurosciences and the phenomenological approach in experimental psychology or between a sociological practice founded upon quantitative methods and ethnography, the former based on tests aiming at an objectivity of scientific character and the latter founded on the observation of the phenomena in their complexity (see for example [10] for what concerns the qualitative character of the ethnographic research). A research, thus, closer to the thinking of the humanities emerges as a need.

In an already mentioned paper [3], cogent argumentations in the direction of recovery of humanities techniques into the field of computer science were recently introduced. Specifically, the subject of the paper is the present role of rhetoric and argumentative reasoning in AI. The author recalls how “Computing, especially in artificial intelligence and multi-agent systems, has moved away from exclusive use of deductive logic and inductive reasoning and has now accepted argumentation as a method of modeling defeasible reasoning.”

In tune with these argumentations, we envisage the reinvention and adaptation of communication techniques developed within pure humanistic frameworks to the context of ID as a powerful strategy for the development of the discipline. We consider this as a coherent and promising research subject from a methodological point of view for both ID and SID, being the latter a subdiscipline of the former. In the context of ID, an effort of exploiting the nature of rhetoric as art of convincing can be found in an article by Grasso et al. [11]. In a recent paper [12], we argue that rhetoric can provide a breakthrough in the definition of sound design for Auditory Display (AD) and SID. In the second part of the paper, we present the results of a first case study concerning the evaluation of a rhetoric-based design procedure of a set of earcons, i.e. of short melodic fragments used as audio iconic representations [13]. The effectiveness of the design was assessed in terms of memorization of the earcon-function associations by groups of subjects. The outcomes of the experiment provided a first positive result encouraging a more general and extensive investigation about the utilization

of rhetorical techniques in support of sound design for AD.

The fields of AD and SID are good examples about what is happening in the HCI revolution. In those disciplines, the issue of defining guidelines in order to go beyond particular cases and solutions is a hot topic. A keen critic about the necessity of development of solid methodologies for the discipline appeared in a paper of some years ago by Barrass [14]. In another paper by the same author [15], the problem is faced from a perceptual point of view. However, perceptual aspects are only one of the facets of SID research. A more comprehensive work [16] appeared in a special issue of the International Journal of Human Computer Studies devoted to SID. In that paper, Frauenberger and Stockman propose to consider design pattern analysis as a point of reference for the discipline. Their article offers an overview of the available methodologies, and points out the lack of a unitary and robust framework for the discipline. In particular, the authors highlight how researchers in the SID field usually do not reveal the rationale of their design decisions. As an alternative, they introduce a method based on pattern mining in a context space. They are aware of the pro and con of a pattern-based approach, and propose to use context as an organizing substrate. In their opinion, this will provide designers facing new problems with useful reference patterns of already existing ID practices. The method promotes the growth of the discipline by means of a process of building upon previous knowledge. The approach presents strong similarities with one of the keystones of rhetoric that is the so-called *loci*. The *loci* are the result of a classification of the argumentation types according to specific criteria, and they provide the orator with a well-organized database of formulas, paradigms, examples and strategies that she or he can browse, select and employ in order to build her/his discourse and promote her/his theses.

We are strongly convinced as well that providing AD and SID with robust operational guidelines is of extreme importance for our forthcoming social life and environment. In fact, we can easily envisage a future, in which a multitude of technological devices will own expressive and listening capabilities in the frame of speech and non-speech audio communication. The acoustic scenario will include thousands of new artificial sounds that will pervade our everyday life, and consume the available “environmental acoustic band”. In particular, we expect a huge proliferation of non-verbal sounds. Such an acoustical hypertrophy requires an adequate action aiming at defining ways to optimally exploit the communication potentialities of non-speech audio, while avoiding the degeneration of the acoustic environment into an overstuffed soundscape. Strategies for designing artificial sounds in a concise and effective way tackle both these aspects at once by optimizing the communication process, and reducing the sonic impact in terms of psychological and physiological fatiguing. The opposite of what an ambulance siren is in the context of alarm design. These ideas are compliant with an ergonomic design of technological

means, and tackle the more general issue of a sustainable technology.

#### 4. TOWARDS A RECOVERY OF A TEMPORAL/SONIC DIMENSION OF THE WORLD

When dealing with sound, time is a crucial aspect. Sound is essentially a temporal phenomenon both from the physical point of view and from the perceptual one. In ID as a whole, dealing with temporal aspects means taking into consideration continuous interaction. This is another important aspect of the above discussed epistemological change of perspective.

In science in general, time has gained new insight during the last quarter of the 20<sup>th</sup> century, marking the end of the supremacy of a static and spatial view of the world by physics [17]. Classical physics is related to a visual and geometric conception of the world: images, as well as written words, allow the eye to gaze indefinitely and to move forth and back in an unified, homogeneous and divisible world, as if time were suspended [18]. On the contrary, time related phenomena as sounds are irreversible. Changing perspective from a visual to an acoustic one has radical consequences on the conception of the world, whereas its acoustic aspects represent the irreversibility of time that involves energy transformation, vitality, complexity, opposite to the ideas of reversibility, immobility, symmetry, simplicity of the classical visually-oriented world conception.

In this fast evolving cultural framework, embodiment and gesture are acquiring more and more importance in HCI (see, for example, the series of workshops on “Gesture in Embodied Communication and Human-Computer Interaction” [19]). Body and gesture are related not only to space, and, therefore, to the visual world, but also to movement in time, and they are intrinsically related to sound: sounds are produced by movements and interactions and constitute one of the modalities of their appearance.

A further consideration is that ID and interactive arts share common digital means. We think that this is a crucial aspect that makes the two fields more related one to the other than traditional arts and design. ID and interactive arts together provide a great opportunity of synergy between humanities, science and technology. We believe that SID, together with the design of new interfaces for music and sound art, constitutes a particular case of this potential synergy, and we share Bill Verplank et al.’s conviction, when they write: “We believe that the direct engagement in an expressive realm like music can generalize to a wide range of human-machine controllers.” [20]. Even more, we are strongly convinced that the sound art and musical workbenches can be a privileged place, where it is possible to explore and develop paradigms for a subversion of the scheme of a mankind running after technological development into that of a technology recovered to its primary scope of means for human life, as discussed in the next sections.

## 5. AN ARTISTIC RESEARCH PERSPECTIVE FOR A SUSTAINABLE RELATIONSHIP WITH TECHNOLOGY

Along the 20<sup>th</sup> century, the philosophical debate was actively engaged into the comprehension and definition of technology in its socio-cultural implications in terms of modifications produced in our existence. The awareness of a technological development living of its own life as a consequence of deep cultural roots of the western world emerged through the century [21]. Technology is not any more reducible to the dimension of a tool or, more in general, a means. Rather, the primary goal of technology is the technological development itself: the mankind is somehow culturally compelled to develop and exploit everything technology allows/offers him. At the same time, the imagination cannot stand the power and the rate of technological production and innovation, but can only run after it. Technology progresses in a tautological way according to an inner logic, and the human goals and concerns can only adequate and draw consequences according to the latest technological advancements.

The question is if we can go beyond this perspective, and if we can still define goals starting from the state of the art of technology but independently from its inner, non-human logic. One could argue that since its first appearance in the second half of the 19<sup>th</sup> century, design in general can be seen as a huge effort in the sense of imposing creativity and human-concerns over technology by reflecting on and planning the industrial production.

The digital era emphasizes this uncontrollable technological growth, however at the same time, it opens chinks for placing again human aspects before technology. This seems, for example, the attitude and source of inspiration of the hacking approach to digital creativity for what concerns hardware or the open source philosophy for what concerns software: “anybody” can adapt and reinvent technology according to personal purposes. More in general, as discussed in Section 2, HCI puts technology explicitly in contact with the complexity of the human being that is with the non univocal nature of the human thoughts, emotions and behaviors. As a consequence, HCI becomes a natural laboratory for an epistemological revolution, and, at the same time, provides the playground of the great challenge for the development of a technology devoted to humans (and not the opposite). In other words, the goal is to go beyond the “computer metaphor and the related Cartesian mind-body dualism [that] have resulted in a fairly mechanical comprehension of the human being using a technical device” [22], in order to strive for a technology meaningful and sustainable for the human beings from many points of view: physical, psychological, social and environmental.

We believe that art can play the role of a laboratory for developing evidences and letting new perspectives of comprehension of the world emerging. A kind of research crosscut following the path of intuition and creativity instead of that of strictly logic thinking and providing knowledge from a different however valuable perspec-

tive. In particular, we believe that interactive arts are a fundamental actor for the development of a sustainable relationship with technology. They can constitute the workbench for a free experimentation of new ways of conceiving, employing, analyzing, interpreting, and criticizing technology in a complementary and synergic way with respect to ID.

Another aspect somehow related to art as investigation is that of art as didactic means. This is nothing new as art has always had a pedagogical role within societies. However is worthy to underline, how a portion of the artistic production since the 70's, i.e. the public art and body art (see for example the work by Dennis Oppenheim, and other artists of that period [23]), has its focus on the experience of the audience and its active participation. This idea can be found in many present-day interactive installations in form of public art, where a didactic-explorative valence of the artistic work emerges explicitly. The idea of participation in interactive arts strongly enhances the didactic valence of art.

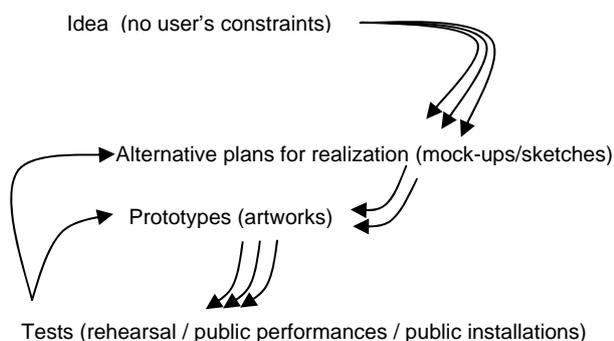
In general, we have the impression that, when dealing with interactive contexts, the distinction between art and design tends to fading out. In our field, a pregnant case of being on the borderline between science, design and art is that of AD and SID. In particular, the former community that studies how to display information through the auditory channel by means of non verbal sounds considers itself as a scientific community in a pretty strict sense. The latter community is, on the contrary, more hybrid and multidisciplinary by its nature, in the same way as ID is. Furthermore, art is explicitly accepted among the contributors to the discipline [24]. On the other side, we believe that the interconnection between art and design can proceed also along the inverse direction that is a designerly approach can be fruitfully adopted in interactive arts (and art in general), as argued in the next section.

## 6. A DESIGN-ORIENTED ARTISTIC PARADIGM

SMC is a highly interdisciplinary field and a relatively new one [25]. The profile of the SMC researcher is not always easy to define from a disciplinary point of view. For example, the question if a person, who faces the challenge of creating a new interface or a new sonic/musical system, is necessarily supposed to be an electronic engineer or a computer scientist, is a cumbersome one [26]. Given the accessibility of the present technologies, we believe that this is not always a must. On the other side, when this type of work takes place within and for a musical and artistic domain, we think that the designer denomination would not be the most appropriate. Often, what we are in front of is the work of technologically skilled artists and musicians. At the same time, we pose ourselves another question: could design methodologies act as point of reference for an artist that works with digital technologies?

We think that making art inspired by a designerly approach, where ideas are followed by multiple and alterna-

tive realizations that can be compared in order to reveal the multifaceted and critical points of questioned ideas from different perspectives, can be a profitable strategy for art as well. Also, the principle of cyclic iterations, realization, evaluation and redefinition of the realization (or of the idea itself) according to the evaluation results could constitute a strong paradigm to establish an artistic practice structured and biased towards a systematic investigation of an idea. Third, the fundamental design principle of going through rapid sketching and/or realization of mock-ups provides a powerful operating praxis in front of the unavoidable rapidity of technological evolution. In fact, the impossibility of being anchored to standards in the sense of solid reference tools and methodologies, on the top of which to build something valuable and durable/repeatable because sufficiently independent from the particular technology state of the art is a severe drawback. Fourth, a design approach involves as a connate praxis working in team: the artwork becomes a product of a group of people jointly contributing to it and used to share ideas, plans and goals as in a research group.



**Figure 1.** A design-oriented artistic practice.

The evolution rate is one of the main aspects that determine a lack of stable and long lasting technological means, through which to develop new traditions and solid cultural and stylistic peculiarities. In case of our discipline, this corresponds for example to the difficulty of creating new musical instruments that people are interested in exploring musically and technically for a significant while (let's say, at least some decades?). Design is thought of as guideline for a sustainable relationship with technology evolution, from one side, and methodological instrument for a structured artistic research, from the other. The framework of an artistic practice inspired by the procedures of design is represented in the diagram in Figure 1. In the artistic case, the starting idea is not the outcome of a brainstorming about consumer/stakeholder needs and/or requirements, but a free artistic investigation. In the same way, the validation/evaluation phase by means of user-tests is substituted by the rehearsals with the performers or by the observation of the reaction of the visitors to a system exhibited in public spaces (finally, a sort of qualitative user test), without any quantitative or logically rigorous evaluation as usually required in product design.

## 7. FOR A COLLABORATION BETWEEN ARTS AND SCIENCES

In this section, we figure different kind of forms of collaboration between arts and science. A preliminary issue is the necessity of working in a research group. Working in team on an artistic project in a design fashion can be very similar to the activity of a scientific research group. Nowadays, interactive artists are more and more trained to work with other people, contrarily to the model of artist as isolated creator. This means a shared capacity among artists for an integrated work with people having different disciplinary skills, methodologies and goals.

A first form of collaboration could regard art as a means for the development of the representation of the world in an epoch and a culture, by means of the display (in a multimedia sense) of results and concepts produced by sciences. In this sense, art can become a stimulus for scientific imagination and thinking and, vice-versa, science can be a source of inspiration for arts. The latter is actually a common practice. Moreover, collaboration between arts and sciences is nothing new in history, during epochs of minor disciplinary specialization. Anyhow, in this kind of relationships, the risk of being pretty superficial or even vague is high.

In the context of some disciplines, the relationship could be tighter and more effective. For example, psychology could collaborate with art at any level, from perception to cognition up to emotions, in order to provide data, study cases, alternatives, counterexamples, exceptions. At least since the Bauhaus experience, there are many contemporary artists that conceive their work as an explicit investigation of perception and cognition.

The case of computer science is also a key research area, able to involve disciplinary fields related to humanities too, as outlined in this paper. In particular, we discussed the AD and SID domains (see also [27]).

Concerning sound, it is possible to consider architecture, city and landscape planning as potential partners. We hope that as a consequence of the emergence of the soundscape as an important aspect of life quality, sound artist will be able to contribute to the development of a consolidated discipline of soundscape design.

In the next section, we briefly review some team works by the author and others as particular implementations of the principles previously discussed. The first work, the *Gamelunch*, is a sonically augmented dining table in between a public art work and a product design project. In 2007, it was presented as an interactive art installation at *Enaction in Arts* in Grenoble [28]. At the same time, it was developed in a design context and contextualized in the general theme of continuous sonic interaction within ID [29], providing, in our opinion, an example of strict relationship between themes and tools that can be developed both in artistic and design contexts.

The others results are related to the Elementary Gestalt for Gesture Sonification (EGGS) project [30]. The works are both in the form of public art installations and of interactive performances. All of them are inspired by a

common idea that is developed and questioned in different alternative realizations in the spirit of what depicted in Figure 1.

## 8. EXAMPLES FROM RECENT WORKS

In this section, we provide an overview of some team works by the author and other researchers and artists, as preliminary results about what discussed in the present paper.

The already mentioned *Gamelunch* was an interactive installation based on a dining table. The work aimed at investigating the enactive loop connecting action, sound and sensation. By means of various sensors, the continuous gesture interactions of a dining context were captured and transformed into energetically coherent data driving a set of physically-based sound synthesis algorithms, provided by the Sound Design Toolkit (SDT) package [31]. One of the key points of the installation was to raise the user attention and awareness about the importance of the sound response in any human physical action by means of unexpected and sometimes contradictory sonic feedbacks. The work was also intended as an investigation about the potentialities of sound as an augmenting element in interactive systems for everyday life, tackling aspects such as the sonic identity of materials (in an enhancing or contradicting fashion) and the alteration of the user proprioception during the action (in a prompting or retaining way).

Sound as means of gesture representation in the time domain combined with the principle of simplicity based on the use of elementary sonic and movement units are the leading ideas of another set of works related to the already mentioned EGGs project. In the spirit of Bauhaus, one of the principles we adopted is to consider straight and circular trajectories as elementary gestalts for gesture analysis and segmentation (see [31] for more details). Some of them were conceived as interactive installation in the form of public art as Visual Sonic Enaction (VSE) [32] and Sonic Walking (SW) [33], others as interactive performances as Swish 'n' Break (SnB) [34] and Body Jockey (BJ) [35].

VSE, is a multimodal and interactive installation that allows to generate audiovisual representations of one's gestural expressivity. The installation is usually presented as if it were an interactive graffiti painting system, where one can "listen" to her/his gesture. The visitors are encouraged to paint on a large wall by means of an "electric torch/spray can" controlling different graphic and sound processing algorithms. The sound elicits and guides the movements of the user and immerses she/him in a bodily-visual-auditive experience, providing gesture with a multimodal and continuous feedback. Indeed, sound plays the role of connective element of the three components of VSE. In fact, the EGGs principles of simplicity are applied to the visual domain as well. The final aim is not to paint. Rather, what appears on the wall or on the computer screen is a visualization of the expressivity of gesture guided and prompted by the sonic feedback. At the same time, in an enactive way, the visual feedback spurs

the user to modify and control her/his own gesture also according to different type of visualized graphic. A further subject of investigation offered by this kind of works and planned for the future is to question, if the definition of abstract (gestural) categories and of effective, however independent, mappings of gesture onto sounds and graphics generation will reveal unexpected cross-modal relations between visual and sonic structures.

In another public installation, Sonic Walking (SW), we moved the focus on gait expressiveness, therefore, shifting the focus from the upper part of the body to the lower part and taking into consideration gesture in an everyday context. Visitors had just to walk freely along a straight path in an ordinary indoor space, while their gait was sonified by means of ecological sounds related to nature. Similarly to VSE, the users were told to "listen" to her/his walk. Since natural soundscape sounds were employed, the didactic valence of SW regards as well a sort of soundscape listening training through the use of the body.

When working with a professional performer/dancer on a stage, as in SnB and BJ, the premises are different. Sound is meant as an effect of the choreographic gesture and a representation of her/his gestural expressiveness. EGGs becomes what we call a "choreophone": the performer/dancer does neither follow a musical piece, nor controls the execution of a musical piece, and not even generates music with her/his movement. Rather, (s)he listens to her/his gesture, enactively, modifying and controlling her/his performative action according to the produced sound [36]. The sounds, thus, are a representation of the movement, a sonic consequence and a continuous feedback, in no way external to the gesture itself. In this fashion, sound is intended as augmenting the proprioception of the performer.

SnB was presented in the context of the latest SMC conference. The employed sounds were retrieved from the Freesound Project [37]. Beside the specific composition process, the choreographic choices and the decision of using everyday-life sound samples, the EGGs principles were the main focus of our attention in the development of the work. The main guideline was how to map different sound sets to different movements/gestures categories on the basis of a elementary straight/circular-clockwise/circular-counterclockwise trajectory discrimination (see [30] for more details).

The same holds for the last work, BJ, presented at NIME 2011. The idea was to introduce embodiment in club culture and musical styles. The technical setup is the same as the one in SnB, but including also a video projection according to the same principles of VSE. The three performers act as if being in a DJ and VJ set. The dancer triggers and modulates sounds by mean of her body, while the laptop performers change sounds, graphics and mappings, following a predetermined score. With respect to SnB, the system can be applied to non-trained bodies that is non professional dancers according to what disco dancing is: a way of moving that is totally personal and has none of the established barriers of dance language.

## 9. CONCLUSIONS

In this paper, we have presented some considerations about artistic research in interactive contexts and its actual or potential synergies with scientific research. We have underlined as the necessity of a broader and more inclusive way of thinking is emerging within various disciplines related to ICT and to computer science. We discussed how this widened epistemological scope involves humanities and its methodologies as well. When in the study of some subject, the environment plays a fundamental and non-renounceable role, the reductionistic and modeling paradigms of natural sciences become inadequate, since they always involve decontextualization as a premise.

In this framework, a significant example is provided by the employment of rhetorical strategies in AI and HCI. We argue that the recovery of argumentative thinking in AI and HCI is coherent with the epistemological revolution discussed, for example, by Brey [2]. We have recalled some results in this sense concerning the case of AD and the design of earcons.

In order to foster an enlargement of the interdisciplinary scope to art as well, we proposed an integration of properly adapted design methodologies within the praxis of artistic research. The idea that investigation through the artistic means can be an interlocutor of scientific research is supported by some examples produced by the author in team with various artists and researchers, and concisely reviewed in Section 8. In those examples the aim was providing evidences about the potentialities of non verbal sounds in terms of representation and comprehension of reality focusing on the particular case of human gesture/action sonification. Such works can be viewed both from and artistic and an ID perspective.

The proposal of framing an artistic activity into a cyclic process involving evaluation and rethinking of an (artistic) idea in a systematic way appears to us as a potential way to open a renewed and profitable dialogue between artistic research and scientific research. Also, becoming comfortable with the development of mock-ups in interactive contexts, from one side, and with team work, from the other, seems to be a promising strategy to make interactive arts and ID close enough to engage fruitful relationships.

## 10. REFERENCES

- [1] J. Löwgren and E. Stolterman, *Thoughtful interaction design: A design perspective on information technology*. New York: MIT Press, 2004.
- [2] P. Brey, "The Epistemology and Ontology of Human-Computer Interaction," in *Minds and Machines*, 2005, Vol. 15(3-4), pp. 383-398.
- [3] D. Walton "Computational dialectic and rhetorical invention," in *AI & Society*, 2011, Vol. 26, pp. 3-17.
- [4] P. Ralph and Y. Wand, "A Proposal for a Formal Definition of the Design Concept," in *Design Requirements Engineering: A Ten-Year Perspective. Lecture Notes in Business Information Processing*, Springer Verlag Berlin Heidelberg, 2009, Volume 14, Part 2, pp. 103-136.
- [5] K. Krippendorff, *The Semantic Turn; A New Foundation for Design*. Boca Ratan, London, New York: Taylor & Francis CRC, 2006.
- [6] E. Stolterman, "The Nature of Design Practice and Implications for Interaction Design Research," in *International Journal of Design*, 2008, Vol. 2 No. 1, pp. 55-65.
- [7] Y. Rogers, "New Theoretical Approaches for Human-Computer Interaction," in *Annual Review of Information Science and Technology*, 2004, Vol. 38, pp. 87-143.
- [8] C. Perelman and L. Olbrechts-Tyteca, *The New Rhetoric, A Treatise on Argumentation*. University of Notre Dame Press, Indiana. 1969 (original edition in French. Presses Universitaires de France, 1958).
- [9] U. Jekosch, "Assigning Meaning to Sounds – Semiotics in the Context of Product-Sound Design," in J. Blauert, ed. *Communication Acoustics*, Berlin, Springer, 2004, pp.193-221.
- [10] J. Clifford and G. E. Marcus (Editors), *Writing Culture: The Poetics and Politics of Ethnography*, University of California Press, 1986.
- [11] F. Grasso, A.Cawsey, and R. Jones, "Dialectical argumentation to solve conflicts in advice giving: a case study in the promotion of healthy nutrition," *Int. Journal of Human Computer Studies*, 2000, Vol. 53 (6), pp. 1077-1115.
- [12] P. Polotti and G. Lemaitre, "Rhetorical strategies for sound design and auditory display: A case study," in *Int. Journal of Human-Computer Studies*, under review, submitted Jun. 2010.
- [13] M. Blattner, D. Sumikawa and R. Greenberg, "Earcons and icons: Their structure and common design principles," in *Human Computer Interaction*, 1989 Vol. 1 (4), pp. 11-44.
- [14] S. Barrass, "A comprehensive framework for auditory display: Comments on Barrass, icad1994," in *ACM Trans. Appl. Perception*, 2005, Vol. 2 (4), pp. 403-406.
- [15] S. Barrass, "A perceptual framework for the auditory display of scientific data," in *ACM Trans. Appl. Perception*, 2005, Vol. 2 (4), pp. 389-402.
- [16] C. Frauenberger and T. Stockman,. "Auditory display design: An investigation of a design pattern approach", in *International Journal of Human Computer Studies*, 2009, Vol. 67 (11), pp. 907-922.

- [17] I. Prigogine, *From Being to Becoming - Time and Complexity in the Physical Sciences*. W. H. Freeman and Co., New York, 1980.
- [18] M. McLuhan, *The Gutenberg Galaxy: The Making of Typographic Man*, University of Toronto Press, 1962.
- [19] S. Kopp and I. Wachsmuth (Eds.), *Gesture in Embodied Communication and Human-Computer Interaction*, LNAI 5934, Springer Verlag, Berlin Heidelberg, 2010.
- [20] B. Verplank, C. Sapp and M. Mathews, "A Course on Controllers," in *Proceedings of the 1st Workshop on New Interfaces for Musical Expression (NIME01)*, ACM SIGCHI, 2001.
- [21] U. Galimberti, "Man in the age of technology". In *Journal of Analytical Psychology*, 2009, Vol. 54, (1), pp. 3-17.
- [22] A. Pirhonen, "Gestures in Human-Computer Interaction – Just Another Modality?" In S. Kopp and I. Wachsmuth (Eds.), *Gesture in Embodied Communication and Human-Computer Interaction*, Springer Verlag Berlin Heidelberg, 2010, pp. 281-288.
- [23] R. L. Goldberg, *Performance Art. From Futurism to the Present*, Thames & Hudson, pp. 156-163, 2001.
- [24] <http://sid.soundobject.org>
- [25] The S2S<sup>2</sup> Consortium, *A Roadmap for Sound and Music Computing*, Version 1.0, 2007, ISBN: 978-9-08-118961-3.
- [26] <http://smc2010.smcnetwork.org/panel.htm> (Mar. 30, 2011).
- [27] G. Eckel and D. Pirrò, "On Artistic Research in the Context of the Project Embodied Generative Music", *Proceedings of the International Computer Music Conference*, Montreal, Canada, August, 2009, pp. 541-544.
- [28] S. Delle Monache and P. Polotti. "Gamelunch - the sonic dining table," interactive sound installation presented at *Enaction in Arts*, Grenoble, Nov. 2007 (<http://acroe.imag.fr/enactive07/gamelunch.php>).
- [29] D. Rocchesso, P. Polotti, S. Delle Monache, "Designing Continuous Sonic Interaction," in *International Journal of Design (IJD)*, 2009, Vol 3, No 3, pp. 13-25.
- [30] P. Polotti and M. Goïna, "EGGS in Action," to appear in the Proceedings of the 2011 International Conference on New Interfaces for Musical Expression (NIME-2011). Oslo, Norway, May 30 - Jun. 1, 2011.
- [31] S. Delle Monache, P. Polotti, and D. Rocchesso, "A Toolkit for Explorations in Sonic Interaction Design," in *Proceedings of Audiomostly '10*, Pitea, Sweden. Sept. 15-17, 2010, pp. 7-13.
- [32] <http://visualsonic.eu/vse.html> (Mar. 30, 2011).
- [33] <http://visualsonic.eu/sw.html> (Mar. 30, 2011).
- [34] M. Goïna, P. Polotti, and S. Taylor, "Swish & Break - Geschlagene-Natur," in *Concert around Freesound*, SMC 2010, 7th Sound and Music Computing Conference, Universitat Pompeu Fabra, Sala Polivalent, Barcelona, Spain, 22 July 2010.
- [35] S. Taylor, M. Goïna and P. Polotti, *Body Jockey (BJ)*, interactive performance to be presented at NIME 2011, Oslo, Norway, May 31, 2011.
- [36] [http://visualsonic.eu/eggs\\_in\\_action.html](http://visualsonic.eu/eggs_in_action.html) (Mar. 30, 2011).
- [37] [www.freesound.org](http://www.freesound.org) (Mar. 30, 2011).