Bridging opposites

understanding computer-based free improvisation

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Introduction

At the time when I arrived at Sonology, about three years ago, my musical endeavors had been more or less equally distributed between composition and performance, the latter oriented mainly towards what is commonly known as free improvisation. I had studied instrumental composition and classical guitar, premiered several ensemble and choral works, and played in various groups and ensembles. Simultaneously, I had begun an auto-didactic study of computer music. From the very beginning of this self-training period, I intuited that computer music could serve as an intersection of my musical activities, bridging apparently opposite ways of approaching —both as listener and maker— music, broadly subsumed under the pairs of (1) composition and improvisation, (2) politics and aesthetics, and (3) individual versus collective musical creation.

After three years of experimentation, I am able to say that, to a large extent, my original intuition has indeed proved to be a fruitful direction for artistic exploration. This, obviously, has had consequences for the distribution of my musical activities, and at the moment I find myself almost exclusively engaged in designing, improving upon, and freely improvising with computer-based musical instruments in a variety of environments, from solo to large ensemble settings.

This thesis is the direct result of the reflections derived from such a commitment, and pivots around the identification of distinct qualities and methods in the practice of computer-based free improvisation. Therefore, it seemed appropriate to group the chapters of this essay into three sections, describing the issues surrounding computers and improvisation in sections I and II, before describing my personal solutions to bridging these «technologies» in section III. However, in practice this differentiation of the text is by necessity superficial, since my discussion of computers is inevitably oriented towards a definition of these as instruments suitable for improvisation, while the section on improvisation gradually fo-

cuses on the peculiarities of using computers in contexts of freely improvised music.

Another factor of importance in the distribution of the text is based on the presentation and discussion of the three above-mentioned dichotomies. If they permeate the prose of the text throughout, instead of being associated with specific sections or chapters, it is because, either as dialectical tensions or compatible concepts, I regard them as constituent of the praxis of computer-based free improvisation, and therefore as valuable tools for understanding what the essence of this practice —if any— could be.

To summarize, the contents of the thesis are as follows:

In the first section, *Computers*, I discuss several particular attitudes towards computers as music-making devices, concentrating on their constitutive and performative use, correspondingly separated into two different chapters:

- In *The Computer as Musical Medium* (chapter i) I explore the analogy between musical notation and computer programming, attempting to broaden the meaning of musical composition to the extent that it could include improvisation as a genuine approach to music creation with computers, for which activity I consider concepts such as practice and skill.
- In *Computers as Theatre* (chapter ii), on the other hand, I recall the Benjaminian notion of «aura» in order to present and evaluate various solutions to the problem of musical performance with computers.

The purpose of this section is to establish a general context in which to think about computer-based improvisation as an activity differentiated both from algorithmic composition and instrumental improvisation. This could eventually be condensed into the hypothesis that a computer-improviser makes use of the computer in three characteristic ways, identified with three differentiated moments, from (1) the design and composition of the musical tools and processes to be used, through (2) the «instrumental» practice with them, to (3) the music-making process itself, which as freely improvised music will normally be identified with public performance.

The second section, *Improvisation*, gives an account of the contexts in which freely improvised music occurs, and examines how computer-based improvisation could fit into this environment:

- *Context of Thought* (chapter iii) begins with a brief explanation of Jacques Rancière's theory about the relationship between aesthetics and politics (terms whose scope will also be defined). Since Rancière hardly speaks about music, not to mention improvisation, he provides an external perspective from which to examine essentials of free improvisation as a specific mode of music-making, the final goal of the chapter.
- Along the same lines, *Context of Action* (chapter iv) deals with specific issues derived from the application of computers in free improvisation, questioning the extent to which computers may either expand the potential or weaken the fundamentals presented in the previous chapter. I discuss two different perspectives, under the generic classification of «player-dependent» and «player-independent».

The third and last section, *Solutions*, reports the results of the two approaches to computer-based improvisation that I developed in the course of the last few years: The *Modular System* (chapter v) and *MISS* (chapter vi). These systems constitute the very origin and ultimate reason of this research, since most of the opinions expressed in the first two sections of this dissertation came as elaborations on the conceptual, practical and aesthetic problems which arose while designing, practicing and performing with these systems.

For the sake of completeness, the Appendices present a description of all *MS* modules (A) and *MISS* control parameters (B), a list of all the performances in which the reported systems were utilized (C), and an index of the musical examples contained in the accompanying DVD (D).

Disclaimer: when writing in the third person singular, a masculine pronoun is used throughout the thesis in order to avoid constructions such as «he or she», «his or her», for the sake of concision. I apologize beforehand for any discomfort caused by this solution.

I. Computers

i. The Computer as Musical Medium

According to the Oxford American Dictionary, a medium is both an «agency or means of doing something» as well as «the material or form used by an artist, composer or writer». These two definitions suggest that the computer, as a medium for improvised music creation, represents a non-simultaneous double medium (I write «non-simultaneous», for a simultaneous medium would be complex, but not double in nature). Both as material and agency, computers serve to formulate the conditions in which music —sound— will occur and, at a later stage, to realize «instrumentally» the music within the defined constrains.

Think, for example, of a computer-engaged composer who designs an algorithm whose results are afterwards transcribed for acoustic instruments. These acoustic instruments are the second medium —the agents— through which the computer-mediated score is realized. If, for a different piece, he decides to work within the realm of computer-generated sounds, the piece will usually be rendered to a sound file for later reproduction, either through a hi-fi system, a multichannel setup, or a specific space or installation, therefore passing over the «instrumental» medium. Some would argue that the latter example is preferable, since the less media in the communication chain, the clearer the original message. However, it could also be argued that rooms and loudspeakers are in fact the «instrumental» media of pure electronic music —and indeed they are. In that sense any piece of music (electronic, acoustic or mixed media; composed or improvised; played in any place with any equipment) has an instrumental medium.

In contrast to these examples, the improviser working with computers finds himself in the middle —medium— between two practices, between music composi-

tion and music improvisation, between design and use, between being «luthier» and player; in summary, between the practices of music creation inside and outside of time. As expressed in the introduction, I propose this to be a distinctive quality of computer-improvisers compared to computer-engaged composers and instrumental improvisers.

Formalization

There is no musical tradition that escapes systematization in one way or another, since it is only through systematization that tradition itself can be recognizable and established. Eastern cultures, for instance, have refined their musical systems through centuries of primarily oral tradition. On the other hand, the advent of musical notation in the West, about ten centuries ago, has favored the emergence of a specific approach to music-making, by relieving memory, facilitating rational and symbolic associations through visual representation, and eventually loosening the musical imagination from the voice and the ear. After ten centuries of written music, this particular method is nearly the only one referred to as music composition in the Western world, thereby excluding musical crafts not based on notation —such as improvisation— as valuable and legitimate tools for musical discovery and invention.

However, towards the mid 20th century Western composers began to explore the idea of a compositional system as something individual, unique and distinct from other musical systems (in addition to the musical works), or with different words, the idea of the compositional system as a creation. As a matter of fact, this happened as a side effect of the dodecaphonic technique. Thereafter, several composers realized that, instead of composing within a system invented by others, they could extend the serial approach through various personal idioms (Stockhausen); refuse the idea of music as an «organization» of sounds (Cage); borrow formalizations from other disciplines or invent their own (Xenakis); develop distinctive procedures based on different musical parameters or inspired by musical systems from non-Western cultures (Ligeti), or write in the absence of a «conscious» system by means of empirical experimentation and improvisation (Scelsi). This is what Jacques Attali intimates in the following paragraph:

> The gigantism of Romantic Music announces and makes possible the end of this code [the functional tonality] as a tool for musical ordering. Later, the serial code, the last formalization of nineteenth-century determinism, was explored and then collapsed, liberating aleatory music. After that, there is no longer any scale or dominant code. Every work creates its own linguistic foundation, without reference to fundamental rules. (Attali, 1985, p. 34)

Nonetheless, two general directions can be observed in the development of Western concert music since the 1950's, even in the absence of a dominant code:

- The «systematic» approaches born out of the serial school (either as continuations or objections), which ultimately will tend to «formulate» both new systems and new music composed with such systems (Koenig, 1971).
- The «experimental» approaches, heralded by John Cage, in which music is not regarded as a methodical organization of musical signs (Cage, 1961), but as an activity demanding diverse empiricist attitudes.

From a systematic perspective, the composer's task is to formulate a series of rules and conditions in which one or more compositions will be subsequently developed. In this sense at least, computers demand from composers a systematic approach since, as Döbereiner has expressed, they require «a formal and unambiguous formulation of procedures» before they can realize a composition's final form, which necessarily «leads the designer of a system or a composer working with the computer to a conscious thinking about his or her work flow and an abstract reflecting on compositional methods» (Döbereiner, 2008).

Electronic music (*Elektronische Musik*), to an extent, released the serialist school from notation (that several electronic pieces were notated is today of musicological interest, but was never a musical necessity), just as graphic scores freed to an extent the experimental tradition. In any case, both strategies succeeded in directing attention away from the score and towards «abstract» sound, unattached from a physical origin (in electronic music) and towards the performer (in experimental music). Computer music, on the other hand, draws the attention towards the abstract processes of music composition. Instead of reintroducing the issue of notation through the metaphor of programming, it somehow destroys it, since a computer program is best explained as the description of a process. In that sense, notation as a set of instructions appears more comparable to sound registration:

> In contrast to earlier methods of representation in music, i.e. notation, the computer shifts interpretation from the product-oriented music notation to process-oriented programs; notation and production method merge in a work process featuring a cyclical interaction. (Döbereiner, 2008, p. 15)

This is one sense in which algorithmic composition could be related to improvisation, insofar as they both deal with issues of form as potential, and besides the fact that they may both lead to fixed forms by means of a score or sound registration. This *potential of form* in algorithmic composition is presented by Vaggione as follows:

> A (musical) system of symbols can be formally structured […] without being completely formalized, the last case arising, strictly speaking, when all non-defined symbols present in the system are properly enumerated. (Vaggione, 2001, p. 56)

Two possible interpretations of this passage are possible. The first is that complete formalization of a system is not a musical goal in itself (this calls to mind Borges's *La Biblioteca de Babel*), since music «cannot be confused with (or reduced to) a formalized discipline» (Vaggione, 2001). But secondly, it suggests that a strategy should be found to explore the system and to enumerate many, if not all, of its possibilities. Such possibilities, though not necessarily musical, should be regarded by the composer as potentially musical. In developing a strategy to explore the inherent potentials of form in a system, the composer develops an *instrument of composition*, with which one or several pieces could be eventually composed.

One way forward, however, is to consider the system —the instrument— as the composition itself, and give up the idea of fixed compositions, thereby identifying each sonic materialization (the result of a different iteration of the algorithm) with a performance; with a unique moment or configuration. This approach is in fact very similar to that of free improvisers.

I will summarize the approaches I have outlined so far: to consider a system as a musical instrument; to regard a musical instrument as a composition, and to think of a musical composition as a performance. These are for me the most intriguing possibilities for music creation today, since they suggest a paradigm in which:

- Computer-designed pieces can be realized uniquely in every performance, rather than fixed into a medium for later reproduction. Moreover, since presumably not

all possible outputs of the system will be of equal interest to the composer, he can compose his pieces during the performance, modifying the parameters and conditions of the system independently or in collaboration with other composer-performers, or even with the audience.

- In such context, improvisation becomes the preferred method of music creation, since it constitutively stresses the importance of an action/perception feedback loop —probably the most prominent skill of an improviser— in driving performance/composition. For this purpose, a period of experimentation and practice is needed.
- Lastly, the live musical process facilitates direct communication with the audience, for the creation and reception of the work shares the same time and space.

Instrumentalizing Composition

Instrumentalizing compositions probably has as many advantages for the composer working in the studio as for the performer of live computer music. As Chadabe has pointed out,

> interactivity qualitatively changes the nature of experimentation with compositional algorithms: the effect of different control variable values on the sounding output of the method can be perceived immediately, even as the variables are being manipulated. (J. Chadabe, quoted in Rowe, 1993, p. 2)

For the composer working in the studio, «interactivity» introduces the possibility of experimenting with algorithms on the fly (tuning coefficients, modifying conditions, etc) with immediate or almost immediate sonification of the results. This convenience, foreseen by G. M. Koenig more than thirty years ago, must certainly enrich the experiences of composers in contemporary studios, since it facilitates direct experimentation with both sounds and structures:

> Today, the composer who wants to work with preconceived structural ideas mostly uses his desk for that —not necessarily wanting sound immediately— but rather to put certain features, certain characteristics, certain items in certain configurations. But I could imagine a stage in which a computer would respond not only with sound but also with structures with such speed that the composer could have as many compositions to

> consider in real-time as he's now able to consider sound characteristics. (Roads, 1978, p. 15)

That vision is beginning to be realized: given that the current size and computational speed of computers now permits real-time algorithmic composition on stage, it is possible to «merge the acts of composing and performing». This particular definition of free improvisation (Munthe, 1996) suggests, as I've already noted, that improvisation might be an excellent method for the live exploration of computer-based musical systems, even if the act of composition in improvised music lies outside the systematic approach I am describing. To facilitate such exploration, however, the composer must first become a special kind of luthier —and in a later stage a special kind of instrumentalist— since probably the greatest divergence with interactive studio composers lies in the way in which communication between human and computer is designed. For an improviser, in particular, this design should take into account issues such as (1) simultaneous multi-parametric control, (2) coherence of response, i.e., ensuring that the system reacts in similar ways to similar actions, and (3) the limitation of the available parameters to those considered musically meaningful. The importance of this stage of development is underlined by Michel Waisvisz in the following excerpt:

> I believe the algorithm for the translation of sensor data into music control data is a major artistic area; the definition of these relationships is part of the composition of a piece. Here is where one defines the expression field for the performer, which is of great influence on how the piece will be perceived. (Waisvisz, 1999, p. 4)

When we think of traditional musical instruments, a set of generic properties can be easily traced with respect to their modes of interaction and sound production. We could say in very general terms, that musical instruments are (1) mechanical devices that (2) respond to concrete manipulations by a human performer in order to activate the physical mechanisms of the instrument (vibration of strings, bodies or air columns) which (3) produce sound. We could also observe that, in general, they require some degree of (4) technical refinement in order to achieve musical results, or at least, that results are expanded in proportion to refinement.

But since computers as music-making devices deviate from the generalization of instruments as mechanical machines, the designer of a computer-based music instrument must choose between simulating physical behaviors and imagining/

formalizing operations not necessarily linked to physical reality (a connection which is, ultimately, the task of the loudspeaker) in order to produce sound. In no instance, in computer-generated music, is there a necessary relationship between physical action and sound. Though designing such a relationship in order to confer a computer with «instrumental» qualities may be justified, other designs not based on metaphors of physical excitation, mechanic response or the «one gesture one acoustic event» model may lead to more genuine results. As Jordá proposes,

> Of all the possibilities that digital instruments present, we will focus on those that are likely to break the «one gesture one acoustic event» archetype, and surpass the sound and note control level in order to embrace new musical models and paradigms. (Jordá, 2005, p. 54)

This issue should at least make us reconsider the notion of skill in relationship to computer-based instruments. A finely developed capacity for mathematical abstraction or versatile programming abilities might replace or supersede fine motor synchronization and physical accuracy. In any case, skill will always be a direct consequence of practice. I regard practice as a necessity in order to identify oneself with the sonic results and to take responsibility for them, especially if the final goal is to improvise within the system. In that sense, the notion of practice is just as important as that of instrument design.

One particular difficulty in defining practice in the domain of computer-based musical instruments, especially if the roles of designer and performer converge upon the same individual, is that the «instrumentalist» may modify and improve his instrument constantly. There is the ever-present temptation to address musical limitations by adding new functionalities or re-programming. Waisvisz opines:

> If you are in the position to be able to design and build your own instruments, and so many interesting technologies pop up almost weekly, you are tempted to change/improve your instrument all the time. This adds another conflict: you never get to master your instrument perfectly even though the instrument gets better (?) all the time. (Waisvisz, 1999, p. 3)

Indeed, one could view the constant rearrangement of the system as a legitimate, specific type of practice in itself, resulting in skills common to many computer-based instrument designers and performers. In contrast, I believe that the computer performer must accept the limitations imposed by a given system in order to awaken his musical imagination. This is, in my opinion, the only way to

achieve the degree of control and responsibility required by freely improvised music.

In conclusion, I believe that, in the act of practice through playing, the computer serves as a non-simultaneous double medium (as previously discussed), for after formalizing and designing the musical process, it becomes the «instrumental» agent for the realization of the music on stage, the true home of improvised music. In this sense at least, systematic and experimental approaches to music creation, though generally appearing to confront each other, meet in the idea of computer-based improvisation.

ii. Computers as Theatre

> I can take any empty space and call it a bare stage. A man walks across this empty space whilst someone else is watching him, and this is all that is needed for an act of theatre to be engaged. (Brooks, 1968, p. 9)

> With the arrival of affordable machines powerful enough for real-time audio processing, and of new powerful audio-processing software […], the laptop became a performance instrument. (Jordá, 2005, p. 402)

The juxtaposition of these two quotes is intended to suggest a way to interlace the notions of «performance» and «computer music», since it is within these (perhaps arbitrarily restricted) concepts that «live computer music» is thought of, criticized and imagined at present.

«Live computer music» could not exist as such until the mid-1970's, when affordable, general purpose microcomputers became available. Since then, the computer has gained a prominent role in almost all kinds of contemporary music today, both through the development of MIDI in the 1980's and the proliferation of software synthesis programs from the 1990's onwards.

The notion of «live computer music» today is somewhat vague, since considerations of genre or style aside, it potentially embraces different practices such as network performance, live algorithmic composition, reactive and interactive com-

puter music systems (with various degrees of interactivity and «intelligence», from hyper-instruments to machine-improvisation), live sound-processing, and live coding. But it is precisely the vagueness of the term which brings to the fore the essential, common characteristic of all these approaches: the necessity of «theatre».

Any performer, be he musician, dancer or actor, must be aware of the fact that his art happens «in the theatre» —on stage. A theatrical work must encompass and be understood through the time and space in which the artist, his work, and his audience are engaged. Hence, in this sense, any studio work prior to the performance (programming, editing, recording, rehearsing, etc.) should be regarded as preparation, rather than as the work itself. This is at least necessarily true from the perspective of a computer-improviser, since free improvisation involves a higher degree of identification between the acts of creation and performance than any other approach to music creation.

Consequently, as soon as computers as music-making devices are introduced on stage, we must consider their «theatrical suitability», since this may help or distract from both the creation of music and its reception. To what extent must we adopt new scenic codes (and avoiding the stage must be considered a decision in this sense) and to what extent should we refuse or adopt inherited codes from instrumental music? My analysis of this question starts by localizing the potential differentia of this use in the Benjaminian concept of «aura» before discussing several proposed solutions.

Aura

> Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be. […] One might subsume the eliminated element in the term «aura» and go on to say: that which withers in the age of mechanical reproduction is the aura of the work of art. (Benjamin, 1968, pp. 220-221)

This excerpt from Walter Benjamin's 1936 seminal paper *The Work of Art in the Age of Mechanical Reproduction*[1] defines the notion of «aura» in relation to a work of art as that which constitutes it uniqueness («the characteristic construction of its intimacy», according to Lachenmann (2005), who names the concept as one of the four fundamental aspects of listening). An aura is imitable indeed, because through reproduction a comparable, but distinct aura arises from the conditions surrounding the copy —a new original. However, an aura can never be mechanically reproducible, since that would entail the impossibility of differentiating between the copy and the original (this impossibility is clear if we think about photography or cinema, which is exactly what he is doing), hence destroying the uniqueness —the aura— of the work of art.

Written music —as well as script-based theatre— represents an interesting case in the constitution of an aura in the Benjaminian sense. While aura is hardly contained in the score (which in itself is mechanically reproducible unless manuscripts were considered musical works themselves, something not contemplated in my interpretation), there is still some «auratic» element representative of the conditions in which the piece was conceived and written (time, space, cultural milieu, spiritual state of the composer, etc.) over which the interpreter discloses the actual aura of the work in performance. Therefore, if the aura of a notated piece of music is seen as a shared creation between the composer and the performer, the score could be regarded as a set of instructions to generate —emanate, if you prefer— a specific aura, which will be as different and unique as each of the performances in which is «recalled», and thus would allow the audience to identify the piece as «the original» every time it is played.

In contrast, recorded sounds or music lack, in the purest Benjaminian sense, an aura. Just as a photograph of a car is not a car, so a recording of a violin, for example, is clearly not the sound of a violin, and thus it can be reproduced infinitely, regardless of the conditions of its primary and unique execution, at the price of having lost its aura. This is one of the senses in which the following variation on Benjamin's text could be interpreted:

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1 I had rather translated «mechanical reproduction» as «technological reproducibility», closer to the original title in German (*Das Kunstwerk im Zeitalter seiner Technischen Reproduzierbarkeit*), since mechanical reproduction has been replaced long ago by digital reproduction, whereas the text still may show currency in other respects.

> Even the most perfect representation of laptop music is lacking in one element: its unique existence at the place where it happened to be created. (Cascone, 2006, p. 88)

Even if Kim Cascone is only referring to «post-digital» music (Cascone, 2000), that is, sample-based music particularly focused on the digitization of sound and the errors and distortions this process may introduce, this statement could be extended to all kinds of recorded music, either registrations of physical sounds or music (having an existence independent of the fact of being recorded) or «tape music» (created specifically for the «technological» medium), since in both cases there is no correspondence between the circumstances of creation —registration— and reception of the work. In order to avoid ambiguity, Cascone could have written: even the most perfect registration of sound is lacking in one element…

Nevertheless, he deliberately —and ambiguously— uses the term «representation» to bring the discussion about aura to a different arena, for he is not interested in sound representation as such, but in the Latin notion of «representatio», which literally means «performance»:

> The use of spectacle as a solution to the lack of visual stimuli only works to reinforce the confusion of authenticity and aura and hence the stereotype of the laptop. (Cascone, 2006, p. 89)

Therefore, he misinterprets the Benjaminian notion of aura subsuming under this term the modes in which live music is «represented» (performed before an audience), and thereby equates the lack of aura to the lack of scenic codes in the particular kind of live computer music he calls «post-digital music». He localizes the problem on stage (a performer sits motionless behind a computer playing samples of music recorded somewhere else before an audience, which ultimately feels cheated by the lack of spectacle); accepts its consequences (arguing that using obsolete modes of music «representation» —think, for instance, of opera or rock concerts— to enhance and dignify a new type of performance is counterfeit); and pretends to find a new aura in the presentation (no longer representation) of the distance —something like a Brechtian *Verfremdungseffekt*[2]— between different times and spaces only made possible by technology. He therefore completes the inversion of the original notion of aura:

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2 Often translated to English as «distancing effect» or «alienation effect».

> The record presented a potent new aura created by the magic of technology —one of displacement, the magic of hearing music emanating from a different place and time by people not physically present. (Cascone, 2006, p. 87)

From my point of view, the question of aura in live computer music, is neither fully identified with sound production mechanisms, nor with the excess or lack of spectacle. A performance, being the convergence in time and space of an artist developing his work in front of an audience, is always unique, even if the materials brought to play are constitutionally «un-auratic» (i.e., pre-recorded.) Theatre thus confers upon computer music the aura it did not have outside the stage. But this gift also associates its practice with ritual. And the acceptance of ritual as a constitutive aspect of music is probably the most important difference between «tape music» composers and computer performers. It is therefore a choice that everyone ought to make individually.

> It is significant that the existence of the work of art with reference to its aura is never entirely separated from its ritual function. In other words, the unique value of the «authentic» work of art has its basis in ritual, the location of its original use value. […] For the first time in world history, mechanical reproduction emancipates the work of art from its parasitical dependence on ritual. (Benjamin, 1968, pp. 223)

Stage

«Pure» laptop music represents one extreme of the theatre, in which the laptop-based player acts on stage (executing previously written lines of code or moving from one preset to the next) with hardly any other musical interaction, either with his computer or with the audience before him. «Gestural» music, represents another theatrical extreme, in which physical gestures (digitalized by means of wearable controllers) determine and condition to the greatest extent the sonic outcome, thus demanding a great deal of practice and virtuosity in order to achieve musically meaningful results. In the middle —the auditorium— nag the suspicion that computers as music-making devices are fake. Western theatre —until Artaud— is almost uniquely based upon an illusionist approach, an orientation also found in the importance given to mimesis in the history of Western art. Hence, the problem computers introduce is that, from an illusionist perspective, they represent some-

thing like the «illusion of the illusion» and subsequently the end of theatre in the way it is traditionally considered. This situation, unprecedented in the whole history of music performance and theatre, could be attributable to the fact that computers are all-in-one devices, utilized in almost every aspect of the contemporary Western lifestyle, from communications to leisure. This lends to an «everyday» air to the performer behind the computer, an atmosphere which is the exact opposite of ritual. As Cascone, continuing his argumentation about aura, has expressed,

> the laptop's signifier as a business tool is so ingrained in the public consciousness that its use as a musical instrument is considered a violation of the codes of musical performance. The audience feels cheated, because the laptop musician appears to be simply playing back soundfiles stored on their hard drive. (Cascone, 2006, p. 88)

This is precisely what might have motivated some artists to design systems with refined physical interfaces that come close to traditional instruments, requiring an enormous amount of practice and effort to achieve musical results, but for the same reason allowing for an incredible amount of mastery. This is the case of artists like Laetitia Sonami and Michel Waisvisz, who expresses his attitudes both towards «un-auratic» and «auratic» displays as follows:

> I cannot be other than very conservative at this point. I do not get any excitement from a performer numbly toddling a mouse or occasionally pushing a key awkwardly posted in a chair. Neither do I enjoy the by now traditional bunch of DJ's jumping around and at regular intervals just pushing a button or hitting a slider. (Waisvisz, 1999, p. 7)

> Or the performer that with lots of dynamic movements plays back multitrack files and moves like every note has been crafted with intense effort and sacrifice at that specific moment of performance by his own hands, live on stage deeply dedicated and generously catering its audience. (Waisvisz, 2003, p. 4)

Another reason for the theatrical problems of performing with computers may lie in the audience's lack of understanding of the mechanisms with which the performer interacts with his computer. In this sense, it has been argued that «until there is some standardization in instrument design, audiences cannot be expected to appreciate the variables in a performance as they do when conventional instruments are played» (Appleton, 1984). While standardization surely brings some positive attributes to the field (especially for commercial purposes), I intuit that, on

the contrary, is the very lack of standards which attracts many artists and composers to computers. It is precisely the absence of an existing corpus of work and instrumental technique conditioned by physical, conceptual and cultural constrains (which inevitably generate equivalent limitations) which makes computers valuable tools for music creation at the present time, since they ultimately make possible a novel identification between instrument and composition, between performer and composer.

In order to resolve the above-mentioned «suspicions,» some artists have tried to make visible and transparent their interactions with the computer (for example by projecting the code they are writing or the software they are using on a screen visible to the audience, by translating sounds into images in a linear, predictable fashion, or by overemphasizing the —usually small— movements required), in the belief that the parameters in control should be revealed and explained to the audience:

> I think the audience does not know what the composer is controlling on an electronic instrument, so that the difference between live performance and a disk, or something that is going on in the background, is really not clear. What I have done, and continue to do, is to do something of a lecture-demonstration, using (recently) monitors, so that the audience can literally see as well as [know] how the process is going on and what is happening. (M. Subotnick, quoted in Appleton, 1984, p. 49)

Though «explanations» might be useful for analytical purposes, I believe that the act of listening to music should in no way be parametric. Such an approach, though functional in that it may open a path to «think» music differently for the computer performer or instrument designer, should never be perceived as a distinctive quality of the music. In essence, my opinion is that excessive transparency kills the magic of a performance, which is always based to some extent on a distance between the actor and his audience. To destroy that distance is to destroy the mystery unsolved within the performance; the ritual itself, and so to awaken the suspicion of a simulacrum.

However, when we move beyond issues of lack or excess of transparency, we can better re-frame the problem of theatricality in terms of the unquestioning acceptance of the classical, proscenium paradigm in which most live computer music is presented:

> Usually, music performed on laptop is presented in a traditional proscenium setting, framed in the traditional performer-audience polarity. This context frustrates the audience because they are unable to resolve the setting with a lack of spectacularized gestures (i.e. the lack of theatrical codes) which signify performance. Gesture and spectacle disappear into the micro-movements of the laptop performer's wrists and fingers. From the audience's view the performer sits motionless, staring into the luminous glow of the laptop screen while sound fills the space by an unseen process. (Cascone, 2006, p. 88)

While Cascone detects the problem, far from providing a solution, he tries to take advantage of the distancing effect this disruption may create. A possible solution, however, comes from the Spanish artist Francisco López, who vehemently argues against a proscenium setting:

> It seems that both artists and audience of electronic music have also inertly accepted this inherited tradition [the frontal stage] in the live presentation of the music. Even to perplexing situations on stage such as symbolically substituting performers by speakers, manipulating a bunch of analog electronics on a table, sitting in front of a laptop or upgrading the DJ to on-stage status. (López, 2004, pp. 1-2)

In his article *Against the Stage* (2004), he enumerates a series of reasons to avoid the classical proscenium setting in performances of electronic music (and he includes under this term «all music manifestations that have electronic means of production, transformation and diffusion of sound in the foreground of its practice and its aesthetics, from classical electroacoustic to underground 'experimental' music to electronica»). He starts by defending the idea that there is nothing to show or contemplate in an electronic music performance, because even if such theatricality can lead to the development of versions of instrumental expression and mastery, «they are not a natural consequence of the practices and essential manners of the operations of electronic music, but rather a symbolic acceptance of a tradition of a very different nature» (López, 2004). Having said this, he derives two beneficial consequences from this apparent problem. First, since there is nothing to look at, the necessity of a frontal configuration disappears, and in this new situation the lack of visual stimuli leads to stronger concentration on the sound itself. Second, since the relation between sound and source is now uncoupled, he advocates sound surrounding the audience from all directions, in order to achieve «immersive» effects.

The benefits extend to the performer; freed from the stage, he is also freed from the «schizophrenia» caused by PA amplification systems, and may elaborate his music from the center of the auditorium without the mediation of the sound technician, sharing with his audience exactly what he himself hears. In his own words,

> one of the beautiful advantages of electronic music is that it allows the reunification of these two sonic spaces [the stage and the auditorium] and of these two personas [the musician and the sound technician]. Turning the spatial electronic separation between generative action and sound source into an advantage instead of a constraint. Because the sound radiates from his/her position, the player of an acoustic instrument cannot be the generative actor and the *receptor-as-audience* at the same time. For three different reasons the electronic musician can. First, because of the alluded to electronic separation, which allows him/her to be in the audience area hearing what the audience is hearing. Second, because of the possibility of simultaneous control over generative and phenomenological aspects of sound (that is, «playing» and «making the sound» at the same time). And third, because of a much smaller scale gear set-up, which makes possible a closer approximation to the *receptor-as-audience* situation and also to minimize the portion of the «hot spot» area not available for the public (López, 2004, p. 3)

This explanation is quite a literal description of López's own «theatre», consisting of a room in complete darkness (he also provides the audience with blinds so visual stimuli are completely eliminated) equipped with a multichannel sound system, in which the audience sits in circles around him, who occupies the center of the space.

His solution, although very specific, is successful in that it integrates a perspective born of reflecting on inherent means, together with a less medium-specific perspective born from the notions of ritual, mystery and aura mentioned throughout this chapter. But because his conception of the «empty stage» is so particular as to be inseparable from his own music —with which it creates a single aesthetic object— it is difficult to consider it as a potentially general solution to the staging of electronic music.

Another approach is the one Agostino di Scipio proposes with his *Audible Ecosystemic* pieces (Di Scipio, 2003). He conceived of self-regulating, computer-based dynamical systems capable of constantly adapt to the surroundings (room acoustics, environmental sounds, etc.) It may be doubtful whether such a collection of

pieces is in any sense related to the «theatre». Nonetheless, when Di Scipio states «sound is the interface», he not only refuses to use any visual interface, MIDI controller or any other type of sensors, regarding the sound as «the only interface among humans, machines and environments» (Anderson, 2005), but he also confers sound with the task of an actor —of a musician— in reacting both to a specific time and space filled with a particular audience: He has moved from «interactive composing» to «composing the interaction» (Di Scipio, 2003).

This scenario opens up a myriad of possibilities for re-evaluating the relations between music, audiences and musicians in a probably less specific way that the one proposed by López. It suggests that the staging issue in electronic music may be one of the reasons why so many sound artists and composers working with computers, in the absence of a fundamental reason to perform, are coherently moving towards installation as the natural locus of balance between the absence of performance and the constitutive importance of the space in which the work unfolds.

So far, I have described different approaches and solutions to the questions posed above (the requirement for new scenic codes in live computer music, and their potential to enhance or disrupt both the creation of music and its reception). It seems clearly apparent to me that there is no general answer to such questions. Two theatrical extremes are virtuoso, «gestural» music, which not only seems to fit perfectly in a classical proscenium setting but to actually call for such a configuration, and «immersive» sound art, which may ask for an unlocalized performance, either avoiding the stage or taking the form of an installation. Moreover, the unspectacularity of certain approaches to live computer music might be inverted and utilized subversively for different aesthetic and conceptual purposes. Summarizing, using computers as music-making devices on stage does not say much about the music itself nor about the expectations and judgments it generates within a particular cultural milieu.

With respect to free improvisation with computers (or a combination of computers and traditional instruments), relationships with other musicians plays an important role in the configuration of the problem. The stage becomes not the locus of the spectacle, but more importantly, the space in which music will spontaneously be created by a group of improvising musicians. Therefore this space must be

optimized to favor the collaborative creation of music and its reception by a group of listeners, and the issues of sound localization, visibility and frontality should be formulated from this perspective.

II. Improvisation

iii. Context of Thought

There is a —probably— unsolvable dichotomy in how I conceive of the music I make. On the one hand, I am engaged with free improvisation in what I could call a political way; on the other hand, I like to think of improvisation simply as an appropriate means with which to provoke an aesthetic experience in the listener —and of course the playing musicians also fall into this category— according to my musical *imaginarium*. By the first, I give importance to the circumstances in which improvised music is embedded: the demands of a live performance, the utmost degree of identification with and responsibility for the sonic materials used, the experience of collective creation, and the piece of music as *site-specific* and *ephemeral*, just to mention a few. By the second, I emphasize the belief that music should be, to an extent, independent from the conditions in which it was created or the methods with which it was crafted, whether individually or collectively composed or improvised. I believe it is this independence which allows personal aesthetic thinking to be achieved through free improvisation. If not an outright contradiction (from my point of view, most freely improvised music also participates in this dichotomy) there is at least an enormous tension between these two positions, which I presume, plays an important role in my music.

Therefore, the aim of this second section is to study how these tensions may have shaped my practice. To that purpose, I will briefly summarize Jacques Rancière's ideas linking aesthetics and politics with the creation of communal spaces, in order to question whether concepts of politics and aesthetics may exist which are particular to free improvisation.

Rancière and the «Aesthetic Regime of Art»

For the French philosopher Jacques Rancière, politics and aesthetics could be seen as two different mechanisms through which a «communal space» is constituted by the individuals participating in it. To put it in Rancière's own terms, both politics and aesthetics are two different, although interdependent, modes of «distribution of the sensible» (*partage du sensible*), that is, «systems of self-evident facts that simultaneously disclose the existence of something in common and the delimitations that define the respective parts and positions within it» (Rancière, 2004).

The difference between these two realms lies on the fact that politics «is about the transformation of the sensory fabric of the 'being together'» (Rancière, 2008) assuming that «human beings are tied together by a certain sensory fabric», operating distributions of the communal space by introducing new objects and subjects, by making visible what was not, and by «listening to whom did not have a chance to speak» (Rancière, 2005). On the other hand, Rancière views aesthetics as the mode of distribution of the sensible specific to art, that is to say, as the connection (dependent on a particular historical configuration) between «modes of producing works of art or developing practices, forms of visibility that disclose them, and ways of conceptualizing the former and the latter» (Rancière, 2004).

Through this combination of art and labor histories, Rancière divides the whole development of Western art into three different «regimes» of identification (Rancière, 2004, 2005), namely the *ethical regime of images* (wherein art is not identified as such but is based both in the truth content of images and its pedagogical use), the *representative regime of the arts* (which establishes the different arts as specific practices with intrinsic systems of doing, making, seeing and judging, principally founded in the couple «poïesis»/mimesis), and the *aesthetic regime of Art*, wherein «the identification or art no longer occurs via a division within ways of doing and making, but is based on distinguishing a sensible mode of being specific to artistic products» (Rancière, 2004). This last regime extends up to the present, embracing both modernism and postmodernism.

Having said this, in the *aesthetic regime* —the combination of these two words could not be more appropriate— there exists a mutually-dependent overlap between the spheres of politics and aesthetics. In reality, aesthetics operates beyond the art world, constituting what he calls the «aesthetics of politics», whereas on the

contrary, there is a certain «politics of aesthetics» defined by the forms of visibility in which art configures —or contributes to— the community and its shared space:

> Aesthetic experience has a political effect to the extent that the loss of destination that it presupposes disturbs the way in which bodies fit their functions and destinations. What it produces is no rhetoric persuasion about what has to be done. Nor is it the framing of a collective body. It is a multiplication of connections and disconnections that reframe the relation between bodies, the world where they live and the way in which they are «equipped» for fitting it. It is a multiplicity of folds and gaps in the fabric of common experience that change the cartography of the perceptible, the thinkable and the feasible. As such, it allows for new modes of political construction of common objects and new possibilities of collective enunciation. (Rancière, 2008, p. 11)

Along this line of thought, Rancière claims that art is political, neither because of the messages it transmits, nor because of the social structures it represents (with this respect agitprop and activist art are not necessarily political), but precisely because of the distance it maintains in relationship to both message and social structures (Rancière, 2005; Dronsfield, 2008). This distance is achieved by means of two different and complementary politics of aesthetics, namely,

> the politics of the «becoming life of art» (*le devenir vie de l'art*) and the politics of the «resistant form» (*la forme resistante*), which always exist together: In the first politics, the aesthetic experience resembles other forms of experiences and as such, it tends to dissolve into other forms of life. In the second politics of aesthetics —the resistant form— the political potential of the aesthetic experience derives from the separation of art from other forms of activity and its resistance to any transformation into a form of life. (Berrebi, 2008, p. 2)

Free Improvisation

Free improvisation is an ambiguous term. Derek Bailey observes that «freely improvised music is an activity which encompasses too many kinds of players, too many different attitudes to music, too many different concepts of what improvisation is, even, for it all to be subsumed under one name» (Bailey, 1992). Therefore, any attempt at defining what free improvisation could mean, would probably and immediately enter into conflict with some other definition of it. For this reason, attaining a general description of free improvisation is probably less useful than

looking at specific points by which several authors and practitioners have found loosely defining characteristics of freely improvised music.

> One understanding of free improvised music is that this is also a tradition (or in the process of so developing) —an idiom with certain (strangely) sounding characteristic timbral properties, structure, idea of form, praxis for performance, etc. (Munthe, 1996, p. 1)

This quotation summarizes many of the impressions a listener —usually a non-practitioner— might make about free improvisation. If, on the one hand, there is a kind of common ground that relates free improvisation with, for instance, extended instrumental techniques or long time structures, this does not necessarily exclude opposing practices from the context of free improvisation. Indeed, Derek Bailey proposes that:

> The lack of precision over its naming is, if anything, increased when we come to the thing itself. Diversity is its most consistent characteristic. It has no stylistic or idiomatic commitment. It has no prescribed idiomatic sound. The characteristics of freely improvised music are established only by the sonic-musical identity of the person or persons playing it. (Bailey, 1992, p. 83)

Following Bailey's line of thinking, it is precisely the absence of a «stylistic or idiomatic commitment» that could be interpreted as one defining feature of free improvisation. This is what makes him differentiate between what he calls «idiomatic» improvisation, which is embedded within a framework of generic expectations and conventions, and «non-idiomatic» improvisation, which somehow works as a synonym for free improvisation:

> much of the impetus towards free improvisation came from the questioning of musical language. Or more correctly, the questioning of the «rules» governing musical language. (Bailey, 1992, p. 84)

Therefore, if free improvisation does not represent a particular aesthetic code (which is only dependent on the musicians playing the music), we should not think of it as a specific kind of music, but as a particular *method* of music-making (Attali, 1985; Bailey, 1992; Munthe, 1996). It is an oral method, in contrast with written music, which unifies the procedures of music-making (the musical imagination with the sonic realization) in a single person, therefore allowing for the collective crea-

tion of music. For me personally, it is this collectivist nature which is the most salient characteristic of freely improvised music.

But if we consider free improvisation as a method of music-making, how shall we then consider the end-results of such method, the product «free improvisation»? This introduces the following paradox:

> What is for the performer a matter of process and practice is for the listener a completed form which unfolds through time, as composed music also does. (Durant, 1989, p. 258)

This tension opens a field of inquiry into whether free improvisation should be regarded as an activity reserved for a few specialists, or as an amateur activity in which everyone should engage as practitioners in the musical process itself. In this sense, and beyond the scope of this discussion, improvisation would free music from being a commodity, and consequently from the rules governing the market. Jacques Attali presented such a vision in his book, *Noise* (originally published in French in 1977), foreseeing in freely improvised music the seeds of a change in a society presently based on mass production and the stockpiling of goods. In the coming epoch, music would consist in

> Doing solely for the sake of doing, without trying artificially to recreate the old codes in an order to reinsert communication into them. Inventing new codes, inventing the message at the same time as the language. Playing for one's own pleasure, which alone can create the conditions for new communication. (Attali, 1985, p. 134).

Returning to the main line of my argumentation, viewing improvisation as a musical creation process underlines the point that this method does not necessarily determine musical form. Free improvisation as a collective process necessarily «creates its own code at the same time as the work» (Attali, 1985), by putting a personal vocabulary through the process of being elaborated by others. And it is through this communal creation of «the code within which communication will take place», that the main expressive force of free improvisation may lie:

> Improvised music stands in clear opposition to traditions of thinking of large-scale formal symmetries as the necessary architecture of musical argument. Even when the contrast between improvisation and composed music is reduced, when both are reproduced on tape or record (with the effect that the improvisation can be known in as precise detail as can be

> the musical composition), the difference between the two kinds remains important: through its formal irregularities, improvisation insists that pleasure need not only to come from perceiving and constructing symmetrical patterns as an informed listener, but can also lie in not knowing which musical directions will be developed, which elements are thematised or what precise musical register or idiom a piece is intended to be in. (Durant, 1989, pp. 276-277)

Politics and Aesthetics of Free Improvisation

When I discovered Rancière's writings, I was not sure of their utility for reflecting upon and analyzing certain constitutive elements and attitudes found in freely improvised music. Nevertheless, his way of relating politics and aesthetics as two particular modes of constituting and distributing communal spaces was congruent with my way of (1) conceiving improvisation as negotiation of a common musical time and space, and with (2) my opinion that, through this negotiation, art still can be an important element in the constitution of social identities. In this sense at least, free improvisation proposes a genuine redistribution of music in terms of the way it is created and the spaces it inhabits, by means of (1) giving voice to a community of players in an equality of competence and (2) by identifying a given auditorium (the place) with a specific audience (the people populating it).

The metaphor of an egalitarian community. I consider the most basic element of free improvisation the equality of conditions in which a community of improvising musicians gather to create music. In this sense, one of the greatest musical opportunities provided by free improvisation is the exploration of different relationships between players, and not between musical parts: given that musical «roles» are not assigned beforehand, every improviser is potentially able to contribute to every aspect and layer of the musical entity. This metaphor of equality should not be translated into a literal and simplistic representation of free improvisers as a democratic society, which would limit musical exploration to a very specific way of interrelation. Indeed, the problem I detect when free improvisation «merely dramatizes and endorses an already established framework of values rather than constructing or investigating them» (Durant, 1989), is that in doing so it ruins the possibility of an authentic redistribution of the sensible, and therefore of actual political effectiveness. Therefore, a community of improvisers should explore other

kinds of musical relationships, including dissension through confrontation, in order to arrive at a new construction in which a community of improvisers and listeners are in a constant process of negotiation.

Site-specificity and ephemerality. Freely improvised music is completely dependent upon the time and the place in which it occurs, determined by the musicians, the physical space, and the audience.

Ephemerality is, in a sense, common to all kinds of live performances: they only exist in the moment of their development. However, in that improvisation equates the acts of composition and performance, it differentiates itself from other kinds of performance by emphasizing the act of communication , rather than the content of the communication itself. Improvisation cannot exist beforehand, as it is a result of a process of negotiation and distribution of roles. In a sense, neither can it exist «after the fact;» this is probably what makes improvised music so weak when it is recorded. What remains are just traces of a musical process of communication at a given time and space; an «un-auratic» documentation of a past event.

Some of the constitutive tensions that I briefly presented in the previous paragraphs, could be understood as tensions between the two *politics of aesthetics* presented by Rancière. Free improvisation, like other kinds of music, stands in some regards as a politics of the «resistant form». It creates an identification of art which is clearly separated from the experiences of daily live, by separating professional practitioners from dedicated audiences. But in a different interpretation, free improvisation could be seen as a representative of the politics of «becoming life of art», in its attempt to reconfigure a social space, negotiating the distribution of the identities among musicians and audiences. Moreover, if we consider the more extreme interpretations of free improvisation as an amateur activity, we arrive at Attali's (1985) proposed abolishment of the differentiation between musician and audience. Such lack of differentiation would truly complete the attempt to bring forms of music and creativity to the domain of the quotidian. Nevertheless, as Ben Vautier has cleverly detected, a true and definitive attempt at bringing art to life, would automatically cancel its effectiveness as art —in the *aesthetic regime*— and therefore its potential utility as a means of rethinking and reconfiguring the shared spaces of a community:

> We are trying to do non-art but non-art cannot exist because it is art. And we are trying to do life-art and life-art cannot exist because it is either art or life; and if is life is life, and then nobody knows about it, is [for example] my mother-in-law opening the tap and she doesn't care, and if she finds out that it is *Drip Music* by George Brecht then she starts thinking and then it is art. So you can't get one into the other; it's one and another. (B. Vautier, interviewed in Movin, 1993)

In summary, if there is something like an aesthetics of free improvisation, this —following Rancière's formulations— should be looked upon its «political» disposition rather than in particular musical contents: in the way improvisation underlines the importance of a process over a product and in its demand of live experiences within a community of improvisers and listeners as the condition *sine qua non* free improvised music can exist. Only through these constitutive features, free improvisation can pursue an specific aesthetics in Rancière's terms, as a particular mode of making, presenting and conceptualizing art in the present time. Then, maybe Attali's previsions of a new society modeled in free improvisation were not completely eccentric and the new period he proclaimed could be identified with a new aesthetic regime, which paradoxically would overcome the *aesthetic regime of Art*:

> In rejecting traditional relationships between performer and performer, and between performer and score, improvisation not only disputes conventions of form but also challenges dominant social relations in which music is made, reproduced, circulated and represented. (Durant, 1989, p. 279)

On the contrary, if free improvisation is thought of as an environment in which to pursue a personal aesthetic, then it should be regarded simply as a method of music-making, whose sonic-musical identity will exclusively be defined by the person or persons playing it. This recalls the idea of the current *aesthetic regime of Art*, in which art consists, not of crafts and methods, but of the perception of an audience that the object viewed is indeed «art» due to a «mode of being specific to artistic products» (Rancière, 2004). In this sense free improvisation may serve as an appropriate means of provoking an aesthetic experience (a distribution of the sensible operated through the realm of art) in equality with other methods of musical craft.

Of course, to claim free improvisation as a completely valid political tool is probably as banal as considering it as an exclusively aesthetic object. In this sense, as I stated in the first lines of this chapter, most freely improvised music is constitutively located somewhere in the middle of these two conceptions.

iv. Context of Action

The notion of instrument is central to improvisation. As I commented in the previous chapter, many approaches to free improvisation pivot around the exploration and exploitation of extended techniques and other novel instrumental approaches. This is certainly a consequence of (1) questioning the validity of an inherited instrumental language as useful for personal expression, and (2) the reunification of the composer and the performer in the same figure, converting the instrument into the particular sound world that the improviser is in charge of organizing:

> The instrument is not just a tool but an ally. It is not only a means to an end, it is a source of material, and technique for the improvisor is often an exploitation of the natural resources of the instrument. He might develop certain aspects of the instrument that appeal to him, that seem particularly fruitful. […] The accidental can be exploited through the amount of control exercised over the instrument, from complete —producing exactly what the player dictates— to none at all —letting the instrument have its say. (Bailey, 1992, pp. 99-100)

In this sense, computers appear to me as suitable instruments for freely improvised music, for they offer fields of exploration as valuable as those offered by any other instrument. Moreover, the double nature of the computer as a medium for music-making, as discussed in section one, makes it an ideal tool for bring together individual and collective music creation. Of course, is true that every improviser develops his own instrumental vocabulary, a task the computer-improviser should not shy away from. But while an instrumental free improviser must address the historical use and design of his instrument in attempting to reformulate existing musical languages, the computer-improviser can skip this step

and to a greater extent, create an instrument specifically for the task of freely improvised music. This, therefore, permits the integration of a field of personal reflection and creativity —the «composition of an instrument»— within the context of collectively improvised music.

Tempering this optimism, the very act of designing an improvisational instrument undermines the conception of free improvisation as questioning existing musical languages and techniques. If you custom-make your instrument for your purpose, then there is nothing to be «freed» from. Besides, the creation of a musical system implies the formalization of a specific set of rules, precisely the sort of framework free improvisers usually refuse.

Having said this, I will now discuss two generic modes of approaching the practice of freely improvised music with computers. These were presented in the introduction as a «player-dependent» and a «player-independent» models. In the former, a computer-musician depends on the live-processing of the player(s)' input in order to produce sound, while in the latter, the computer-improviser aims to have a independent voice, comparable to that of other improvisers.

Live-processing

When I first engaged with Sonology, in September 2006, I had yet to think of the computer as an unique sound source, and I instead committed myself solely to live-processing sound materials from other musicians. On the other hand, I always tried to keep the results of this process as independent as possible from the original sounds. The following quotation by Gilles Deleuze and Claire Parnet summarizes my ideal of musical interaction at that time:

> You encounter people (and sometimes without knowing them or even having seen them) but also movements, ideas, events, entities. All these things have proper names, but the proper name does not designate a person or a subject. It designates an effect, a zigzag, something which passes or happens between two as though under a potential difference: the «Compton effect», the «Kelvin Effect». We said the same thing about becomings: it is not one term which becomes the other, but each encounters the other, a single becoming which is not common to the two, since they have nothing to do with one another, but which is between the two, which has its own direction, a bloc of becoming. (Deleuze & Parnet, 1987, p. 5)

In this «bloc of becoming», the notion of middle appears in anew, (maybe as a confirmation that this thesis is about bridging apparently contradictory conceptions), this time neither in the form of intermediate solutions between the realms of composition and improvisation, nor as the interplay between political and aesthetic conceptions of music. Instead, «the middle» is now discussed as the tension between individual and collective music creation, something emerging exactly in the moment when the former intends to become the latter.

I regard the above quote as a good example of how a text about politics —micro-politics— may suggest an aesthetic realization, confirming to an extent that the political and the aesthetic might be —as Rancière proposes— two comparable procedures to approaching the configuration of a commonality (even if this is just a dialogue between two persons). Indeed, varying interpretations of Deleuze's and Parnet's text may be usefully applied to the collaborative aesthetic process, insofar as the aim of such collaboration is a product not achievable by any one individual participant. In this sense, the above quote can be used as a beautiful metaphor of free improvisation.

Nevertheless, my first interpretation of this excerpt was a bit more radical, spurring me to create conditions in which the «other» creative mind was an absolute necessity. I conceived of a music which would be impossible to create or perform alone, but which could only exist outside the constraints of any one individual musical imagination. In fact, this was for me the ideal behind a live-processing approach to improvisation: that mutual interdependency and negotiation between two musicians would result in an unexpected, unforeseeable merging of musical materials from both parties. A new and different music would arise, as if from a synthetic chemical reaction:

> We do not work together, we work between the two. In these conditions, as soon as there is this type of multiplicity, there is politics, micro-politics. As Félix [Guattari] says: before Being there is politics. We do not work, we negotiate. (Deleuze & Parnet, 1987, p. 13)

After a period of four years, I gave up with this radical interpretation, and presently I regard the more general framework of free improvisation (without this dependent relationship) as a good way to expand one's musical imagination by means of negotiation. I compare this with the type of relationship a composer has

with his system of writing: in both cases, something coming from outside is needed to expand an individual musical mind.

Therefore, taking my own live-processing plan as a model, I will develop and question several fundamental generalizations of this approach in the context of freely improvised music:

In a live-processing approach to improvisation, the computer musician is non-reciprocally forced to play with at least one other musician acting as a sonic source, and is therefore unable to play or practice alone. This means that, contrary to the practice of other improvisers, one's personal voice can only be developed through («with», but also «over») the other's. Therefore, the ideal situation with which to develop this procedure would be a duo consisting of an instrumentalist (providing both as independent musical material and input for the computer system) and a computer-musician (in charge of the sound-processing). Playing with (processing) more than two instrumentalists would imply a loss of balance, as well as a drastic reduction in the control, transparency and intelligibility of the process, both for the musicians and the audience.

Using digital signal processing appears to be a genuine method for approaching improvisation with computers, since on the one hand it is a musical opportunity only provided by computers, and, on the other, it suggests the expansion of the vocabulary of an instrumental free improviser in many ways which are unpredictable for both musicians.

With this respect, a differentiation between (1) «raw» sound material and (2) «processed» musical material can be made: the instrumentalist must provide input to the computer-musician, and the latter is limited to manipulating this material. This differentiation implies predefined roles for the musicians, and while it opens up interesting possibilities for exploring alternative forms of musical communication, it implies that this set-up should be regarded as «tied improvisation» rather than as free improvisation, since as I explained in the previous chapter, one of freely improvised music's defining characteristics is the absence of predefined roles.

Having said that live-processing involves predefined roles, it must be admitted that, while this limitation is clear in the case of the computer-musician, who is completely dependent on raw sound input, it is less clear with respect to the in-

strumentalist, who in a sense, is still as free as in any other musical situation. This provokes, to my understanding, an unbalanced situation between both musicians, that, to some extent, could be solved with the help of some theatrical machinery:

- An amplification system loud enough to mask the natural sounds coming from the acoustic instruments, so they cannot be heard as themselves, and only perceived, through the loudspeaker system. This, at least, would bring the experience of playing «through the other» closer and in a more balanced way. (Of course, the instrumentalist would still have extra feedback from touching his instrument.)
- The total avoidance of a PA amplification system. In such case, the instrumentalist would not be amplified, whereas the output of the computer musician would consist of a localized mono, stereo or multichannel setup. At least in this sense, a more natural equilibrium between unamplified and amplified sounds would be achieved.
- The use of controller-interfaces mimicking real instruments (some of the many commercially available models such as piano keyboards, guitars, aerophones or drumkits, for example) rather than «acoustic» instruments from the side of the processed musician. In such a situation, the computer-improviser would be completely in charge of the sound output, whilst the instrumentalist would take care of the gestural input. This could be of interest in exploring the confrontation of a learned instrumental technique with a non-causal relationship to the results it produces.

One last problem in a live processing approach to improvisation derives from the fact that the model itself requires a very specific type of interaction between musicians, determining to a great extent the musical structure of all the pieces. It is a matter of necessity that the instrumentalist begins the piece; only later (even if this time interval consists of a few milliseconds) may the live-electronics processing react. If this brings an evident coherence to the sonic materials (for one is necessarily derived from the other), such coherence might not be always desirable, and is probably tiresome when excessively repeated. This is due to to the fact that the live-processing improviser has only two basic strategies to approach the design of his instrument with respect to the input: if he chooses a live-sampling strategy, he may recall sound materials that are not necessarily related to the «present» of the improvisation, having a certain degree of independence with respect to the input

materials. If, on the contrary, he goes for a time-delay strategy, his processing will always be directly dependent on the incoming source, meaning that casual solo playing, for instance, is completely impossible. That is one of the reasons why in my personal design (describe in the next section) I aimed at integrating these two techniques:

> At an early stage an important decision was made to use a delay-line model, rather than a sampler model. This decision was taken both for musical and practical reasons. Improvised music is very much a music of the «now», and I felt that longer term storage of material would detract from the immediacy of the performance. The discipline of working with the present, or at least the very recent past, was felt to be an asset. In addition, I felt that having to make decisions about which material to store for future use, and when to replay it, would be a serious distraction in performance. (Casserley, 1997, p. 5)

Synthesis through Synthesis

As I already suggested in the previous paragraph, the metaphor of the middle, taken from Deleuze and Parnet, is much more effectively applied within the common approach of «regular» free improvisation: knowing and playing with other musicians for perhaps the first time, in conditions of equality and independence rather than dependence.

In a sense, the synthesis (the resolution of the apparent contradictions and dichotomies posed throughout this text, especially between composition and improvisation, between singleness and collectivity) came unexpectedly with computer sound synthesis. When I started developing my *Musical Improvisation Sound System* (*MISS*), my intention was to open a field of personal investigation about how computers could be used in contexts of improvisation in a more intimate way. With this, I do not want to accentuate the limitations that a player-dependent model offers (among other reasons, because quantitatively it may offer many more possibilities), but to stress the importance I give to (1) the politics of free improvisation and to (2) the possibility to work simultaneously in a domain of personal aesthetic research. It is only because of this perspective, and because of the reasons related above, that I claim that a player-dependent model might not be a suitable approach to improvising music freely:

> Paradoxically, perhaps, I have found that the best base from which to approach group playing is that of being a solo improvisor. Having no group loyalties to offend and having solo playing as an ultimate resource, it is possible to play with other musicians, of whatever persuasion, as often one wishes without having to enter into a permanent commitment to any stylistic or aesthetic position. This might be, I think, ideal situation for an improvisor. (Bailey, 1992, p. 112)

The possibility of playing solo was indeed one of the main reasons that led me to design a computer system based on sound synthesis, because that would also allow me to (1) superimpose a vocabulary based upon practice with the instrument and (2) to easily play within different musical formations beyond the duet approach required by the live-processing paradigm. In this sense, I could have considered designing an instrument with which I could manipulate samples and prerecorded data. Again, I chose not do so because I believed this would be to some extent inconsistent with the constitutive characteristics of free improvisation as a site-specific, ephemeral creation, since those are exactly the two properties recorded sound does not possess (I refer the reader to the paragraph about aura in the second chapter). A recorded sound, by definition, can be played back an infinity of times, and is usually presented in a different context that the one in which it was registered.

The other motivation for considering computer generated sounds as the starting point for a new design came from questioning the validity of several musical procedures inherent to computer music in a context of free improvisation. As I presented in the first chapter of this thesis, the computer musician is familiar with formalizations, algorithms and abstractions with a degree of intimacy comparable to an instrumentalist's familiarity with his instrument. Therefore, if freely improvised music is born to a great extent from the questioning and expansion of instrumental language, I see it as a consequent procedure to develop a computer-based instrument for free improvisation that to some extent challenges the algorithmic compositional methods inherent to computer music practice.

In the next section, as I announced in the introduction, I describe the two personal solutions I developed in the course of the last few years, which correspond to the two models presented in this chapter. The *Modular System* is directly born of the

ideals of interdependence and necessity reported in the paragraph about live-processing. On the contrary, I consider *MISS* my personal *synthesis* of many of the issues presented along this thesis.

III. Solutions

v. MS

MS (*Modular System*) is a collection of interconnected physical interfaces and digital signal processing tools, which I designed for live-processing of acoustic instruments in improvised music contexts. I implemented the system in Pure Data (Puckette, 1996, 1997) and incorporated a variety of routing possibilities and audio processing facilities. I conceived of a modular system as a practical, non-destructive way in which to integrate new functionalities and devices within existing ones. In the course of its development, from 2005 to 2009, *MS* grew up to thirty modules built in Pure Data, operated from up to seven different physical interfaces.

My approach certainly has precedents; computer-improvisers such as Stelios Manousakis (2006) and Lawrence Casserley (1997) have also favored modular computer instrument design for similar reasons, aside from the fact that modularity can be seen as a natural derivation from the Max paradigm (Puckette, 1988) in which they (and I) were based.

> The first generation instrument grew gradually by combining various elements until a structure emerged. This has led to a situation where further experiment has become more and more difficult. The first task for a second generation instrument is to create a clear framework into which experimental modules may be inserted, so encouraging further development. This structure will also clarify, and make more flexible, the signal paths through the instrument. (Casserley, 1997, p. 6)

In fact, through the *MS* a new combination of procedures and interfaces can be set in a matter minutes, avoiding unnecessary computational consumption by limiting the program only to the desired functionalities.

Description of the System

Conceptual goals and limitations. The *MS* was, from its conception, a completely musician-driven system, and as such was an attempt to conveniently organize a series of tools exclusively dedicated to sound transformation of a given input. Therefore, even though the modularity of the system allowed the integration of further functionalities at any moment, the system was neither intended to extract control information from the input by means of analysis, nor to behave autonomously from the actions of the performer. The reasons for this self-limitation (that the computer takes part in only the most superficial layer of the music) is to be found in a personal skepticism towards computers as listeners on the one hand, and as improvisers on the other:

- **Human Improvisation.** The *Modular System* was designed to be manipulated in the course of a performance by a human improviser, conceived of in a quite traditional fashion. That is, as the only one responsible for the control and output of his instrument, he was expected to grow in expressiveness and accuracy through practice with the system.
- **Activity balance.** Since the system was built to process instrumental sounds generated by an improviser playing independently of the fact that his sounds were going to be the computer's input, I decided to depend neither on analysis algorithms nor upon automatized procedures to generate the output. Musical input was, in principle, not formally linked to a number of possible outputs. Instead, my goal was to create an equilibrium in the decision-making procedures between the two improvisers involved, and I therefore chose to base responsiveness on the computer-improviser's listening and subjectivity.

The interfaces. The lack of automated procedures implies that all parameters may be set and reset by the person controlling the system at any moment. This was done with the use of different human interface devices, some of them specifically designed for musical or audio production purposes (piano keyboards, fader-boxes, foot-pedals), others, for general purpose computer interaction (joysticks, computer keyboard). Others still were built specifically for the *Modular System* (the *Microhorn* and the *SensoryFabric*). Hence, different types of data needed to be integrated, since the devices were in the end functioning as a single, compound interface.

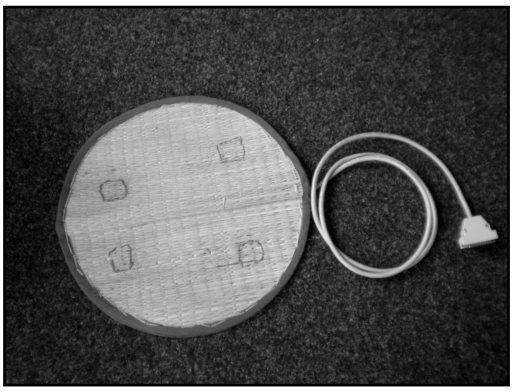

Figure 1. Homemade interfaces: the *Microhorn* and the *SensoryFabric.*

More than utilizing this battery of devices simultaneously, my aim was to extend the modularity inherent to the software design to the input stage. In this sense, most of the interfaces are to a great extent linked to specific DSP tools, so decisions about which interfaces to use were closely dependent on the audio processes desired. Consequently, I have never used all the these devices simultaneously. Some of them, like the *Microhorn* (an extension with switches and a tilt sensor attached to a dynamic microphone) were designed and used only for specific projects (in this case, a solo setup in which I was both singing and doing the sound processing). Others, like the *SensoryFabric* (a foot controller with four pressure sensors, two under the big toes and two under the heels, enabling continuous control input), were built as substitutes for more restricted devices like the MIDI foot-controller. Still others, like the piano keyboard or the joystick, fell into disuse when their respective sound processing tools ceased to be of interest.

The modules. Pure Data modules[3] are divided into three different categories depending on their functionality:

- The «**audio processing**» **modules**, which are the core of the system, are in charge of the actual digital sound processing. They can be classified as (1) sound storage modules (samplers), (2) delay-line based modules (karplus-strong resonators, harmonizers, multi-tap delays, etc.), or (3) real-time operation modules (waveshaping, FFT operations), which aside from the latency of the system, were designed to operate directly on the input signal.

3. See Appendix A for a short reference of all *MS* objects.

- The **«audio routing» modules** distribute and handle the signal flow to and from the audio processing modules, with functionalities similar to those found in audio mixers: mono and stereo busses, channel conversion capabilities (mono to stereo and vice versa), cross-faders, audio matrices and gates.
- Lastly, several **«control management» modules** were designed to integrate the communication of the different physical interfaces and the computer program. They can be further divided into (1) interface-specific objects, in charge of translating specific data from the different interfaces and protocols (MIDI, Open Sound Control) for later integration into a common system, (2) scaling and mapping objects, which integrate and format the incoming data conveniently, and (3) routing objects, which distribute the control signals among the different DSP modules.

MS in use

During the main development of the *Modular System*, from 2005 to 2008, I took true advantage of its modularity. As my first attempt at creating a computer environment for improvisation, it allowed me to easily integrate new knowledge and discoveries without forcing me to interrupt the actual use of the system. In this way, technical development and musical practice went together from the first moment, constantly influencing, questioning and enhancing one another.

Nevertheless, after the first stage of development, I naturally came to prefer certain procedures and interfaces, and though I continued to make minor improvements (especially a refinement in mapping strategies), I have came to work with a fixed setup in almost every situation since 2008.

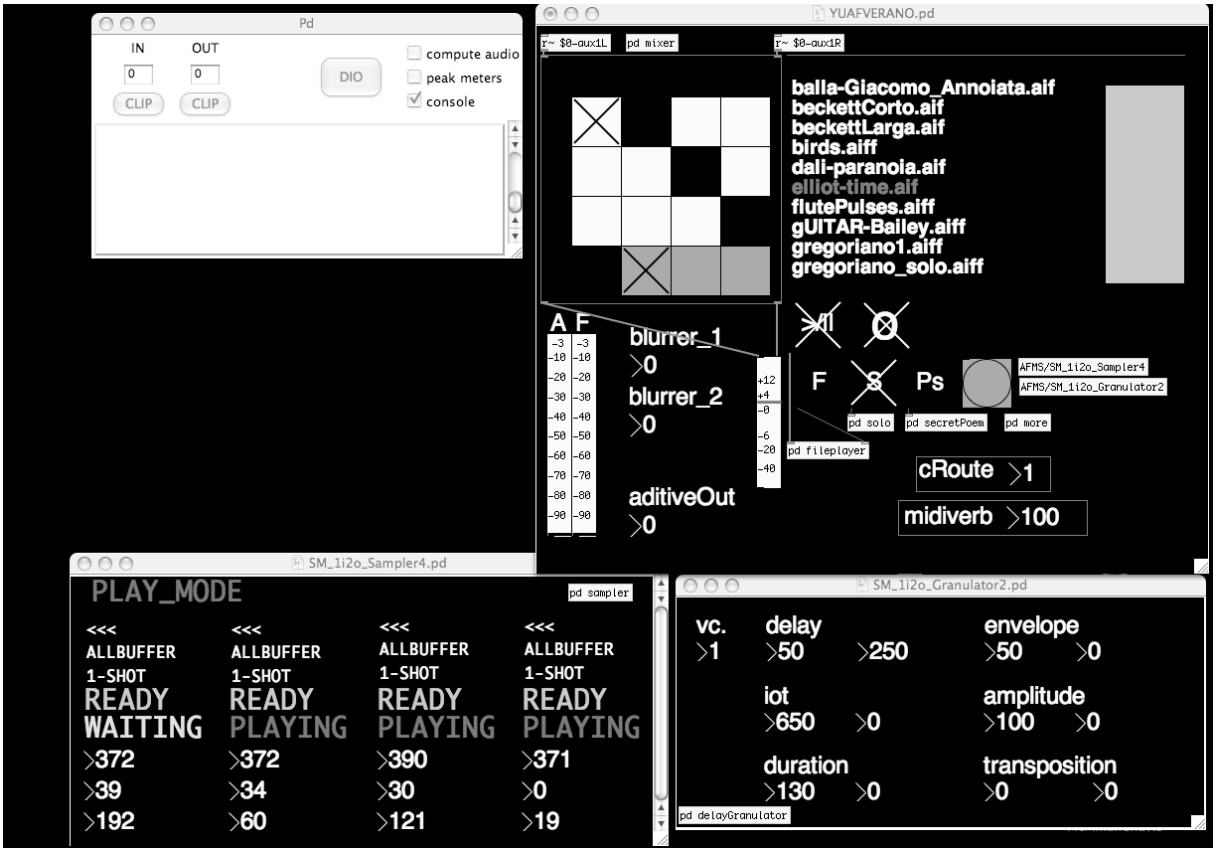

Figure 2. Screenshot of a typical *MS* configuration. A sampler (bottom-left) and a delay-line granulator (bottom-right) are the basic ingredients of this setup. The up-right window includes, among others, a matrix audio-router and a sound file player.

The hardware of this setup is a compound interface consisting of a MIDI fader-box (an *Evolution UC-33*), the *SensoryFabric* pedal and the computer keyboard. With regard to the computational tools, three sound-processing units are used in correspondence with the threefold classification of the audio-processing modules, providing three different «time approaches» to the sound materials given by the instrumentalist:

- A four-buffer **sampler** is ready to record sound from the instrumentalist at any point in time, either reproducing it immediately or storing it for later use. This is particularly useful for building long-term memory structures with which to revive past materials in the course of a piece (which potentially could trigger a similar «recapitulatory» behavior in the other player) and for establishing a sonic independence from the other player (working on the materials as the player abandons them). Besides autonomous storage and reproduction in each buffer,

the sampler can reproduce backwards and operate time-stretching and transposition independently in each buffer.

- A fifteen-second **delay-line granulator**, inspired to a great extent by the one described in (Bencina, 2001), was the most successful tool in the «intermediate» level, that is, audio-processing dependent on the input with a maximum separation time of fifteen seconds. The delay-granulator consists of a maximum of up to 64 voices, splitting the sound signal in chunks lasting between 1 and 500 milliseconds. All the parameters of the granulator (envelopes, grain duration, inter-onset time, reading point, transposition factor and relative amplitude) follow a gaussian probability distribution in which the user sets the mean value and a deviation factor for each parameter.
- Last, a «**blurrer**» module was the preferred strategy at the smallest time separation level between the input and the output. It is also based on a delay-line (even if the effect is intended to operate in «real-time»), of one second's length, which is modulated with low-pass filtered noise. In contrast to the extreme simplicity of this module, the sonic results are considerably different from the input, permitting operation on the input with reasonable timbre and gestural autonomy.

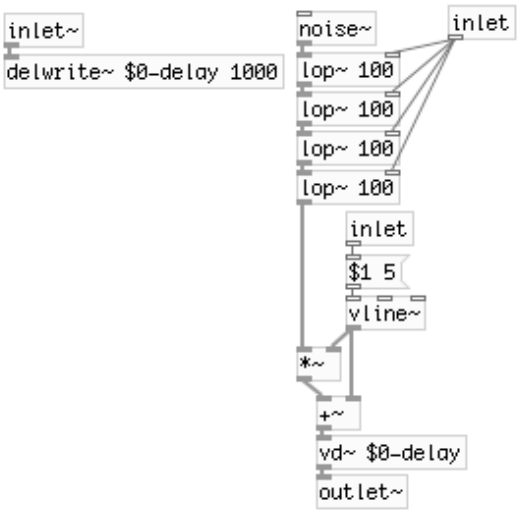

Figure 3. The «blurrer» module uses filtered noise to modulate the reading point of a delay-line, producing an odd vibrato effect. The only controls of the module are the cutoff frequency of the filter and the modulation width.

An **audio routing matrix** allows the interconnection of the three different processes in many different ways (to the extent that one module could be the input of itself) at any moment during the performance. For example, the sounds stored in

the sampler could be sent to the «blurrer» and subsequently processed with the delay-granulator, which eventually can be connected to the input of the sampler. There, these newly processed materials can be stored for later or immediate use, either creating a processing loop or changing the matrix routing to explore a different configuration.

The use of these three simultaneous time and sound-processing strategies was an attempt to integrate (1) different memory strategies in improvising with computers, (2) recognizability and non-recognizability between the musical materials, and (3) dependence and independence between the instrumentalist and the computer musician.

The success of this stable configuration was due, in my opinion, to the fact that different processing strategies were utilized simultaneously at the three levels described, from the long, stretched sounds of the sampler, to the micro-sounds generated by the granulator. In this sense, the closer the time interval between the input and the computer output, the more difficult it became to distinguish between source and transformation. This distinction was quite evident in the sampler, but almost unnoticeable, apart from an amplitude envelope resemblance, in the «blurrer».

Conclusion

I observed two main advantages in a modular approach to digital instrument development. On the one hand, the designer of such a system does not need to make plans in advance about the future of such system (besides the very fact of its modularity). In that sense, it not only gives room for imagining new uses and provides impetus for the expansion of existing tools, but indeed demands continuous development as its most constitutive essence. On the other hand, the user of a modular system can easily modify his setup (both the DSP tools and the input interfaces) from one performance to another, and this flexibility may be desirable in a number of situations.

The disadvantages, on the other hand, only appear when experimentation and improvement cease to be goals in and of themselves; when one finds himself work-

ing within the same setup in all kinds of situations, and the willingness to include new functionalities is substituted by a desire for stability.

In this sense, a modular system constitutes probably the best way to start making music with computers, for it establishes a coherent framework for experimentation upon which new discoveries and knowledge can be tested and integrated with older achievements, which eventually may lead to a personal formulation of the role of the computer in music creation. Once this step is attained, it is probably better to conceptualize this role and test it through a particular «object», ultimately aiming to establish a new and more constrained framework, and to work within that framework with the freedom —knowledge— brought about by practice and skill.

Practice, control, balance, identification and responsibility are common words in the vocabulary of an improviser. Therefore, it was natural that my *MS*, which represents my first attempts at developing an improvisational instrumental practice with computers, was deeply dependent on these concepts. This was probably the reason for my initial fear that discovering new sounds with the computer would come at the price of losing individuality and expressiveness. The situation has changed a bit at present (one of my reasons for having abandoned further development of *MS*) and that skepticism has turned into a commitment to exploring through improvisation the unique capabilities of the computer in different musical layers, without renouncing those foundational ideals of control, responsibility and identification. This work evokes a different vision of balance. My ideas now attempt to address a balance between (algorithmic) composition and improvisation, between individual (the design of the programs) and collective creation (the improvisation), between aesthetics (the behavioral design, the algorithm, the musical predefined framework) and politics (the fact that this is brought to life in a communal, site-specific context). *MISS*, as described in the following pages, is the first solution born of this commitment.

vi. MISS

MISS (*Musical Improvisation Sound System*) is a digital musical instrument implemented, like *MS*, in Pure Data. I began developing it in February 2008, and presented it for the first time at the last Sonology Discussion Concert of that academic year (April 29, Koninklijk Conservatorium, The Hague). Since then, I've improved and used it in a number of performances[4] showing satisfactory projection for music creation in improvisational contexts. The current description corresponds to the state of the instrument as of November 2008.

MISS's main goal was real-time synthesis of sound in response to an improviser's manipulations in the course of a live performance, not based on any live input or stored data. The system was therefore intended to allow the improviser both to solo without any references to external materials (something that is simply not possible if one has decided to manipulate sounds generated by other musicians during the performance), and to have equal independence with other players in ensemble settings.

Basic Assumptions and Inspirations

A set of assumptions and sources of inspiration were drawn up prior to the development of the work, to guide the design throughout and ensure some internal coherence. They are as follows:

- **External control**. The computer should receive control data from an external device manipulated by a human improviser/composer, allowing simultaneous, multi-parametric control of the system.
- **Minimized set-up.** Using only one external controller was desirable, to constrain the number of operations available to the performer and to ensure portability.
- **Avoidance of any extra visual or numerical feedback** from the computer (being able to hide the computer both from the player and from the audience if desired), so that musical performance could be driven exclusively through listening and through experience and expertise working with the system.

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4. For a detailed list of public performances using the systems described, see Appendix C.

- **Integration of compositional and improvisational aims.** My main interest in formulating the sound synthesis algorithms was to generate the most varied sonic output as quickly as possible in response to the performer's instruction, while working within a clearly limited sonic framework. At the same time, I defined certain formal procedures for the sound algorithm design by systematically applying basic compositional rules to every sound parameter and at almost every time layer. I will explain how this was done in the following pages. For the moment, it is enough to know that a four-level time layering was defined, namely, «period», «event», «sequence» and «macro» levels (the latter identified with which is usually called «form»). While the first three levels are the result of an algorithm manipulated in real-time, the latter is a consequence of the improviser's actions and decisions during the entire performance time, and is therefore also identified with «the piece».
- **Non-referentiality to any physical or natural phenomena**, that is, emulating neither the behavior of an acoustic musical instrument, nor its sound quality, nor the manner in which it is played. This idea is deeply rooted in the use of computers assumed by composers like Gottfried Michael Koenig and the «hard-edge Utrecht School» (as coined in (Truax, 1999)) at the *Instituut voor Sonologie*, where a number of projects related to raw digital data manipulations like Koenig's *Sound Synthesis Program* (Banks et al., 1979) or Paul Berg's *PILE* (Berg, 1979) were developed. For this reason, literature about so-called «non-standard» synthesis methods was tremendously inspiring in the course of designing *MISS*. Xenakis' *Dynamic Stochastic Synthesis* model, in particular, was taken as a kind of departure point, not only for the algorithms themselves, but also in light of the considerable effort made by others in its analysis and expansion (Xenakis, 1992; Serra, 1992; Hoffmann, 1996, 2000; Bokesoy & Pape, 2003; Luque Ancona, 2006), including live performance applications (Brown & Jenkins, 2004; Brown, 2004, 2005).
- Last, **instantaneous multichannel expansion** (from 1 to an undefined number of channels, depending on CPU power and audio hardware) was also desired, since necessities are usually different when performing alone (where I use either a stereo or multichannel system, depending on venue configuration) or in an ensemble (where I play through a single loudspeaker by my side).

Description of the System

Basic architecture. The core of the interface (at the moment of this report, an *Evolution UC-33* assignable MIDI controller, providing a collection of 9 faders, 24 knobs and 14 switches) is a group of eight sliders [1-8][5] used to schematically draw an eight-point table (equivalently, the nucleus of the algorithm). This table controls simultaneously almost every parameter of the synthesizer in real-time, so by moving one or more faders, a perceivable change in different domains occurs. The main task of the performer is, therefore, to shape and re-shape this table, as well as to define the rates and ranges of the available parameters.

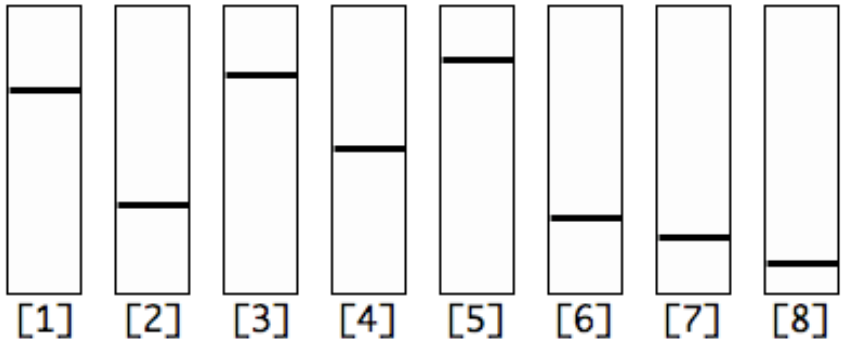

Figure 4. The faders in the interface are used to «draw» an eight-point table which will control almost every sound parameter.

The above-mentioned table operates simultaneously, as I mentioned, at three different time levels, namely, «period», «event» and «sequence» level.

At the period level, the table, scaled between minus one and one, is interpreted as a basic waveform period that oscillates at a frequency defined by the user. The maximum frequency permitted, if the eight-point table to be fully meaningful, equals the sampling rate divided by eight[6]. When the frequency is below that threshold, no interpolation scheme is used, resulting in a square-like wave output. The amplitude of the sliders (given that they move up and down from a center position) naturally determines the peak amplitude of the signal.

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5. Numbers in brackets correspond to the parameter control localization in the interface. See Appendix B.

6. Even if *MISS* can function at any sampling rate supported by the digital audio converter used, it generally runs at 44.1 KHz, therefore the maximum frequency is 5512.5 Hz

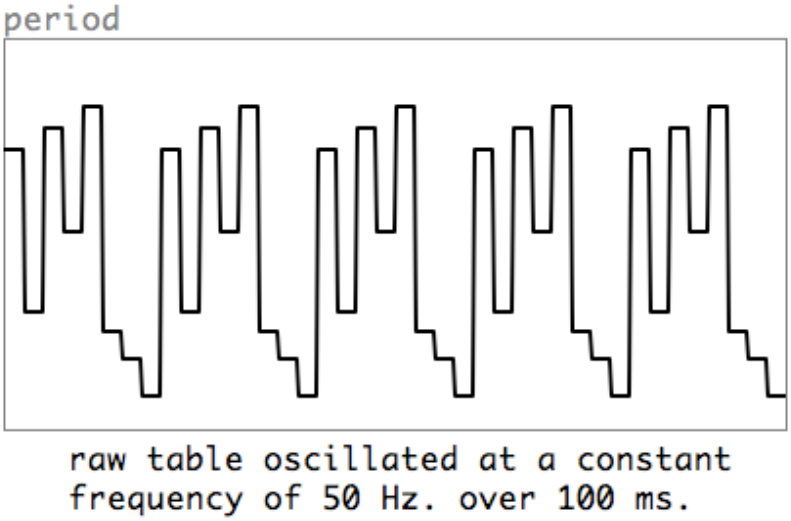

Figure 5. Eight-point table oscillated at the period level (compare the waveshape with the «drawing» in [Figure 4]).

At the sequence level, (I leave the event level for later explanation, since it appears as a consequence of what I will report now), the same table is used, in a sequencer-like manner, to organize a series of eight pitch events within a user-defined (and constantly re-defined) frequency range. This range, also linked to the maximum and minimum values of the sliders, is scaled from zero to the sampling rate divided by eight. Zero was considered an easy and elegant way to introduce silence and rhythmic patterns (using frequencies below the hearing threshold) in the sequence, while the upper limit was chosen for the reasons explained in the previous paragraph. Low- [25] and high-frequency boundaries [26] can be set and varied independently at every moment. As in the period level, no interpolation scheme is used while reading the table. The reason for this is that otherwise, the outcome of the sequence would be perceived as a continuum of glissandi rather than as a series of clear and demarcated events, something that was definitely not desired as a main sonic characteristic of the system.

In the current implementation, the sequence loops from left to right at a rate selected by the user [27] within the range 0.001 to 25 Hz, which in practical terms means that the pitch-sequence could not only be perceived as a series of events, but as different sections on the macro-structural level, for at the minimum speed of 0.001 Hz, each step lasts more than fifteen minutes.

A further development of the system could include different contrapuntal and serial manipulations of the sequence, such as retrograde, inversion, reordering and filtering, according to various selection principles; nevertheless, these operations would add some difficulties for the performer, for he could no longer «see» the sequence as sketched by the slider positions on the interface. However, the user can decide whether to read the whole eight-step sequence or a portion of it, from 1 to 8 consecutive steps starting from the left [28].

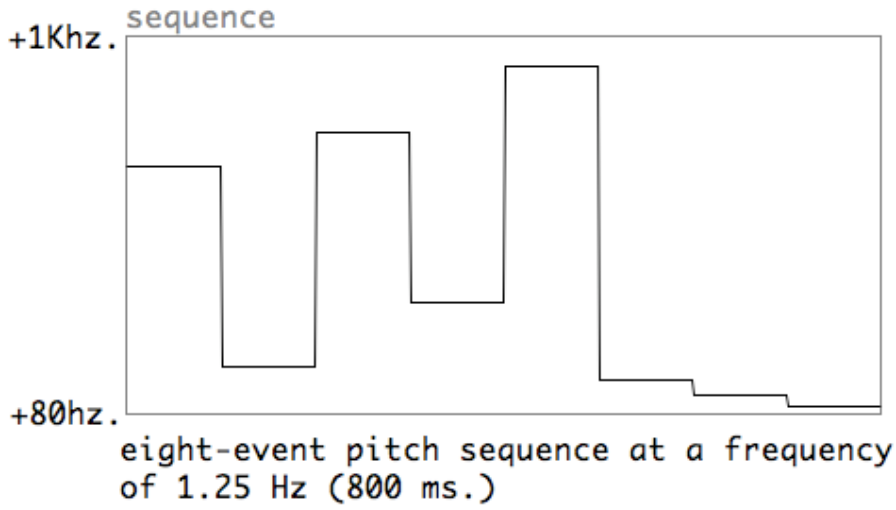

Figure 6. The eight-fader drawing (compare with previous figures) is interpreted as a sequence of pitches. Low- and high-frequency boundaries has been set to 80 and 1000 Hz, respectively.

Every single step occurring in the sequence falls into the category of what I called the event level. Here, an eight-point envelope curve also derived from the nuclear eight-point table, is applied to each of the individual events. For this purpose, the table is now scaled as the absolute value of the range from minus one to one, so the amplitude is minimum at the center and maximum at the edges.

The envelope speed [29] depends upon the sequence loop rate, being a fraction or a multiple of it within the range ⅛ to 8 Hz per event. This means that one can choose to read the envelope window synchronously with the sequence (⅛ Hz), where every single event would have a different amplitude related to its corresponding slider position, once per event (1 Hz), or up to eight times per event (8 Hz), generating a series of amplitude-modulated «micro-events».

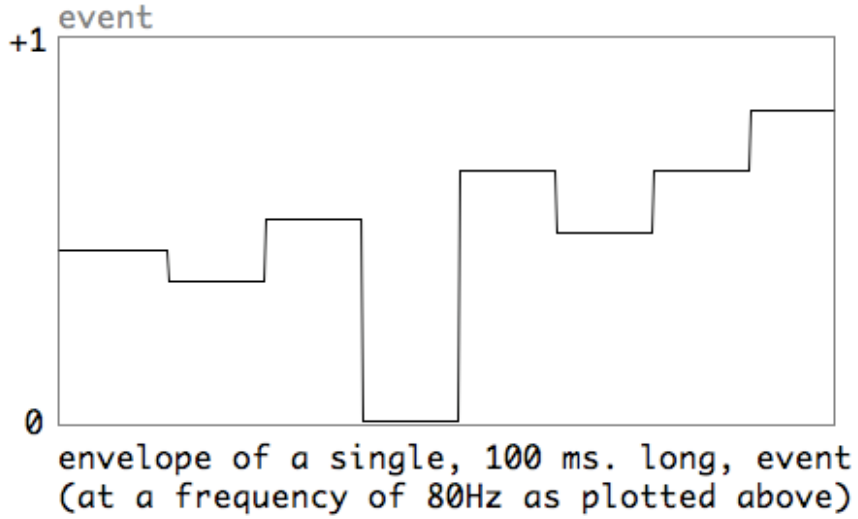

Figure 7. Envelope curve derived from the eight-point table. At first glance, the graph could seem unrelated to the previous ones because a symmetrical scaling is applied, resulting in 0 when the faders are at the center position and 1 at the edges.

Both sequence and event level can be independently enabled or disabled with dedicated switches. If the event level is deactivated [36], the overall amplitude will correspond to the peak amplitude of the table. If the sequence level is deactivated [35], however, the sequence speed control would still affect the envelope speed per event as already explained.

[Figure 8] shows a diagram of how these three time layers and their corresponding sound parameters relate to each other.

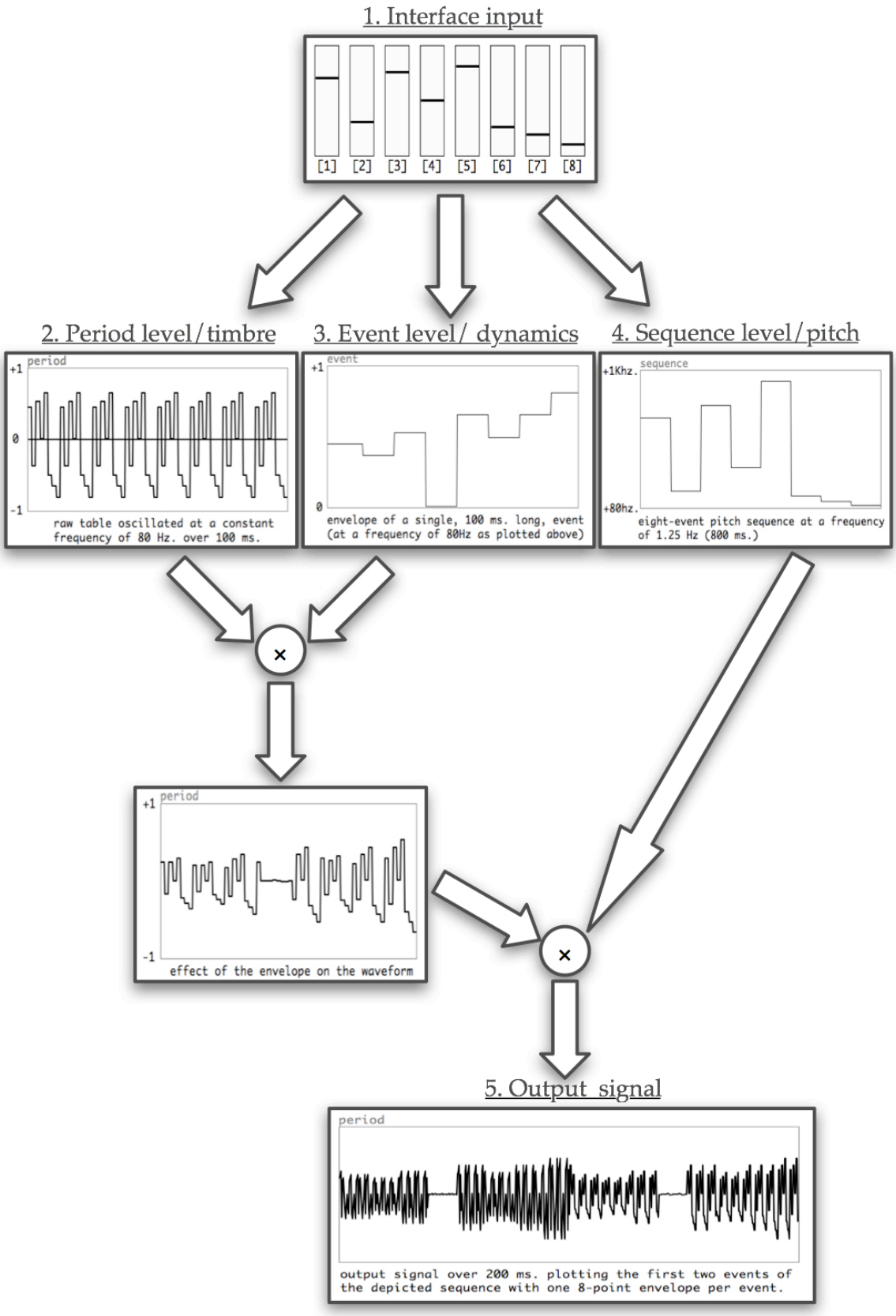

Figure 8. Basic architecture of *MISS*.

Deviations. For every parameter described, a dedicated deviation range control was implemented. Deviations in *MISS* were conceived following a mean/deviation model, that is, every parameter value defined by the user acts as a center value, from which deviations are calculated conforming to a linear random distribution (a further development could include other probability distributions). The user, therefore, defines the amplitude of the deviation —the largest distance from the center— in the range from zero to «maximum-parameter-value-divided-by-two». The output value corresponds to the mean value plus or minus the deviation.

If the new value, due to this operation, lies outside the range of each individual parameter, then it is reflected back into the range by the same amount by which it exceeded it. This idea follows the «mirror» procedure used by Xenakis in *GenDy* (Serra, 1992). However, since every parameter in *MISS* is derived from the eight-point table, variable amplitude boundaries [22, 30] were defined only at the input stage, that is, before the table is interpreted in any way. That said, since individual parameters all have dedicated deviation range control, static «mirror barriers» were implemented to force values into their specified ranges.

At the input stage, each point in the table —each slider in the interface— has its own independent deviation range control [9-16]. Since the table is the basis of every sound parameter and time layer, these deviations will be meaningful everywhere in the algorithm. The basic rule for the deviation behavior could be summarized as «only one deviation per point per cycle». This means that at the period level, a different waveform (depending on how many and how extreme deviations are configured) is generated at every cycle (and therefore is frequency dependent). It is also possible to decide how many periods of the waveform, from 1 to 128, are to be repeated before new values are calculated, and consequently, the «periods per value» parameter [32] has a dedicated deviation range control [24].

Deviations in frequency (if the sequence level is active) are obtained by independently setting low- [17] and high-frequency boundary deviations [18]. This will provide, following the above-mentioned rule, only «one different value per event per sequence». In case we want more than one deviation per event (therefore generating a group of «micro-events» inside the event) we need to create a deviation in the corresponding point in the table. When the sequence is disabled, only the high-frequency boundary control remains operative, being interpreted as the center fre-

quency from which deviations occur. If this is to happen, the deviation rate must be linked to the period level, updating a new value every specified number of periods.

Sequence looping rate deviations [19] act as a link between the sequence and the event levels, because speed deviations are calculated not per sequence but per event, so when active, each event in the sequence will have a different duration. In a similar way, the «steps per sequence» deviation range control [20], determines both the number of events to be played in a sequence and the number of points to be considered in the envelope curve. The aforementioned rule at the event level means that only one envelope deviation is calculated per envelope cycle.

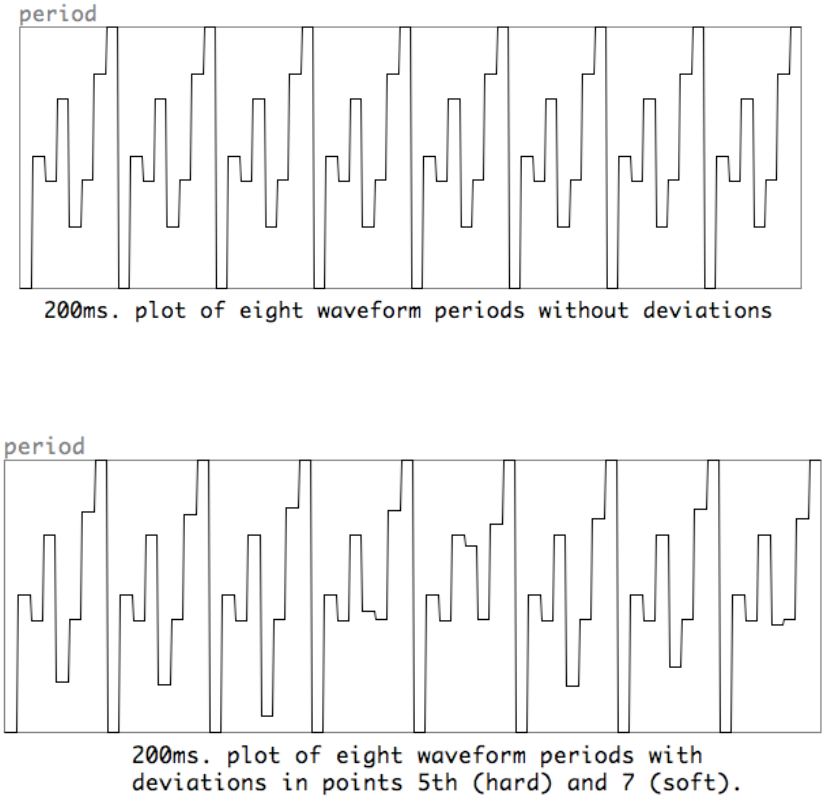

Figure 9. Waveform oscillated at a constant frequency with and without deviations.

Voices. All of the procedures described constitute what I would call a voice. So far, the system described was purely monophonic. However, *MISS* allows the instantiation of up to eight simultaneous voices, and this number could be in theory expanded infinitely, depending on the CPU power. Each of these voices, or instances, reads exactly the same control data. This implies that if the performer does not introduce any deviations from the mean values, every voice will sound exactly the same. It is only when deviations come into action that individual voices differ-

entiate from each other. Since every single parameter has independent deviation control, the variety and differentiation of simultaneous voices is quite substantial.

In musical terms, the idea behind multiple instantiations of the same procedure was largely inspired by the concept of heterophony. Heterophony, that is, variations in interpretation (in terms of ornamentation, timbre, etc.) upon a basic melody or rhythm played simultaneously by multiple musicians, is a procedure usually found in Non-western music, for instance in Indonesian Gamelan or Japanese Gagaku music. I found heterophony a preferable approach, since a polyphonic approach (i.e., complete independence of all the voices, though perhaps linked by some formal strategy) would certainly increase performance difficulties. Different specifications for table drawing and parameter values would be needed for different voices, implying not only a much larger battery of external devices and controllers, but also a loss of the intimate control inherent in a limited but highly significant number of tasks. That said, certain models of late Medieval and early Renaissance polyphony did serve as sources of inspiration for the system. For instance, isorhytmic-like techniques can be easily achieved by setting different speeds at both sequence and event levels, and imitative counterpoint is made possible simply by deviating the frequency range of the sequence or by making phase-asynchronous readings of the same material in different voices. For this reason, one extra button was added to the interface, causing all the voices to again re-synchronize [37], and enabling homophonic textures.

Extra features. A few extra functionalities were added to the system, mostly dedicated to filtering the data in different ways.

- Low- and high-amplitude boundaries [30, 22] were, as mentioned, added at the input stage, causing all the samples to fold within the defined amplitude range. Since these amplitude values redefine the initial (raw, not scaled) table, every parameter is affected by these boundaries.
- A low-pass filter [23] was added at the input stage for every individual point. This was done to filter out very rapid changes in the input, to smooth transitions between sample values[7], and to create *glissandi*. The cut-off frequency of the filter can be selected from the range 0.0005 Hz to the sampling rate divided by two.

7. Not between consecutive samples (this would be interpolation) but between different values [y] for the same index [x].

- A band-pass filter [31] with center frequency equal to the actual sounding fundamental frequency and adjustable bandwidth was the solution chosen to soften, when desired, the harshness of the non-interpolated signal (actually, this is a kind of interpolation). The filter is implemented at the output stage of the design, and therefore does not affect the way in which the eight-point table is read in different layers.

Lastly, two switches were added to bypass [34] the communication between the interface and the computer, in order to make possible drastic changes in many parameters before sending them all at once and in order to mute [38] the sound.

Conclusion and Further Development

Brown & Jenkins, (2004) announced their *Interactive Dynamic Stochastic Synthesizer* as the «first implementation designed specifically for live performance» of Xenakis' model through a real-time synthesis engine. Nevertheless, real-time operation does not ensure suitability for performance; for instance, the *New GENDYN Program* (Hoffmann, 2000) and *Stochos* (Bokesoy & Pape, 2003) operate in real-time, but were not specifically meant for live performances. *Dynamic Stochastic Synthesis*, from my point of view, appears to be particularly difficult to use for performance (especially improvisation), since its self-generative sound synthesis algorithm forces a performer to act as a sort of demiurge (creating the initial conditions and observing the autonomous behavior of the system) rather than as a player (determining and following the «actual» conditions at any time). In this sense, my main concern while designing *MISS* was indeed to start a personal field of reflection about how algorithmic composition strategies —even at the most basic level— could be used effectively in improvisational performance. That is to say, I wanted my design to favor, or at least not disturb, close relationships between the actions of the user, the control interface, and the generated sound. This, I believe, was partly achieved by implementing the mean/deviation model I described, rather than random walks or Markov chains as the random procedures (which produce a self-generative output) and by creating a direct link between the control sliders and the sound algorithm.

> The Greek word *syn-thesis* and the Latin *com-posing* are equivalent; obviously, they both mean *putting together*. (Anderson, 2005, p. 12)

This quotation by Agostino di Scipio emphasizes that, at present, music composition tends to focus more and more on microscopic aspects of time, as computers make it possible to smooth the differences between sound design and formal composition. For me, the implications of this sentence are inspiring, for beyond redefining ways of making music, they suggests a different way of listening to music, dislocating the traditional discussion about musical form and structure, and thus qualifying (computer) improvisation as a genuine means of composition through synthesis. In Xenakis' words, «one of the most interesting aspects of *dynamic stochastic synthesis* is that it reduces aspects of score composition to sound synthesis» (Hoffmann, 2000). Therefore, to create such «composed» sound in improvisational situations opens up real possibilities for integrating composition and improvisation. For example, this could be accomplished by clearly differentiating the time levels in which one or the other approach is chosen. As Vaggione says, «what is interesting for music composition [with computers] is the possibility of elaborate syntaxes that might take into account the different time levels, without trying to make them uniform» (Vaggione, 1996).

Two final observations follow. The first is that, since the macro-structure of a performance is dependent upon the improviser's decisions and actions over a given time, the nature of the algorithm itself must remain simple to facilitate manipulation and allow for a certain predictability. I find this an important quality in order to master the computer instrument and gain a feel for the direct relationship between input and output, though of course I am not advocating for a state of total control (even if it were desirable, it would never be possible). Second, this structural «simplicity» is what constitutes one of the most salient characteristic of *MISS*, contributing to its rough, characteristic timbre, and transparently linking the internal properties of the sound with the improviser's musical phrasings.

I am sure that I will explore richer and more complex micro-time algorithms in the future, because they could lead to an intimate, non-interfering, and non-uniform (in the sense used by Vaggione) integration of compositional and improvisational approaches, without sacrificing the advantages of any of these fields.

With regard to *MISS*, I believe both that there are still many musical possibilities to explore within the system as it is implemented, and that such exploration will suggest further expansion of the system.

More specifically, I've found that the control interface itself is the main physical limitation for many envisioned developments. For that reason, I am currently experimenting with multi-touch screen controllers, as they would allow bi-directional communication between the player and the system. If the computer can update the actual interface while playing, that not only will easily permit contrapuntal manipulations without sacrificing playing control or accuracy, but I hope will also suggest subtler interactions between the player and the computer.

I would also like to make *MISS* capable of interpolation between various states with different transition times and curves. This should be possible, because communication between the control interface and the computer can be bypassed at any time, in order to make modifications and send all control data simultaneously. Such flexibility would facilitate a great number of structures and behaviors unattainable in *MISS*'s current implementation. Following the same logic, a system of presets could permit «snapshots» of a given state of the interface, to be recalled at a later time during the same performance.

Lastly, substituting the eight-fader interface for a bigger number of controls (I'm arbitrarily considering sixty-four) would have immediate consequences for the timbre (because the waveform period could be shaped more accurately), as well as for the event and sequence levels. But having said this, working with a touch screen means the «fader» metaphor is no longer necessary, so drawing directly on the interface could be a more coherent way of approaching a new design.

Appendices

A. Short Reference to MS Objects

Control Management Objects

[binKey] Maps MIDI note in messages to binary numerical system.

[ctlBypass] Bypasses communication between MIDI control in messages and pure data.

[ctlinRouter] Routes data coming from MIDI control in messages up to 10 different locations selectable with the alphanumeric keyboard.

[logitechJst] Enables communication with an external joystick and scales its data conveniently.

[mverbPrg] Controls MIDI program changes with the alphanumeric keyboard (used to communicate with an *Alesis Midiverb III* multi-effects processor).

[pedalRoute] Routes data coming from MIDI program change messages (i. e., MIDI pedals) up to 10 different locations selectable with the alphanumeric keyboard.

[presets] Stores and recalls up to 9 different MIDI control configurations.

[OSCpackage] Distributes incoming OSC data to all possible OSC destinations (used to communicate with an *IpSon Compact*[8]).

[softCtlin] Generates floating point control data from MIDI control in messages depending on the speed of movement.

[trptSwitch] Enables communication with the *Microhorn* and scales its data conveniently.

Audio Processing Objects

Most audio processing objects are implemented in both mono and stereo versions. They are listed here disregarding this consideration.

[blurrer] Modulates the input signal with filtered noise.

[boostorsion] Up 20 dB extra amplification with an arctangent wave-shaping function.

[cheapReverb] Delay line-based low-consuming reverb.

[compander] FFT time stretcher.

[degrader] Lowers the sampling rate and bit quantization of the signal.

[delay] Simple delay line (20 to 2000 ms.) with mix and feedback controls.

[delGran] Delay line-based real-time granulator with up to 64 voices and a mean/deviation model with a gaussian probabilistic distribution. Available controls: (1) grain mean duration and (2) deviation percentage, (3) grain mean inter-onset time and (4) deviation percentage, (5) delay line mean read point and (6) deviation percentage, (7) grain mean transposition and (8) deviation percentage, (9) grain mean envelope and (10) deviation percentage, (11) grain mean amplitude and (12) deviation percentage, (13) number of voices.

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8. The *IpSon* (Internet Protocol Sonology) *Compact* is a voltage to OSC converter designed and developed at the Technical Department of the Institute of Sonology, in collaboration with Michiel van der Weiden. (www.koncon.nl/ipsonlab)

[extraGain] Up to 20 dB extra amplification.

[freqShift] Single sideband frequency shifter.

[initDelay] Initial delay time (0 - 60000 ms.).

[keyDelay] Multi-tap delay.

[mono2Stereo] Converts a mono input into a pseudo-stereo signal.

[panelPlayer] Sound file player.

[randPan] Time-variant random panorama generator.

[resonator] Variation of the karplus-strong algorithm; it resonates if the fundamental frequency of the input is an harmonic of the given resonance frequency.

[sampler] Real-time sampler with four independent buffers. Available controls: (1) independent recording and playback, (2) reading point, (3) sample length, (4) transposition, (time-stretching factor), (6) loop, (7) backwards reading and (8) gain per buffer.

[spectralFilter] Noise modulated FFT filter.

Audio Routing Objects

[1in_Nout] One input is routed up to N outputs.

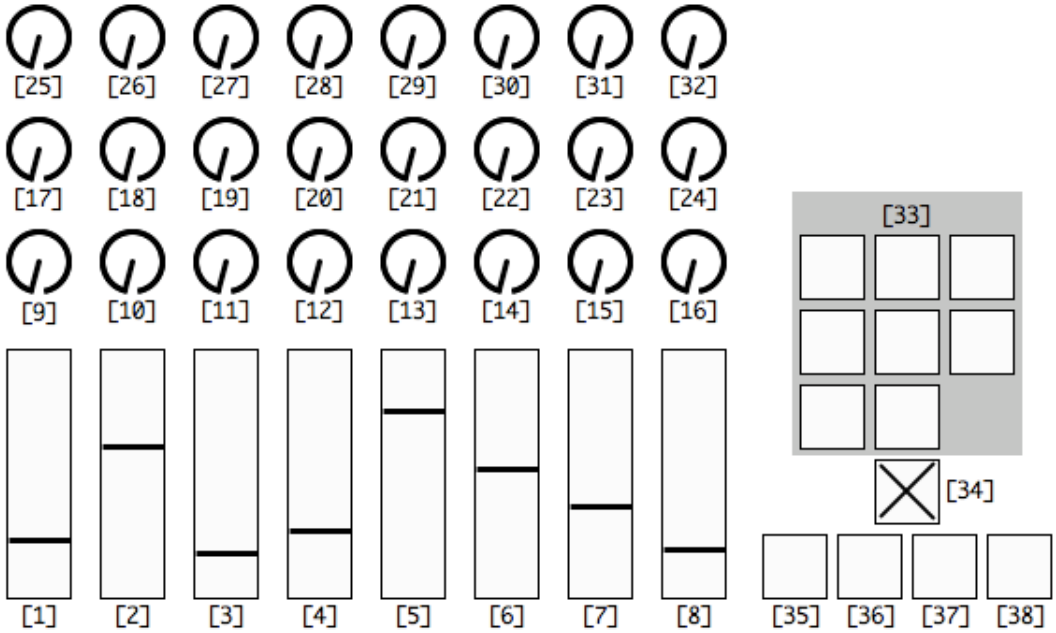
[Nin_1out] N inputs are routed to one single output.

[crossfader] Cross-fader between two signals.

[IO_Mtx] Audio matrix. Routes inputs and outputs in many different ways, allowing to create loops in the signal flow.

[jx4] Joystick-controlled audio mixer up to four different inputs.

B. List of Available Controls in MISS



- [1-8] Mean shape of the table.
- [9-16] Deviations for each individual point in the table.
- [25] Mean low-frequency boundary (0 Hz - SR/8) and [17] deviation.
- [26] Mean high-frequency boundary (0 Hz - SR/8 Hz) and [18] deviation.
- [27] Mean sequence loop speed (0 - 25 Hz) and [19] deviation.
- [28] Mean number of events per sequence (1 - 8) and [20] deviation.
- [29] Mean event-envelope speed (⅛ - 8 Hz) and [21] deviation.
- [30] High- and [22] low-amplitude boundaries.
- [31] Band-pass filter bandwidth in semitones.
- [23] Smoothing low-pass filter cut-off frequency.
- [32] Mean periods per value (1 - 128) and [24] deviation.
- [33] Number of voices (1-8).
- [34] Bypass communication.
- [35] Sequence-level switch (on/off).

- [36] Event-level switch (on/off).
- [37] Phase synchronization (trigger).
- [38] Mute switch (on/off).

C. List of Performances

MS

2006-05-11 with Miguel Álvarez (guitar [ES]) and Ernesto Ojeda (electronics [ES]). Conservatorio Profesional de Música Francisco Guerrero, Seville.

2006-06-09 with Miguel Álvarez and Érica Zisa (vocals [AR]). Fine Arts Faculty, Universidad Complutense, Madrid.

2006-07-08 with Miguel Álvarez and Érica Zisa. La Zebra Coja, Madrid.

2007-05-07 with Marian Marqués (vocals [ES]). Koninklijk Conservatorium, The Hague.

2007-05-29 Solo Performance. STEIM, Amsterdam.

2007-07-01 with *FOCO Orchestra*. La Casa de los Jacintos, Madrid.

2007-07-29 with *FOCO Orchestra*. Teatro Juan del Enzina, Leon.

2007-09-17 with Rodrigo Parejo (flute [ES]). Koninklijk Conservatorium, The Hague.

2007-10-10 with Ronald Boersen (viola [NL]). Koninklijk Conservatorium, The Hague.

2007-12-04 with Yolanda Uriz (flutes [ES]). Koninklijk Conservatorium, The Hague.

2008-02-11 with Yolanda Uriz. Poteen Still, The Hague.

2008-03-26 with Yolanda Uriz and Orlando Aguilar (vibraphone [MX]). Paard van Troje, The Hague.

2008-05-14 with Manoulis Manousakis (electronics [GR]) and Joe Tornabene (saxophones [USA]). ElectroMediaWorks'08, Athens.

2008-05-14 with Yolanda Uriz. ElectroMediaWorks'08, Athens.

2008-07-01 with Yolanda Uriz. CRUCE, Madrid.

2008-08-02 with Yolanda Uriz. Galería DF, Santiago de Compostela.

2008-08-05 with Yolanda Uriz. MACUF, A Coruña.

2008-08-08 with Yolanda Uriz. Le Larraskito, Bilbao.

2008-10-21 with Yolanda Uriz. The Klinker, London.

2008-10-22 with Yolanda Uriz. Flym Flam, London.

2008-10-30 with Yolanda Uriz. Studio LOOS, The Hague.

MISS

2008-04-24 with *RIO* (*Royal Improvisers Orchestra*). Regentenkamer, The Hague.

2008-04-29 Solo performance. Koninklijk Conservatorium, The Hague.

2008-05-05 with Orlando Aguilar, Lynn Cassiers (vocals [BE]) and Yolanda Uriz. SJU Jazzpodium, Utrecht.

2008-05-20 with *RIO*. Tic Tac, The Hague.

2008-05-21 with *RIO*. Zaal 100, Amsterdam.

2008-06-30 with Érica Zisa, Pedro Rato (electronics [PT]) and Yolanda Uriz. Espacio menosuno, Madrid.

2008-07-15 with Manoel Giao (guitar, [PT]). MACUF, A Coruña.

2008-10-29 with Ricardo Tejero (saxophones, [ES]) and Yolanda Uriz. The Boating, London.

2008-10-30 with *RIO*. Studio LOOS, The Hague.

2008-11-27 with *RIO*. Studio LOOS, The Hague.

2008-12-02 Solo performance. Koninklijk Conservatorium, The Hague.

2008-12-06 with Ricardo Tejero and Yolanda Uriz. The Amethist, Amsterdam.

2008-12-10 with Mike Majkovski (double-bass [AU], Laura Altman (clarinet [AU]) and Yolanda Uriz. Regentenkamer, The Hague.

2008-12-13 with *RIO*. Zaal 100, Amsterdam.

2008-12-19 Solo performance. Audiência Zero, O'Porto.

2009-01-08 with Mike Majkovski, Laura Altman and Yolanda Uriz. Scheltema Complex, Leiden.

2009-01-22 with *RIO*. Bimhuis, Amsterdam.

2009-01-29 with *RIO*. Studio LOOS, The Hague.

2009-02-01 with Raoul van der Weide (double-bass [NL], John Dikeman (saxophone [USA]) and Yolanda Uriz. Regentenkamer, The Hague.

2009-02-26 with Raoul van der Weide, John Dikeman and Yolanda Uriz. Studio LOOS, The Hague.

2009-02-26 with *RIO*. Studio LOOS, The Hague.

2009-03-10 Solo on the NoWFS system. Scheltema Complex, Leiden.

2009-03-21 Solo on the NoWFS system. Scheltema Complex, Leiden.

2009-03-26 with *RIO*. Studio LOOS, The Hague.

2009-03-29 with Eva Novoa (piano [ES]) and Yolanda Uriz. Regentenkamer, The Hague.

2009-04-18 with *RIO* featuring Tristan Honsinger (violoncello [IT]) and *Tobias Delius Quartet* [NL]. Studio LOOS, The Hague.

2009-04-22 with *RIO*. Maarten Lutherkerk, Amsterdam.

2009-05-06 with Neel de Jong (dance [NL]), Michele Bagaglio (computer [IT]) and Yolanda Uriz. Regentenkamer, The Hague.

2009-05-08 with *RIO* and *Instant Composers Pool Orchestra* [NL]. Studio LOOS, The Hague.

2009-05-21 with Yolanda Uriz. Studio LOOS, The Hague.

2009-05-29 with Eva Novoa and Yolanda Uriz. Koninklijk Conservatorium, The Hague.

2009-06-01 Solo. DNK Concert Series, Amsterdam.

2009-06-04 with *RIO,* Peter van Bergen (saxophones [NL]) and *Trio BaamDeJoode-Vatcher* [NL]. Studio LOOS, The Hague.

2009-06-23 with Yolanda Uriz. Koninklijk Conservatorium, The Hague.

2009-06-24 with Yolanda Uriz. Koninklijk Conservatorium, The Hague.

2009-06-27 with *RIO* featuring Han Bennink (drums [NL]) and Steve Beresford (piano [UK]). Bimhuis, Amsterdam.

D. Guide to the DVD

/00. Faraldo 2009 Bridging Opposites. PDF version of this document.

/01. Yolanda Uriz & Ángel Faraldo - Villa Ockenburg. This release provides an example of the *Modular System* in use. Recorded in The Hague in April, 2009. Sound registration and edition by the authors.

/02. AUMF - Scheltema Concert. Laura Altman (clarinet), Yolanda Uriz (flutes), Mike Majkovski (double-bass) & Ángel Faraldo (*MISS*). Live-performance, January 9, 2009, Scheltema Complex (Leiden). Sound registration and edition: Ángel Faraldo.

/03. MISS' Solo Improvisations. Selection of solo improvisations with *MISS.* Unedited.

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