Interactive systems in improvisation and composition. A work in progress

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Abstract

In this article I will present my artistic research project entitled 'Interactive systems in improvisation and composition' and discuss certain aspects of the project's development during the course of my work on it. I will briefly explain the theory that forms the framework for the research and discuss three selected projects that are all a part of my PhD studies. I will also touch upon the widely discussed issue of choosing a method for artistic research. The conclusion drawn from my experience is that an artistic research project is similar to the very nature of artistic practice; one needs to follow the paths opened up by the work. Finally, I comment on the potential validity of artistic research as a discipline.

1 Introduction - the project

The core of this project is to establish a set of artistic means through which electronic instruments and timbres (created through computer software) can be successfully integrated with acoustic instruments in both improvisational and compositional contexts. The success of this project may be measured in terms of how well I manage to describe and, through the development of a series of works, implement models for artistic creation (compositional and improvisational) where acoustic and electronic instruments interact.

At the outset the thesis was that if a seamless integration of digital and analog instruments is the object, i.e. both on the level of sound and performance, and we do not wish to compromise the 'human feel' of the performance[1], then we need to make the digital instruments approach the analog instruments, both on the level of sound and performance. Hence, the research question may in essence be articulated as: how does one accomplish this seamless integration? Since this question is too broad to handle in a PhD project it has been limited to a test of the following case: *Can an interactive system that uses sound as its object of interaction provide the necessary premises for an integration of digital and analog sound sources on the level of both sound (as it is perceived) and performance (as it is experienced)?*

I will return to this research question in an attempt to untangle its meanings, contextualize the field in which this research is performed and discuss the environments in which the results of the research may have significance. But before that, I will present the tools

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[1] Remember that there are types of music in which this is not desirable - I am sure that for Kraftwerk it would have made no sense to attempt at making the instruments sound more 'human'.

with which I will make these descriptions and the method with which I will present the work in progress; i.e. the meta-method of this article.

2   Method

For this article I will make use of some of the methodological ideas for artistic research introduced by Mika Hannula in his paper, "The Responsibility and Freedom of Interpretation" [Hannula, 2002]. In this paper, Hannula uses a hermeneutic approach in order to arrive at "a preliminary, and [...] a merely tentative notion, of the distinctive character and minimum requirements of artistic research" (*ibid* pp. 73). It should be noted that Hannula himself is mainly active in the field of visual arts and his proposed method, although it takes a general approach, is probably mainly geared towards that area. Though the two disciplines, music and the field of visual arts, have many overlapping areas of interest, the field of visual arts is in many respects very different from that of contemporary Western art music.

> The researcher must explain what he or she is researching, why he or she is doing the research, why it is of interest, and what is the aim. The success or distortion of artistic research is largely dependent on how carefully and meticulously this first step is planned and then, of course, implemented. At this stage, the researcher should explain why the research is undertaken in the sphere of art and within the purview of contemporary art, and not in art history, for example, or sociology. (*ibid* pp. 82)

These ideas were further developed in a presentation by Hannula at a seminar in Gothenburg, Sweden, in 2004[2]. At this seminar he pointed out a total of ten aspects of artistic research where the first three aspects are:

A Before. (Where am I coming from?)

B Now. (Where am I at?)

C After. (Where am I going?)

In my interpretation of Hannula's method I look at the first item in the list (Before) as an inquiry into the aesthetics of the artistic work of the researcher and (which I believe is related) perhaps even into trivial details of the personal and artistic background of the researcher. The second aspect (Now) is described by Hannula as the attempt at "contextualising oneself" and it presupposes the 'before'. The 'now' is obviously something that needs to be constantly re-phrased or re-thought. In my project I have been trying to map these 'nows' in my online research diary [Frisk, 2004]. The third aspect (After) presupposes that the first and the second aspects are absolutely transparent, according to Hannula. As I am currently three quarters into the project, it is difficult for me, at this point, to envision any 'after'. I am currently very focused on the 'now,' which is why this third aspect will only be briefly touched upon here.

The aesthetics or the aesthetic theory that leads one to, or forms the context for, the research project is both interesting and, I believe, fairly significant in the field of artistic research. It is not necessarily an explicit aesthetic but rather the contextual background

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[2]The seminar was held as a part of the series "Fria seminarierna", at Gothenburg University, October 20, 2004. The title of Hannula's presentation was "What are we talking about when we we talk about artistic research?"

of the artist that creates a platform on which the investigation can take place. For my particular project it is probably difficult to even begin to understand its relevance until it is seen in the context of my own artistic work.

3   Before

For more than ten years, there have been two significant areas of interest in my musical practice:

1 As an improvisor, I am interested in the dynamic relationship between stimuli and responses. Even when working with composition in a relatively traditional manner (i.e., using musical notation), it is the non-static, or that which changes or evolves, that is at the very core of my involvement.

2 I have worked with the computer in almost all of my artistic work. As an artist I feel a responsibility to explore the world and its artifacts. The computer has become an important part of this world and hence, a part of our culture. In the Western world it is part of daily life and allows for our most basic as well as our most intimate communications. It cannot be placed outside of our culture, nor can it be regarded as merely a tool or a fashionable gadget with a limited import; rather it must be included in our understanding of the world as well as in our artistic explorations.

The basis for my PhD project can be traced back to my difficulties in successfully integrating two different types of music - *improvised* or *open form* music and *computer-music*. For the sake of argument one might make some rough generalizations and move to a more abstract level, calling this a dichotomy between the *continuous* or *analog* on the one hand and the *discrete* or *digital* on the other. The problems I experienced in my practice occurred in the contexts of improvisation as well as composition and resulted in growing artistic frustration. It was my attempt at addressing this frustration that led me to form the current research project.

The problem for me was that I could not achieve the merge between the analog - i.e. the acoustic intruments - and the digital - the electronic instruments. My aim was, and still is, to be able to alter, distort or expand the traditional notion and pre-conception of the sound of the musical instrument; i.e., to introduce a discontinuity between the expected sound and the perceived sound. To achieve this result I use digital sound processing of the acoustic instrument(s), sometimes in combination with pre-recorded and synthesized sound sources. If the two sound sources do not merge successfully, then the desired effect will fail to appear and the perceptual result will be that of two discrete sound sources. This undertaking, along with the wish to explore the computer in the sphere of contemporary culture is in principle an attempt to move past "the 20th century's ambivalent relationship to the technology of machines" [Garnett, 2001]. Having said that we could further generalize the dichotomy above and talk about the *human/machine* relationship; I believe the tension between man and machine is at the very heart of my project.

To use Garnett's words, this is not only an ambivalent relationship, it is also a complex one. He continues:

> The machine did not make the life of the factory worker better, at least not at first. Rather, the worker had to learn to adapt to the pace and consistency of the machine, with sometimes rather unpleasant effects. Part of my contention here is that this view of technology is now no longer relevant. Technology is beginning to empower individuals. (*ibid*)

Garnett brings up a practical aspect of the relationship between man and machine, dating from the early ages of industrialism. I agree that there is a need for an updated view of technology,[3] but even if it is true that technology is empowering the individual, what is the nature of our relationship with technology? Are we comfortable with the tools we have been given? Skepticism towards the machine can be found in many sources. In Derrida's reading of Freud in "Freud and the scene of writing" [Derrida, 1978a] he discusses the Mystic Writing-Pad, a construction that "shows a remarkable agreement with my hypothetical structure of our perceptual apparatus":[4]

> That the machine does not run by itself means something else: a mechanism without its own energy. The machine is dead. It is death. Not that we risk death in playing with machines, but because the origin of machines is the relation to death. (*ibid.* pp. 285)

The machine according to Derrida is dangerous because it is the opposite of life; it is "pure representation" and "never runs by itself" (*ibid.* pp. 286). So far it is difficult to argue with Derrida. But is there no way around this? Is the machine destined to be "complexity without depth"? (*ibid.*) Danish philosopher Peter Kemp argues that Derrida's interpretation of the machine is problematic because it posits a 'technique' (now in the sense of *techne*): a 'technique' that is only problematic in the way we make use of it. According to Kemp, Derrida argues as if the "technological development of our culture did not confront us with an existential inquiry of planning and organisation" [Kemp, 1981, pp. 139]. I find Kemp's idea that we are in fact in control, or at least that we may gain control, of the multiple, co-existing technological systems, to be a very useful one. We can use them and inform them. The machine cannot run by itself but it can run alongside us. It is not merely a tool and part of our 'technique', but may also become a part of our culture. More specifically, if we move to the field of music, our creative intentions and our wish to *play* (in every sense of the word) need to be communicated to the machine in order to integrate it into the larger sphere of (musical) communication. This does not make the machine autonomous in any way - the machine still does not run by itself - it runs by means of parallel representation. This is somewhat closer to Deleuze and Guattari's notion of the war machine that, according to them, can potentially be "an 'ideological,' scientific, or artistic movement" [Deleuze and Guattari, 1987, pp. 466]. But even Deleuze and Guattari choose to call it a "war machine": a machine with a potential power to kill, hence closely related to death.

What then are the issues that have to be overcome in order to move from the idea of the machine as death to the machine as a potential instrument to be included in artistic practice? Derrida's main point is that the machine has no energy and by definition cannot express anything, but can only represent. Could this be related to the reason for my inability to merge the two elements in practice? Let us for the time being move away from abstract philosophy and turn to the natural sciences.

> Digital computers are superb number crunchers. Ask them to predict a rocket's trajectory or calculate the financial figures for a large multinational corporation, and they can churn out the answers in seconds. But seemingly simple actions that people routinely perform, such as recognizing a face or reading handwriting, have been devilishy tricky to program.
> [Copeland and Proudfoot, 1999]

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[3]The term technology is used here to denote the hardware, the machines themselves, and not how they are used - it should not be confused with the Aristotelian notion of *techne*

[4]Freud quoted in [Derrida, 1978a, pp. 280].

This is in essence the reason Derrida calls the machine 'dead'. It can do things that are incomprehensible for a human being but yet it cannot solve routine tasks that we perform on a daily basis. But Alan Turing, who was the first to conceive of the abstract machine that we now refer to as the digital computer, was already beginning to think about connectionist networks in 1947: "Perhaps the networks of neurons that make up the brain have a natural facility for such tasks that standard computers lack. Scientists have thus been investigating computers modeled more closely on the human brain." (*ibid*) And over the last few decades, not only the way we think about computers, but the way computer science thinks about programming, is moving away from an extreme formalism with a focus on the program, towards an increasing attention to the *programmer*;

> [...] from the logical and computational structure of algorithms to the cognitive structures of the people who produce them [the programs]. Innovations such as interactive programming environments, object-oriented programming, and visual programming have not been driven by considerations of algorithm efficiency or formal program verification, but by the ongoing drive to increase the programmer's effectiveness in understanding, generating, and modifying code. [Winograd, 1995]

The interaction between machine and programmer and, eventually, betweeen machine and end user, is the key issue, if the computer is to be fully incorporated in our practice - in our culture and in our artistic expressions. And this interaction must take place on multiple levels. It cannot be simply the tapping of fingers on a keyboard, but also has to move to yet unresolved spheres of action. We need to find ways to navigate the 'de-territorialized,' smooth, nomadic space of the war machine as Deleuze and Guattari refers to it, "a tactile space, or rather 'haptic,' a sonorous much more than a visual space." [Deleuze and Guattari, 1987, pp.421] They discuss this further in the chapter following "Treatise on Nomadology":

> [...] the reinvention of a machine in which the human beings are constituent parts, instead of subjective workers or users. If motorized machines constituted the second age of the technical machine, cybernetic and informational machines form a third age that reconstructs a generalized regime of subjection: [...] the relation between human and machine is based on internal, mutual communication, and no longer on usage or action. [Deleuze and Guattari, 1987, pp. 505-6]

The need is not only to move focus away from the program and towards the programmer but further, towards the *meaning* of the program in relation to the intended context for the program, including the user, and any possible output from it. In the context of the construction of music, the programming of a machine is an artistic endeavour comparable to the preparation of a score for a performer or a group of performers. It is a prescriptive notation meant for the machine as expert interpreter and performer. For this to even begin to be possible, the fear of the machine as a representative of power and/or destruction must be abandoned. Furthermore, great care must be taken to the way in which the flow of information within the man/machine system is understood, since we are no longer talking about a simple sender/receiver information theory system. We are looking at a potentially very complex and continuous system in which we need to allow for concepts such as 'interpretation,' 'multiple meaning,' 'sign' and 'signifier,' 'cultural convention,' etc.

4   Now

If I had a tendency, at the beginning of this PhD study to think of computer/performer interaction as merely a technical problem, the research involved in this study has made me reconsider the question behind the project itself. Through the projects that I have completed, as well as the ones that I am currently working on, I have focused on investigating the experience of interaction between the different agents involved in the production of musical content. In the case of *etherSound*, it was the interaction between the user (and/or listener) and the sound; in the project *Negotiating the Musical Work*, it is between the performer and the composer; and in the composition 'Repetition Repeats all other Repetitions' (for which the collaborative project *Negotiating the Musical Work* is a pre-study), it is between the performer, the score, the computer and the sounds produced by means of the computer. I now believe that it is only through a thorough understanding of the very nature of interaction in the context of musical production, that an artistically relevant and perceivable mapping mechanism between input and output in an interactive system can be achieved. The updated research question now reads: *Can an interactive system that uses the sound as its object of interaction provide the necessary premises for an integration of digital and analog sound sources on the level of both sound (as it is perceived) and performance (as it is experienced), and, furthermore, how can significant features of human/human and human/sound interaction in the context of musical production inform such a system?*

4.1   Main Projects

At first glance, the following selection of artistic works and projects, belonging to the larger investigation of sound and interactivity, may seem disparate or heterogeneous. However, if the focus is placed not so much on the content of each of the projects, but rather on the larger frame within which they exist, i.e., on the premises and outsets, then the projects form a more homogeneous collection of studies. The intention is to create a platform for the investigation of the limits for interaction and sound, and the result is intended to be an artifact of artistic output. Apart from the three projects presented below, a number of improvisations and smaller scale works have been, and will be, produced within my PhD project.

4.1.1   etherSound - an interactive sound installation

etherSound was commissioned by curator Miya Yoshida for her project *The Invisible Landscapes* and was premiered in August 2003 at Malmö Art Museum in the city of Malmö, Sweden. The curatorial concept for The Invisible Landscapes project was the use of cellular phones as a means of experiencing and creating artistic expressions. The principle idea behind *etherSound* came to be an attempt at developing an instrument that can be played by anyone who knows how to send an SMS (Short Messages Service) from a cellular phone. In the version displayed at *The Invisible Landscapes*, all messages sent to a specified phone number were received by an Internet server, parsed for its content as well as the phone number it was sent from and the date and time it was received. This information was written into a database which was queried at regular intervals by a computer running a control as well as a text analysis application (written in Java [J2SE 1.4.2, 2004, J2EE 1.4.1, 2004]), with sound-synthesis software (Max/MSP [Zicarelli, 2001] running a Csound orchestra [Boulanger, 2000]). For every new message, the data was downloaded, processed and analyzed by the control program, and turned into control signals, which were then sent to the sound-synthesis engine. Every message generated one sonic object that would last for up to two minutes. The response was very direct with a clear causality between the input and

the output of the system - a received SMS would result in an immediate and perceivable change in the sound (see `http://www.henrikfrisk.com/index.jsp?metaId=music&id=music&about=1&field=name&query=etherSound` for some audio examples).

There are two states in which *etherSound* may operate. One is as a stand-alone, interactive sound installation and the other as a vehicle for improvisation. In the latter, one or several performers improvise along with the sounds of the installation while the audience contribute actively to the performance by sending text messages. *etherSound* is an investigation of some of the aspects of interaction between the listener, the sounds created and the performing musicians, and also of the formal and temporal distribution of the music that this interaction results in [Frisk and Yoshida, 2005, Yoshida, 2006, Frisk, 2005].

etherSound also has significance in relation to the discussion of the man/machine relationship, described above. Perhaps the mobile phone is one of the machines of recent years that humans have most successfully and naturally integrated in their lives. Furthermore, although the traditional roles of the agents involved in the production of the music in *etherSound* were shifted or distorted, there is no doubt that the programming, i.e., the actual code that constitutes the synthesis and the control program, is the score - if a score exists at all. In any event, these programs contain the only apparent work identifying instructions, to use the language of Stephen Davies [Davies, 2001]. When technology is put in the center in this way, the *technique* (in the broad sense of the word) that is required of the user/listener is of a different kind. Traditionally there is an intimate connection between social class, level of education and cultural interests [DiMaggio and Useem, 1978, Bourdieu, 1979] which affects cultural consumption. Despite the fact that the connection between social class and mobile phones is likely to be of a different nature than that between social class and arts consumption, interactivity and collaborative art in themselves may help to counteract the exclusiveness of contemporary art and music. Perhaps it can contribute to creating conditions for classless and unprejudiced participation in the arts without compromising the content and the expression. Roy Ascott, in addressing the issue of 'content' in art involving computers and telecommunications writes:

> In telematic art, meaning is not something created by the artist, distributed through the network, and *received* by the observer. Meaning is the product of interaction between the observer and the system, the content of which is in a state of flux, of endless change and transformation [Ascott, 1990].

Following this line of thought, it may be concluded that the need for a thorough insight into the history of art or electronic music is no longer a prerequisite for understanding a collaborative, interactive work of art. This limits the advantages of the educated listener and makes room for new interpretations of the term 'understanding' in the arts.

4.1.2   Negotiating the musical work.

I am undertaking this project, which is not yet completed, in collaboration with guitarist Stefan Östersjö. It consists of three distinct parts:

1 Empirical analysis of composer-performer interaction.

2 Application of the resulting data from the empirical analysis in the composition of a new work for guitar and computer for Stefan Östersjö ('Repetition Repeats all other Repetitions').

3 Assessment of the research and comparison of the analysis and the different versions (performances) of 'Repetition Repeats all other Repetitions'.

Primarily, we discuss the musical work prior to its ultimate notation and prior to its performance; we discuss the musical work within the context of Western 'art music' tradition, in which musical notation has an ontologically crucial function. The study deals exclusively with music for solo instrument and live electronics. Our purpose is to acquire a deeper understanding of the underlying processes in the communication between the composer and the performer as well as their respective roles. Through an improved understanding of the musical interaction between the two parties involved in the creation of the work, we also hope to better understand the necessary conditions for a successful interaction between the performer and the electronics. We have developed a hybrid method of investigation, which involves musical semiology, qualitative method involving hermeneutics, and verbatim transcriptions of the video documentation.

Musical semiology has been constructed with the intention of providing tools for analytical understanding of the musical work in its entirety - not only in terms of analyzing formal structures or details in the construction of the work, but also examining its socio-cultural context. Attempting to move to a more basic level of organization than that of musical notation may help to further clarify the issue in relation to a wider sphere of knowledge. For the analysis of the composer/performer interaction we used the tripartite model suggested by Nattiez and Molino:

> ...recognizing, elaborating, and articulating the three relatively autonomous levels (poietic, neutral and esthesic) facilitates knowledge of all processes unleashed by the musical work, from the moment of the work's conception, passing through its 'writing down', to its performance. [Nattiez, 1990]

In short, according to Nattiez the *poietic* phase is the complex series of activities that are part of the construction of a musical work, the *esthesic* phase is the reconstruction of the message and the *neutral* level is the trace left by the poietic (or the esthesic) processes.

The conclusions we draw from the first stage of the study, which has many implications for both the second and the third phase, is that both the creative and interpretative activities oscillate between poietic and esthesic processes. Taken in this context, in *etherSound* for example, one may dispute whether one can talk about *a single work* as an ontological unit or even *a single originator* in the role of 'composer.' We also found striking examples of creative misunderstandings between the agents involved in the collaboration which led us to the perhaps somewhat exaggerated conclusion that, in communication noise is not a problem. As has already been mentioned, we are used to thinking of a computer-based interactive system as a cybernetic system in which information is transmitted from point A to point B, and where great care is taken to avoid noise in the transmission. In our joint project we will attempt to avoid the kind of binary oppositions that require a clean control-signal path (such as the pressing of a pedal) in the design of the interactive system. Obviously this will also affect the way the instrumental part is written.

4.1.3   timbreMap - an audio analysis software for tracing relative timbre changes.

timbreMap is a software development project that attempts to allow for direct interaction with sound itself rather than with an abstract classification of sound. This is the part of my doctoral project that I was initially inclined to look at as the central goal. I have already referred to my growing frustration with the way in which the tools available to me for letting a computer interact with a performer in real time did not satisfy my needs as a composer. One example of a widely-used tool in electroacoustic music with live instruments is something that is referred to as "pitch-tracking". What this process attempts to achieve is the transformation of a (monophonic) audio signal into discrete pitches. Aside from the fact

that this is a difficult task, the information gleaned by this system is only useful if the pitch class representation is a meaningful and substantial parameter in the intended totality of the musical output. In much of my music it is not.[5] With *timbreMap* I have attempted to construct a system that uses self-organizing feature maps and chained neural-networks to track the relative change of timbre in an audio stream and make this information available for interaction. As was mentioned above, 'connectionism' or neuron-like computing is in itself a move away from the binary representation of numbers, approaching what may be called an attempt at modeling continuous processes. It is a special purpose machine that is closely linked to the artistic enterprise that created the need for it. In that sense, although in a more abstract way than the programming of *etherSound*, its code is part of the notation of the possible pieces it may give rise to.

In the time that has passed since I started my doctoral project I have come to realize that, although *timbreMap* is a big part of the totality of my project, both in terms of time invested and its significance to the whole, its most intriguing aspect may be the mapping of the output of the system and the musical stimuli to which it gives rise. The mapping must be related to large-scale empirical studies, such as those mentioned in this article, but also has to be tested in the specific case-studies. From *etherSound* I learned that successful mapping involves a certain amount of pedagogy - knowledge creates anticipation and expectation. The studies performed within the project *Negotiating the Musical Work* opened up the idea of the 'creative misunderstanding' and a semiological analysis of the communication within an interactive system.

5   After

5.1   Artistic research and its methods

Artistic research is a much-disputed activity. Does research performed within the realms of artistic practice fulfill the fundamental requirements of research in general, whether within the natural or human sciences? That question is discussed in detail by Henk Borgdorff in this issue and I will not in this article attempt to defend the *raison d'être* of my own research project. However, for the sake of argument and perspective, I would like to begin a short discussion on the methods used in my artistic research project by referring to Freud's dream of a scientific psychology succinctly described by Peter Kemp [Kemp, 1981, pp. 29]. Freud argued that *no* science can be or become science by building on clear and sharply defined fundamental concepts, but that any science has to begin with a description of phenomena that may then be grouped, ordered and put into context. The fundamental concepts of the science are developed afterwards. Freud's line of thought in "Grundbegriffe der Wissenschaft" is summarized by Kemp as a four-step process in the development of a new science (*ibid* pp. 30):

1 Description of material.

2 Use of abstract ideas based on this material.

3 Creation of fundamental concepts.

4 Definition of the fundamental concepts.

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[5]Please see `http://www.henrikfrisk.com/index.jsp?metaId=music&id=music&about=1&field=name&query=Insanity` for an example of an improvised piece in which pitch has no significance from a structural point of view.

Not only is there a lack of general terminology in the field of electroacoustic music or computer music,[6] there is also a lack of methodology and terminology in the field of artistic and practice-based research. In my own project, I am at the second step in the list above; I am using abstract ideas based on the material, and I have begun to consider the creation of the fundamental concepts for my work.

Further, the primary method I am using is that of artistic practice. But it is not the only method. In the projects presented above, the practice as the method was a point of departure. In *etherSound*, the investigation of the interaction between the user/listener and the sound in the production of musical content was carried out in the form of a sound installation that functioned as a vehicle for public participation. As it turned out, the development and the design of the software for the interface required a fairly standard scientific method rooted in information theory. On the other hand, in *Negotiating the Musical Work*, although the intended result (i.e., the composition 'Repetition Repeats all other Repetitions') can in one sense be said to be the method, we soon realized the project needed a much firmer methodological framework. As has already been mentioned we developed a hybrid method for the analysis of the case studies. In *timbreMap*, both *etherSound* and *Negotiating the Musical Work* are part of the method, as well as a hybrid of semiology and information theory.

In all three cases the research method was developed as a result of initiating the artistic process - the artistic work led the way to the method(s) with which the problems, as they appeared in this process, could be resolved. Furthermore, in all three cases the method or methods chosen were well known within closely related disciplines (musicology, sociology, computer science, etc.). I would argue that this is a relevant methodology for artistic research: to let the needs that arise within the artistic practice yield the method.

Going back to the research question: *Can an interactive system that uses sound as its object of interaction provide the necessary premises for an integration of digital and analog sound sources on the level of both sound (as it is perceived) and performance (as it is experienced), and, furthermore, how can significant features of human/human and human/sound interaction in the context of musical production inform such a system?* In what ways will I be able to answer this question and what will be the significance of this answer? In this article I have allowed myself to move rather freely between generalized philosophical reasoning and specific cases. The context and the musical sphere I am working within is, however, that of contemporary Western improvised and composed music and it is in relation to this field that the results of my work will primarily be of interest. The study of different forms of interaction between musician and computer is an active research field in the computer music community and there has been a growing interest in the sound itself over the last few years. I believe that the great strength of artistic research in general (and I hope that this will be true of my project as well) is that the research is informed by the artistic work. For my project this means that subjects traditionally belonging to the realm of natural sciences, such as sound analysis, can now be informed by the values of an artistic practice, which in turn may lead to potentially very different results as compared with more traditionally-oriented research. At the risk of sounding evasive, I believe that newly posed questions will be just as meaningful a response to the research question as a clearly defined 'answer.'

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[6]Recently the EMS 2006 conference was dedicated to the subject of language and terminology in the field of elctroacoustic music. There is no consensus even for the name of the genre itself [Battier, 2006].

References

[Ascott, 1990] Ascott, R. (1990). Is there love in the telematic embrace? *Art Journal - Computers and Art: Issues of Content*, 49(3):241–247.

[Battier, 2006] Battier, M. (2006). Ems 2006. Website. `http://www.ems.dmu.ac.uk/ems06/`.

[Boulanger, 2000] Boulanger, R., editor (2000). *The Csound Book, Perspectives in Software Synthesis, Sound Design, Signal Processing and Programming*. MIT Press, 2 edition.

[Bourdieu, 1979] Bourdieu, P. (1979). *Distinction: a social critique of the judgement of taste*. Harvard University Press. Translation by Richard Nice.

[Copeland and Proudfoot, 1999] Copeland, B. J. and Proudfoot, D. (1999). Alan Turing's forgotten ideas in computer science. *Scientific American*, 4:77–81.

[Davies, 2001] Davies, S. (2001). *Musical Works & Performances: a philosophical exploration*. Oxford: Clarendon Press.

[Deleuze and Guattari, 1987] Deleuze, G. and Guattari, F. (1980 (1987)). *A thousand plateaus - Capitalism and schizophrenia*. University of Minnesota.

[Derrida, 1978a] Derrida, J. (1978a). *Freud and the scene of writing*, pages 246–92. in [Derrida, 1978b].

[Derrida, 1978b] Derrida, J. (1978b). *Writing and difference*. Routledge & Kegan Paul Ltd.

[DiMaggio and Useem, 1978] DiMaggio, P. and Useem, M. (1978). Social class and arts consumption: The origins and consequences of class differences to the arts in america. *Theory and Society*, 5(2):141–161.

[Frisk, 2004] Frisk, H. (2004). Research diary. Web resource: `http://www.henrikfrisk.com/diary/`.

[Frisk, 2005] Frisk, H. (2005). ethersound - an interactive sound installation. In *Spark festival of electronic music and art*, pages 42–45. University of Minnesota. See also `http://www.henrikfrisk.com/index.jsp?id=docs`.

[Frisk and Yoshida, 2005] Frisk, H. and Yoshida, M. (2005). New communications technology in the context of interactive sound art: an empirical analysis. *Organised sound*, 10(2):121–127.

[Garnett, 2001] Garnett, G. E. (2001). The aesthetics of interactive computer music. *Computer Music Journal*, 25(1). The MIT Press.

[Hannula, 2002] Hannula, M. (2002). The responsibility and freedom of interpretation. In Kiljunen, S. and Hannula, M., editors, *Artistic Research*, pages 73–88. Academy of Fine Arts, Helsinki.

[J2EE 1.4.1, 2004] J2EE 1.4.1 (2004). *Java Enterprise Edition, API Specification 1.4.1*. Sun, `http://java.sun.com`, 1.4.1 edition.

[J2SE 1.4.2, 2004] J2SE 1.4.2 (2004). *Java Standard Edition, API Specification*. Sun, `http://java.sun.com`, 1.4.2 edition.

[Kemp, 1981] Kemp, P. (1981). *Døden og maskinen*. Rhodos, København.

[Nattiez, 1990] Nattiez, J.-J. (1990). *Music and Discourse - Toward a Semiology of Music*. Princeton University Press. Translation by Carolyn Abbate.

[Winograd, 1995] Winograd, T. (1995). From programming environments to environments for designing. *Communications of the ACM*.

[Yoshida, 2006] Yoshida, M. (2006). *The Invisible Landscapes*. PhD thesis, Malmö Academies of performing arts, Lund University, Sweden.

[Zicarelli, 2001] Zicarelli, D. (2000/2001). *Max/MSP Reference Manual*. Cycling 74, IRCAM, `http://www.cycling74.com/products/maxmsp.html`, 4.2 edition.