Brunel University
Centre for Contemporary Music Practice

Commentary on the pieces submitted for the degree of PhD in Music Composition

Hacking Traditional Instruments

Approaches to sound-oriented instrumental composition

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To Bob Gilmore

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Abstract

Technology plays a vital role in the creation of any form of art. In music this has been dominated by a stationary condition in which contemporary 'academic music' (new music created in institutions and descending from traditional European models) is in its majority still generated exclusively by a technology of more than a century ago. Additionally, the totality of sound as musical material is now commonly acknowledged, posing problems about the nature and efficiency of the already existing musical instruments and the development of new ones.

The current situation in the creation of contemporary music offers a myriad of possibilities in which tools, controllers and instruments have an impact on the creation and conceptualization of music, giving rise to different aesthetic positions and creating new dilemmas in which present, past and future are in constant assessment.

This thesis seeks to examine some of the concepts and ideas behind a number of my works in which instrumental sound exploration is essential for the development of the compositional process. As a result, a series of questions, systems and techniques are analyzed, investigating the relation between tools, technique, notation, composition and musical result. This text is intended as an illustration of my own choices and methods, hoping to offer an insight into my own compositional practice as a product of an exercise of self-analysis and rationalization of my current musical output.

Introduction

Art relies on technology. Artists require some kind of technology in order to articulate, structure and express their ideas. Music technology is in a constant and rapid state of change and any thesis that would endeavor to explain, summarize, or defend any modern musical/technological topic would soon be old fashioned or completely out of date. On the other hand, aesthetical and creative transformations and developments need much longer periods of time (and most of the time the proper socio-cultural conditions) to occur, permeating into larger-scale domains and eventually creating revolutions.

A number of technological and creative developments that took place in the previous century gave rise to present-day conditions where a huge pool of possibilities are present for composers, musicians, amateurs and computer geeks alike, along with a whole set of problems, paradigms and questions the answers and solutions to which appear still far from being solved. One of these fields of research and development is that of musical instruments, the physical human interfaces of music generation and expression.

For almost the whole of music history, mechanical instruments have been the carriers of musical information and expression. Although technology has made it possible for the first time in human history to bypass the performer and the musical instrument in order to create music ('tape music'), technology and present-day computational speeds have offered the possibility to expand traditional instruments through real time processing techniques or/and to create new instruments and controllers, either based on conventional instruments or by finding new inventive ways of controlling sound through 'non-instrumental' objects. However their differences, responsiveness, expression and communication appear to be common concerns among performers and inventors.

Parallel to musical technological developments from the previous century is the opening up of 'all sounds' as musical material, and together with this the construction of methods, techniques and strategies to analyze and organize these sounds, sound-oriented composition[1]. Sonic complexity and richness have a convoluted history of artistic acceptance with their

[1] Referring to a composition concerned with the organization and combination of sounds, rather than pitches.

[2] In the entire text the term "sound" refers to the whole variety of acoustic phenomena, including

possible origins after the industrial revolution, but whatever its path of development noise[2] has grown in social acceptance, although it remains more common in popular music than in 'art' music. Nevertheless, the expansion of the percussion family in the orchestra, the development of unusual techniques for traditional instruments and the use of technology in combination with conventional instruments, reflect a creative necessity in which sometimes digital processes and found objects give the impression of having more to offer to the composer interested in sound, than another more 'clichéd' approach coming from a catalogue of extended 'tricks' for traditional instruments.

Even though more composers and performers are currently jumping to explore present technologies (as a fashion or a genuine interest), most 'serious' instrumental music is still being composed for a technology designed to fulfill the necessities and creative ideals of people a hundred years ago, composing the music from today with the technology from the past, a technology that remains very much untouched since the Romantic period. On top of that there are all the deficiencies of the system, practical, logistical and economical. Orchestras, ensembles and other instrumental groups are mostly devoted to established repertoire and the chances of having enough time to rehearse and work at a laborious composition are mainly reserved for the 'well known' composers. And the current panorama does not look very promising for the emerging instrumental composer hoping to have his music premiered by the best orchestras or ensembles. The current socio-economical problematic even jeopardizes yet another performance of music by Mahler or Beethoven, so what are the chances for a novice composer with one more complex and "strange" piece requiring a lot of (unavailable) rehearsal time? Perhaps in a not-too distant future orchestras, and other conservative instrumental groups, are to be confined to ever-more perfect performances of established repertory, almost as an anthropological exercise. And to play music that would sell enough tickets for the performers and concert halls to be independent of any private or government grant.

But in the meantime we still have two available instrumental worlds, 'acoustic' and electronic. Each one has a whole set of challenges, problems, paradigms and potential to be explored, a multiplied potential when they are combined. On one hand the "old fashioned" traditional instrumental world, full of timbral, technical and even economical and political limitations, carries a whole baggage of cultural and referential identity and is in the hands of

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[2] In the entire text the term "sound" refers to the whole variety of acoustic phenomena, including "noise". For that reason this last term is avoided since I would rather define it as "sound without acquired musical meaning", just as "music is castrated noise" (Feiler, 2008).

not always adventurous players. On the other hand, we have "new" instruments and commercial controllers (most of them difficult to afford) looking for new virtuosos, new repertoire and open to a whole new set of sound environments.

But, do new instruments necessarily create new music? And if they do, what is then the role of traditional instruments (and instrumentalists) within the creative world of contemporary music? Is it necessary to follow a continuous line of development between the instruments of the Romantic orchestra and the new sound control interfaces, or do we have to break any resemblance with the past in order to create the present and the future?

A common mediator between tradition and novelty in new music has been the use of computers to process or accompanied conventional instruments. Computers are now frequent in the creation and performance of contemporary music, but are they really becoming new musical instruments? or simply tools helping us to create music. Combining traditional instruments with real-time (or fixed) processes and/or computer-generated sounds, is a widespread compositional exercise but, are these techniques really extending the sonic and technical possibilities of traditional instruments? or every piece is an attempt to join two extremely unrelated worlds by relaying in more or less similar techniques to make them coincide.

It seems that sound, in general, has become music, or at least is widely accepted as such. If so, are traditional instruments able to compete with the wide range of complex sounds that a computer can generate? And, what kinds of instrumental techniques would be necessary to produce complex sounds? Do we really need trained musicians to play essentially music that is unidiomatic to their own instruments; do we really need conventional instruments at all? And if not, when does a primitive object become a musical instrument and how?

Technology is present in every aspect of our lives, and art is not an exception. Is this exacerbated use of new technologies in music simply a superfluous impetus of modernity, a question of fashion, or is it really an artistic necessity deeply affecting the essential fabric of music composition, aesthetics and performance? And if so, is this contributing to emphasize or to blur the differences between 'academic', experimental and pop music, being this accentuated by the actual socio-economical conditions and essentially having an impact in new generations of composers.

The answers of all of these questions are complex and many of the subjects would necessitate a deep an independent analysis out of the scope of this text in order to be fully answered. Nonetheless, the constant quest for solutions has been the driving force behind my work for some years now, therefore I decided to open up the discussion about their possible answers as well as to illustrate and explain my personal choices, considerations and solutions through a series of recent works that reflect my own perspectives and views on many of these topics.

This thesis consists of six main compositions for a mixture of acoustic and electronic media. The earliest of these is *Enclosure* for modified cajón and digital process in real-time, and the most recent *Valves*, for Disklavier, pianist and digital process in real-time. Additionally, a series of three controlled improvisational environments for a number of instruments used and designed for previous pieces. Altogether try to offer a wide perspective of the implemented compositional ideas and concepts discussed throughout the text.

The written component of the thesis is organized in six chapters. The first chapter deals with the current situation of instrumental sound-based composition, attempting to establish a context of discussion and exposing my personal solutions and approaches to some of its problems. The second consists on a categorization of instrumental techniques extracted from my own works, explaining what constitutes them and illustrating each with examples. The third chapter explores the boundaries between instruments and rudimentary objects, investigating the advantages and disadvantages of found objects as musical instruments as well as providing examples on my own music. The fourth goes deeper into the use of computers in combination with traditional instruments, explaining some of the perceived problematic involved and developing some of my personal approaches and standpoints in relation to the use of these two media. A more detailed description of some of the implementations exposed in the submitted pieces is given in chapter five, each piece explained in terms of context, technique/structure, and notation. To conclude, some final considerations on a number of topics are exposed as a form of reflection of particular related issues treated throughout the text.

Chapter 1

Looking for Sound in Tradition

For what kinds of music are traditional music instruments intended?
I have heard several times professional instrumentalists disencouraging novice composers to focus so much on extended (unconventional) instrumental techniques and concentrate on melodic or 'pitch-oriented' material. This conservative attitude is many times the product of a concern about the integrity of their instruments, or of players bored of interpreting repeatedly similar repertoire and still others simply based on a matter of musical taste. But on the other hand we can indeed affirm that Western musical history has made pitch the most essential musical parameter, and that the development of musical systems (notational, compositional, theoretical) has been primarily related to the manipulation of discrete sounds (notes). Correspondingly, musical instruments have been developed to function within the necessities of each period (aesthetically and practically), but possibly since the invention of musical notation, instrumental development has been directed towards two main goals, to improve and stabilize intonation and augment acoustic power (Jorda, 2005). To determine what was first, aesthetic necessities giving rise to musical systems or aesthetics being affected by constrains of already available systems, is a chicken and egg dilemma. But what is clear is that socio-cultural and technological surroundings have conditioned the evolution of orchestral instruments reaching its peak of their of evolution in the 19th century.

Today the composer interested in dealing with instruments and sound as compositional material is presented with a number of options. On one hand, there are instrumental "extended techniques" which have been mainly developed from the second half of the previous century and which have found progressively a place in the standardization and practice of more conventional instrumental technique. On the other, the use of technology and more concretely computers, which, from computer-assisted music to human-computer interaction, have rapidly permeated the common musical praxis. And finally, the combination of instruments and digital/analogue sound processes.

In the quest for instrumental sound resources the most immediate alternative is to consult a performer, or in his/her absence methods and books. One is lucky if the instrumentalist in question is also fond of experimenting and exploring his/her instrument, sometimes even offering the composer a pool of tricks and skills that he can choose from. In certain cases the composer decides to push forward these techniques by imaginatively combining or expanding them in musically successful (and sometimes challenging) ways. Then instrumental technique evolves, transcending the skills of the performer and the standardized 'idiomatic' techniques as a result of a good collaboration between performer and composer. However, in my experience, this is a difficult situation to achieve, as you have to rely on the time, ability and attitude of the performer. And in many occasions, instrumental experimentation is reserved

for established composers; otherwise they are considered mistakes or impossibilities written by a young inexperienced composer.

On the other hand, the use of fingering charts or books is more complicated and sometimes misleading, as they end up being used as recipes for creating particular sounds, which without a proper sound organization or further conceptualization, become discrete sound events (effects or catalogue of instrumental possibilities) disembodied from a sonic meaningful discourse, this probably due to a lack of experiential engagement between theory and practice.

As a composer this combined problematic eventually pushed me to find my own means, when dealing with traditional instruments, towards a sound-based vocabulary.

1.2 Inventing Sound

Personal approaches to instrumental sound-oriented composition

To a certain extent each composer is influenced by the different musical experiences and stimuli during the learning process back in their childhood, determining the different strategies, methods and orientations along the compositional processes and conversely reflecting this in their own musical output. In my case, the first musical encounters were by practicing and learning how to play an instrument, thus the relation between physical effort, movement sound and emotion were always reinforced throughout my early musical practice and understanding, this having an impact in my way of working and inventing music.

During my classical compositional formation I soon discovered a fascination for ‘raw’ sound as opposed to notes or pitch-based structures. The possibility of creating complex sound structures in an environment where approximately ninety percent of the material is tone oriented was, and still is, a problem as much as a subject of interest. Later on, my experience with electronic means and technology led to the discovery of a great number of tools and gained knowledge, allowing me to concentrate directly into the nature and manipulation of sound as basic material for music composition and expanding my conceptions in working with traditional instruments, accentuating the necessity for techniques that would generate more complex and interesting sounds.

The influence of working with computers, where experimentation and immediacy are part of the common process, added to the aforementioned problematic of the performer/composer

collaboration, have progressively pushed me to acquire my own set of traditional instruments. In this way I can have a physical relation with each instrument, exploring its architecture, possibilities and reactions to different techniques, progressively becoming an essential part in the process of composing a new piece. This approach to instrumentation is surely not the most practical, nor the most economical, and although it involves a series of problems it also allows a number of possibilities that are currently crucial in my compositional output. Here I will mention some aspects of them.

Advantages of self-experimentation with traditional instruments:

- One of the most obvious advantages is the accessible conditions and time availability. In relation to the composer/performer problematic described above, having an instrument of my own allows me to have all the necessary time to experiment without having to rely on the availability of the performer.

- Having a direct physical relation with the instrument permits a constant immediate feedback between the methods applied and the results obtained, as opposed to trying ideas on paper and waiting for the first rehearsal to hear the results.

- To develop a relationship with the instrument based on constant observation and experimentation can generate different perspectives from the same instrument, in the sense that the instrumentalist would hardly see his own instrument with the same vision as someone who is in contact with the instrument for the first time, or has a much more detached relation with it.

- And probably the most important reason is to render results that could not have been possible otherwise. To produce an outcome specific to each instrument (or group of instruments) deriving the material and progressively discovering form.

Disadvantages of self-experimentation with traditional instruments:

- Of course, acquiring instruments can be a very expensive habit to sustain. But finding the right channels and places can lower the costs substantially.

- A problematic related to the previous point is that many times ‘affordable’ instruments are too old or in a bad state, many times producing more interesting sounds than the

performers' ones. But it is indeed frustrating to find out that it is not possible to get the same results with better instruments. For this I always try to check with the instrumentalist before the first rehearsal, or simply avoid sounds I suspect are created by the conditions of the instrument. As a last resource I specify in the score an instrument with certain characteristics, or lending my own instrument to the performer.

- Not having a 'proper' or orthodox technique to play the instrument results in techniques that performers have to learn from scratch or that even go against their training. . A fact that can be quite problematic with not so adventurous musicians, as they have to re-learn how to play their instruments, but finding the common ground, good communication, and the necessary musical reasons can sometimes persuade to some of the less adventurous ones.

- One of the most delicate points is the degree in which an instrument can tolerate 'improper' or unusual manipulation. Some instruments are more susceptible to damage than others, and possibly the line of action is not so broad after all, but imaginatively finding the precise and efficient technique that would generate the right sounds without jeopardizing in any sense the integrity of the instrument is the core of instrumental experimentation.

1.3 Summary

In short, I consider self-experimentation with traditional instruments a fruitful field for this sort of instrumental sound-oriented composition, an instrumental practice concerned with sound as a whole rather than its construction by the juxtaposition of pitches. On one hand it expands the vocabulary and potential for many instruments, confronting expectations about instrumental possibilities and their resulting sounds (both from the performers' as from the audience's point of view) and on the other, it provides the necessary tools for a more individual approach to composing sound with conventional instruments, re-designing their identities, possibilities, notation and technique. At the same time there is a certain resistance from some players of 'misusing' their instruments or using them in ways in which they are not supposed to function, many times with techniques that can be more familiar to instrumentalists of other families (i.e. using percussion technique to play a cello). However, I believe that a good instrumentalist/performer is overall a good **musician**, with a great sensitivity to manipulate almost "any object" as an instrument and be able to listen musically (which as easy it can sound, it is not always easy to find).

Chapter 2

Hacking Traditional Instruments

When confronted with a new piece the starting point of the process I go through is almost always designing the sound of the instrument (rather than taking it for granted), observing and exploring its acoustics, architecture and reaction to different methods of excitation. During this process larger scale structures emerge as the sounds of the instrument in question progressively materialize into the final sounds of the piece. In this way almost every piece is the story of the discovery of a "new" instrument out of an existing one, and the ways this progressively emerges shapes the global structure of the work[3]. Nonetheless, even if there is a clear emphasis in the low level scale of parameters (as is the case of finding instrumental sounds) there is always a constant influence between all compositional scales, as initial sounds can suggest certain higher structures and vice versa. But in general I can affirm that I usually start a piece by exploring an instrument.

Categorizing and labeling instrumental actions may be trivial and boring for the pure purposes of performance, but as a composer I consider this an exercise of rationalization and analysis of the techniques I have been implementing in my latest works, as it can be helpful to organize and draw a distinction between the different methods of instrumental sound production in order to gain some insight into what constitutes them and possibly finding new paths of development. For this reason I will devote the present chapter to elaborating a general description of some of the current techniques employed for instrumental sound transformation, as well as illustrating some of them with examples of my own music.

Classifying instrumental techniques is hard for two reasons: first, it is a field in continuous development and as such it is hard to contemplate all the possible ways an instrument can be manipulated. Secondly, on many occasions these techniques can be combined making it difficult to distinguish how many levels of manipulation are being executed. In an analysis of my works I have encountered six basic types.

[3] In the case of ensemble pieces there are elements of interaction and orchestration that are also essential to the composition.

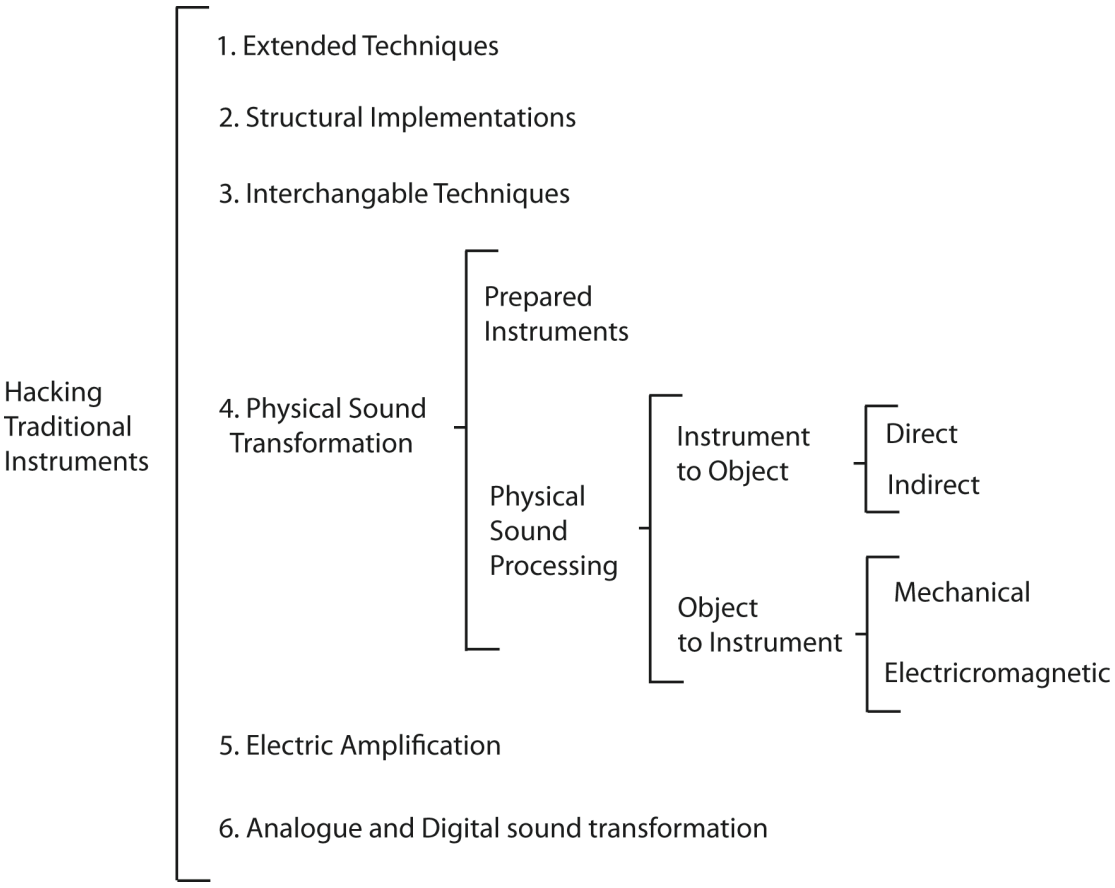

Fig. 1 Techniques for sound transformation using traditional instruments

I will develop each of these six categories as well as their subdivisions, giving examples from my own music as study cases.

2.1 Extended techniques[4]

How adaptable traditional instruments are to musical languages where pitch is not the most relevant parameter is a polemical subject. From the second half of the previous century extended instrumental techniques have found their way into the repertoire of contemporary music. The idea of pushing instrumental technique while bringing focus to "sound" as

[4] Even if all the rest of techniques can be considered as "extended techniques" I am referring to these as the most commonly standardized techniques (multiphonics, over –pressure, whistle tones, etc).

musical material is from my perspective a major breakthrough in the creation and performance of new music. On the other hand, the possibility of exploiting a more meaningful language of sound composition is blurred by the many times these techniques are used as "exotic" sounds under a most prevalent and organized set of musical parameters, remaining almost as sound effects or superficial elements of timbre coloration. And as their name itself suggests, they stay only as "extensions" or deviations from the more regular technique, almost by default making them belong to the much bigger corpus of all other traditional techniques.

Methods and catalogues of these new sounds became progressively more popular. Bags of instrumental sound tricks are now at the service of any composer, without any further sound/compositional involvement or authentic musical necessity. The experiential discovery of sound was substituted and compressed to a set of discrete elements, just as adding more notes to the available ones. These eventually brought a trivialization of sound resources and enhanced the utilitarian view of "sonic ornaments" within the traditional system; however, there have been a number of composers incorporating extended techniques into a more personal sound language.

In this field one example is Helmut Lachenmann. Lachenmann defines his music as "Instrumental Music Concrete", as a reference to the term employed by Schaeffer adapted to his own instrumental composition. Lachenmann advocates the use of sound material as energy profiles derived from instrumental actions, actions that do not belong exclusively to instrumental activity but that we experience constantly in our daily life. In this way, Lachenmann tries to build a compositional technique out of composing different relationships from sound and its energy characteristics: intensity, pressure, loudness, distortion, etc. translating them into a context where the traditional musical parameters are no longer of primacy importance, but the complex combinations achieved by the juxtapositions of previously neglected instrumental sounds acquired a musical meaning.

2.2 Structural implementations

Focusing on a single part or structural feature of an instrument, or shifting components between two different instruments can bear interesting sound results, sometimes difficult to relate to the instruments to which they belong. These techniques can be specially successful and easy to apply when working with dissembling instruments.

Case study I

In my piece *Tu vo* from 2005, the first of my pieces with an 'objective' instrumental approach, I decided to limit myself to the use of a headjoint of a classical flute. The constrained possibilities of the flute to generate the sounds I was trying to achieve pushed me to limit the instrument even more by using a single part of it. These helped me to concentrate on a single feature of the instrument and finding sounds experimenting with articulations that would have been very difficult to discover by using the whole instrument. It was probably the first step in this instrumental direction, it encouraged me to continue working with very simple objects attempting to get the most of them.

2.3 Interchangeable techniques

A popular method of experimenting with techniques, the implementation of a technique belonging to another instrument can generate successful sound resources and provide new perspectives from the same instrument.

Case study II

Homogenization of techniques - from *Transients*-

In my piece *Transients* from 2008, originally scored for harpsichord, violoncello and turntable, I try to create a single instrument with slightly different characteristics out of the combination of the three. For this, every instrument becomes a percussion instrument and gets extended by an integration of other small ones.

Fig.2 Percussive violoncello technique

- Violoncello -Throughout the entire piece the violoncello is placed horizontally on a stable surface, normally a keyboard stand, and carefully hit by soft mallets in strategic places. The performer uses two kinds of mallets, wool and rubber. The use of the rubber mallet is employed to strike the cello in 4 different places, the endpiece, the tailpiece, the strings and behind the bridge, creating short dry attacks of different pitch content. The use of softer mallets is reserved for longer and more continuous layers of sounds crated by hitting the strings softly with both hands in a roll.

As the instrument is amplified the technique becomes quite delicate, and for this reason the performer requires a high degree of control as he taps the instrument with the mallets.

- Harpsichord- One of the manuals of the instrument is in *silent mode* for the entire piece, so only the amplified sound of the keys and their mechanism is heard. Within this technique the performer is expected to articulate different accents and attacks sometimes with one hand and sometimes with two hands. This almost entirely withdraws the condition of the harpsichord as a plucked instrument converting it into a sort of "percussive silent keyboard".

- Turntable- As a request from the percussionist I decided to use a turntable, however this becomes also a percussion instrument by controlling prerecorded attacks of a woodblock with the vinyl disc, accelerating, interrupting and playing forward the disc. While the rest of the musicians become percussionists with their own instruments, the percussionist of the group employs interchanged DJ techniques to play percussion too.

- Tuning forks and woodblocks- An important feature of the piece is the implementation of external instruments incorporated into each individual technique. Despite the very different nature of each instrument, I wanted to have a sound that would be common for the three instruments. The idea of using tuning forks in contact with the instruments was quite appealing as the clear pitch they produced stands out of the rest of the sound material, becoming a recurrent element that eventually takes over the whole piece. But the problem was how to set them in motion; I decided to use other percussion instruments as exciters for the tuning forks as another musical element of the piece. As a result the technique consisted of playing the instrument with one hand while holding the tuning fork with the other, rapidly striking it with the woodblock and putting it in contact with the instrument letting it resonate.

Fig.3 Tuning fork using a hi-hat as resonator

In my opinion, interchanging instrumental techniques can lead to very interesting results in the sense that two instrumentalists (from different instruments) using the same technique on the same instrument (i.e. a percussionist and a cellist playing a cello as a percussion instrument) can generate very different sound outcomes, possibly as a result of the different

views and knowledge about the same instrument and 'almost' the same technique. In the same way I consider switching and/or combining different instrumental techniques a fertile field for exploration, expansion and development (both for performers and composers), which with the right care and the proper technique can provide extended possibilities for already available instruments.

2.4 Physical sound transformation

This category includes all those transformations carried out by means of physical objects used to alter the sound of an instrument. These can be of different nature; fixed or dynamic, in direct contact with the instrument or through an energy conversion device, mechanical or electromagnetic, etc.

2.4.1 Prepared Instruments

Besides the use of extended techniques is the use of rudimentary objects applied to instruments to physically transform their sound. These can be permanent or temporary.

2.4.1.1 Temporary

One of the first composers who transformed the sounds of an instrument by means of preparations was John Cage. Cage's prepared piano pieces originated coincidentally, as many other great art inventions, by a creative solution for a lack of resources; the pieces were supposed to be composed for the percussion accompaniment to a dance performance, a common task for Cage at that time, but the costs and problems of logistics made very impractical for Cage to perform with a percussion ensemble in small dance recitals, and specifically in this case, the only available instrument for the performance was a piano. Thus, Cage, surely influenced by Cowell's "String Piano", decided to use the inside of the piano, changing the tone and sound quality by adding preparations that would result in an emphasis on the percussive identity of the instrument.

However, ironically, after the time consuming process of composing the different sounds and tuning the piano (the most traditional tempered instrument of Western tradition) into a "miniature percussion orchestra", the emphasis of these pieces was in melody rather than sound, an approach opposed to the blocks organized by rhythmic structures creating masses of sound that he developed in his earlier percussion works. The decision to concentrate on melodic lines in the first approach to the prepared piano was perhaps due to the nature of the instrument and the combination with dance. Nonetheless, Cage's instrumental invention was one of the first in which new sounds are composed by a transformation of a traditional

instrument into a new instrument, adapting a conventional instrument onto its own musical necessities through self-experimentation.

Instrumental preparation is possibly one of the most simple and effective ways to physically transform the sound of an instrument without radically transforming the technique.

Case Study III

Muted piano -from *Espacios Encordados*-

A common preparation in my works for keyboard is the use of "Bluetack" on the string in order to mute part of their resonance, emphasizing the attack or certain overtones.

In the case of this piece the sound of the highest register of the piano is muted, and having these strings a very short length mostly just the attack is perceived. The pianist is to play rapid 'clouds' of ascending notes that deviate into short incisive attacks variating in dynamic. The use of the sustain pedal in combination with this impulses sets the rest of the strings into resonance, characteristic that is emphasized by getting rid of the pitch content of the high strings due to this preparation.

2.4.1.2 Permanent instrumental modifications

In some cases instrumental preparations can be time consuming and some of the objects or components too fragile to resist the placement every time the piece is performed. Furthermore, the results of the preparation might not be always the same, if a similar result is expected, which can lead to problems of control from the performer.

But modifying an instrument in order to permanently attach or fix the objects that alter the sound its not always possible, and is normally applied to low cost instruments or too old to function in an ordinary fashion. Nonetheless, it can be a practical solution for transportable prepared instruments.

Case Study IV

Modified cajón -from *Enclosure*-

The original preparation of the instrument consisted of three piezo microphones placed on, and attached to, some of the inner components of the instrument (snare strings and jingle

bells) through a hole of approx. 20 cm, which makes it very complicated specially considering that there is no visual reference. Every time the piece was to be performed the discs had to be manually attached which consequently rendered different results, as the specific placement can be finely sensitive. Moreover, the nature of the microphones makes them very fragile for repeated handling and the use of spare ones was almost always unavoidable

Ultimately I decided to build in the microphones and create fixed inputs from the back of the instrument (Fig.3). This practical solution eventually resulted in a more functional set-up for the piece and at the same time allowing the performer to develop a technique based upon linear responsiveness.

Fig.4 XLR inputs for fixed preparations

2.4.2 Physical Sound Processing

While instrumental preparation is normally fixed and is generally made in advance, PSP is a physical manipulation in real time that involves a continuous transformative process by the injection of energy into the system affecting the vibrating body of an object, more flexible and dynamic. This process can be related to the actions/sound from a performer in correlation with an object or a performer controlling an instrument with an object.

A) Instrument to Object

Energy of an instrument can be rendered directly or indirectly.

a) Direct

There is no transformation of energy between the instrument and the object/source.

Case Study V

Maraca bell - from *Aushtentatic-*

In this piece the horns are treated by a cardboard (or plastic) cup, filled with a number of light metal objects, and placed inside the bell. The production of the lowest note on the instrument produced by covering all the holes pushes the air out through the bell setting the cup in motion. These rapid vibrations excite the light metal objects inside the cup, making them shiver on its bottom and producing a kind of 'pitch distortion' that is in constant variation depending on the fingering and the breath from the performer. Therefore, the sound can be gradually controlled by these parameters.

Fig.4 Light metal objects inside a saxophone bell

Case Study VI

Resonant can -from *Toques-*

In the work *Toques* for mixed choir (2010), each singer is given a short L-shaped PVC tube, a small can and a light coin. With these simple objects they are expected to process and transform their own voices. The basic procedure consists in singing into the can, using the tube as an energy carrier for the voice, making it vibrate and conversely articulating this resonance by touching the bottom of the can with the coin.

Fig.5 Coin technique for voice processing in 'Toques'

b) Indirect

The energy produced by the instrument is electrically transformed by means of a device like a microphone, amplifier or other similar mediums, and directed to a location for other performer, or object, to be processed.

Case Study VII

Cavities for 7 instruments and PSP

The piece consists of seven custom-built resonating objects attached to speakers, from which each member of the ensemble is amplified via miniature microphones inserted in their instruments, making each of the objects resonate. These objects are controlled and physically manipulated by a percussionist that stands in the middle of them. The result is a Meta instrument that intermingles the individual identities of the instruments combining them into a mass of evolving sounds.

Fig. 6 coil attached to speaker cone in Cavities

The resonant instrument consists of four coils (or Slinkys) attached to a speaker cone on one side and on the other to a microphone (speaker used in reverse) Fig.7, these driven by the lowest instruments of the ensemble. Two metal sheets attached to small transducers, and one middle size speaker on the center, these three managing high and middle frequencies.

The piece is an environment where musicians are required to *listen* and react to the cues of the percussionist; hence the later faces the audience while the ensemble is facing him with their backs to the audience. In a first version of the piece the instruments are exclusively routed to each object while a second version explores the reaction of these in combination with sine-waves creating beating patterns.

From my perspective the piece explores interesting ideas of PSP in an ensemble situation, however it relies heavily on the abilities of the ensemble to identify the different sounds and the reaction of the resonant instrument to their own actions, which is difficult to distinguish considering the number of instruments playing simultaneously. Another aspect is the skill of the percussionist to be able to lead an ensemble through the piece, besides the necessary sensitivity he needs to develop in order to control the instrument, obstacles possible to work

with the right monitoring system and enough rehearsal time for the entire group to get acquainted with the sound processes.

Fig.7 Percussionist physically processing the amplified instruments through different resonators; Performance by Ensemble MAE, Amsterdam 2010

Case Study VIII

Prepared remote speaker - from *Empathies*

This piece can be considered an extended, and more practical, approach to the previous idea. It is based upon the manipulation of a single loudspeaker (prepared with a piezo microphone disc placed on the speaker cone enclosed by a Chinese cymbal with 4 coins on its surface) which vibrates every time a sympathetic frequency coming form the instruments crosses through it. It follows the same principle as *Cavities*, however the preparation of the speaker is done in advance and there is no human tactile operation affecting it in real time (as in the case of the percussionist in *Cavities*) but the manipulation is generated by the sound produced from the speaker which is the combination of interferences between the sine-waves and instrumental frequencies.

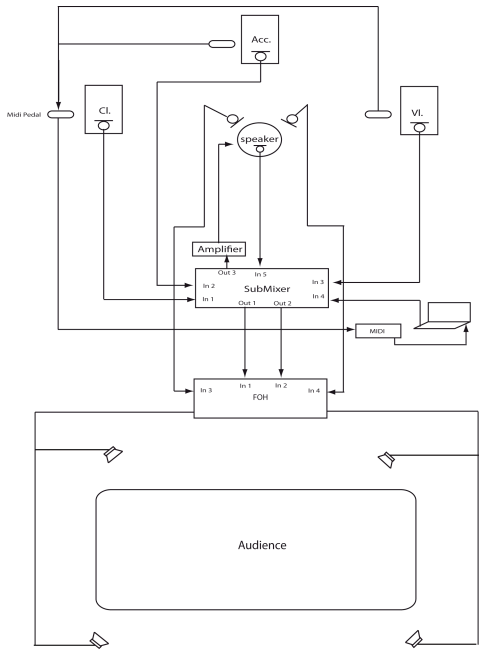

Fig. 8 Diagram of Empathies – prepared loudspeaker as physical processor

B. Object to Instrument

There is a myriad of objects and methods of excitation that can be used when working with instruments, from the physical human plucking, blowing, striking, bowing or scrubbing to the use of objects and tools (usually not intended for musical purposes) that can go beyond the possible speed of human mechanical control, and others that can excite the instrument without physically touching it, like electricity or magnetism.

I will exemplify a number of these objects in relation to its applications in some of my works.

a) Mechanical

Case Study IX

Vibrator – from *Interferences* and *5Cuts* –

A DC motor can be a great tool for rapid mechanical articulation when they are taken out of balance by adding a small weight in its shaft. A commercial form of this is a vibrator (sexual toy). I have used plastic vibrators in two pieces. In *5Cuts* for ensemble, they are used in the high register inside the piano simply to create a layer of constant activity while the low register is scratched with plectrums or guitar strings.

In another piece, Interferences, also for ensemble, they are applied to the double bass and violoncello on a palm muted string, the movement from a sul tasto position to sul ponticello rises up the pitch as the tension of the string increases. For this piece, however, I built a small switch, as the rhythmic values have to be accurate with regard to the rest of the ensemble. The addition of this switch creates a higher level of control (Fig.9).

Fig. 9 Vibrators with switch, from "Interferences".

A third implementation of this technique was done for the performance with the Dutch ensemble POW, where I built my own vibrating mallets by attaching a DC small motor with a weight to a mallet controlled by a switch (Fig.10). This gave me the chance to try them with different materials as one of the mallets was for glockenspiel and the other for drums.

I believe that the use of vibrators for sound articulation can be quite successful if used with the right care and proper technique. It is possible to articulate very clear rhythmic patterns as well as to play continuous rolls on a regular speed and duration not humanly possible.

Fig. 10 Vibrating DC mallets

Case Study X

Corked Transducers – from *Valves*-

As exemplified before, loudspeakers can be used as electromechanical exciters driving the vibration of other objects and/or instruments.

An example of instrument-to-instrument manipulation can be "Windy Gong" by the German singer Ute Wassermann from 1995, who amplifies her own voice through a small speaker with a cork attached to the cone and uses it to press against the surface of a gong, at the same time amplified by another condenser microphone and a contact microphone. In this way the

gong is used as a resonator and filter of her own voice that progressively changes as she moves the corked speaker around the gong (Collins, 2009).

A similar realization takes place in my piece *Valves*, where the same idea is implemented in one instrument alone. Towards the end of the piece the Disklavier plays random long notes that are recognized by the computer as MIDI note numbers and then sending its analogue sine-wave frequency to a pair of corked tactile transducers. These transducers are used in turn by the pianist who plays the inside strings of the piano. As the sustain pedal is open this technique creates an enormous amount of resonance due to the rapid mechanical vibrations, which can be controlled depending on the pressure exerted on the strings.

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b) Electromagnetic

Case Study XI

E-bow – various pieces -

The electronic bow, invented in the late 60's, has regained popularity in the recent years after it was almost forgotten. I have used them in several of my works. Some techniques can be achieved by moving the device along the strings producing different overtones and by slightly touching the string causing a distortion in its vibration (a technique used in my piece Interferences). Recently I have used it statically by building a structure to hold it right above the string of a berimbau; this allows for the possibility of keeping the string vibrating indefinitely, or as long as the battery lasts, and to change the sounds and overtones by touching the string with different objects.

Fig. 11 Static E-bow on a horizontal berimbau

2.5 Electric Amplification

With an appropriate technique, the right microphones and a lot of experimentation amplification can be a great tool to find hidden sounds in any instrument or technique. While playing an instrument there is an enormous world of microsounds happening inside and around it, the physical contact of a microphone with the vibration of any resonant part, the insertion of mini microphones inside the cavities of an instrument, the close miking of all those tiny secondary sounds product of a conventional technique, are some of the ways to bring life to the great variety of sounds normally masked by the ordinary sound of the instrument or simply too soft to perceive.

"..finding sources of sound and inspiration in uncovering that which exists but is not normally heard" (Barrett, 2007)

Once an instrument (or technique) is amplified, with the proper monitoring system the performer is able to hear and recognize the effect of its, sometimes minuscule, actions manifested in the sound, which many times evidences a greater cause and effect relationship than many live electronic processes. This allows a great deal of control and development of new techniques to control the "new" discovered sounds. Hyper amplification can be a very organic approach to sound composition/discovery, however it can also be used simply to reinforce the results of any other technique magnifying its properties with great results.

Hyper-amplification

I have used piezo discs on several occasions to amplify the results of a technique, to catch the sound of various vibrating components of an instrument, as part of instruments or as instruments themselves[5]. The cheap commercial piezo makes them very useful for experimentation and instrument development.

Case Study XII

Stringed piezos – from *Enclosure*-

In the development of the sounds and technique for my piece *Enclosure* I used piezos between the internal strings of the instrument and its surface. One characteristic of the conventional technique of the instrument consists on pressing the surface of the instrument with feet or hands and by that compressing the air inside the box and raising the pitch. Additionally the instrument has four guitar strings (sometimes snares) pressed against the

[5] See next chapter on object-based music

opposite (internal) side of the surface to produce a high frequency buzzing. After a lot of experimentation I decided to place two piezos between the strings and the surface (inside the instrument), the external surface of the instrument can be pressed and attacked in different ways making the strings rattle over the piezo discs. The pressure between them can be regulated in many different ways depending on the technique and stress applied to the instrument, obtaining a wide variety of sounds.

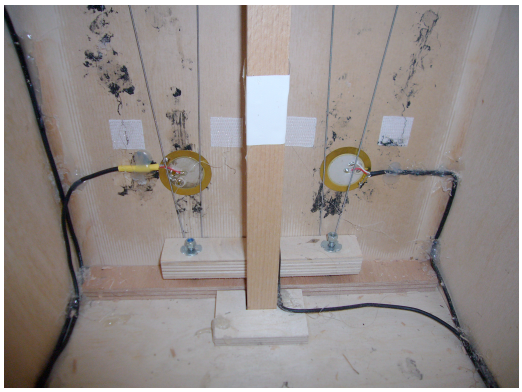


Fig. 12 Built-in piezo discs in contact with strings, from 'Enclosure'

Case Study XIII

Piezo Mallets – from *Cavities*-

In a first version of my piece *Cavities* I used conventional glockenspiel mallets to touch the different vibrating objects of the custom-built resonator, but a straight close amplification was not enough to bring all the detailed sounds as expected without having feedback problems. After some speculation I decided to attach piezo microphones to sticks and with them touch the different vibrating objects. The different degrees of mechanic vibration of the object with the disc as well as the changing sound characteristics in relation to the disc's surface give the possibility to control and obtain a whole variety of sounds making them look almost like "magic sticks" that bring live the sounds of an apparently silent vibrating body.

2.6 Analogue and Digital sound transformation

This is arguably the most typical method for instrumental sound transformation. The use of computers to create music dates back to the middle of the previous century and nowadays its use has spread over a large spectrum of musical genres and tendencies. In contemporary music the use of programming languages to elaborate different sound transformations from conventional instruments is an increasing practice, a work that almost always used to involve the assistance of a technician/programmer in the compositional process, but that today is taken over by basically anybody who owns a computer and has enough determination to use it

and explore it in musical ways, a practice that is blurring the division between, technician, performer, composer and programmer.

Young composers are increasingly seduced by the musical power of computers, joining educational programs to develop their own strategies and expanding their musical horizons, thus becoming performers by making an instrument out of a computer or expanding sound resources by combining its use with the already available tools, as traditional instruments.

One of the first possibilities to combine synthetic or previously recorded material with live instruments was to generate the sounds in a studio and reproduce them in a fixed media format like tape. A more ambitious approach was to bring the studio itself to the concert hall and process the instruments in real time with analogue devices.
But nowadays the current computer's processing power allows the possibility to create and transform sound in real time, either by triggering pre-processed material or by processing the sound of an instrument in real time, the laptop has become a familiar 'instrument' in the concert hall.

If it is true that computer generated sounds and processes have opened up new ways of conceiving and working musical material, as well as greatly expanding the possibilities when working with traditional instruments, I believe there are some fundamental differences and issues that need to be considered when combining these two media[6].

In my latest instrumental works I reserve the use of computers for the following purposes:

- Generation of very simple sound material mainly consisting of sine-waves, pulses or noise

- Dynamic process of amplified signals as well as to distribute or diffuse this signals on the space.

- Analysis of incoming information, triggering events or regulating and administrating sound resources.

I will exemplify these uses in the following chapter.

[6] I will develop further this discussion in the chapter *Computerized Instruments*.

2.7 Summary

As mentioned before, this brief classification does not pretend to be a universal categorization of sound oriented instrumental techniques, as it does not encompass all the available systems and approaches to manipulate instruments within a sound-based framework. However, it is an effort to exemplify and categorize some of the instrumental treatments I have used so far in my own compositions, hoping that this would offer some insight into my own works and possibly suggest some paths for further developments in the generation of complex sound structures using traditional instruments.

When working with experimental techniques for traditional instruments the presentation of these to the instrumentalist is crucial (either through notation or in the rehearsal process). In that respect I am constantly learning the best way for a performer to approach my music. As composers we know what we musically want (or at least we should) and we spend hours, days and months developing a certain work. In my case, I spend a long time developing techniques with my own instruments and notating these as clear, and coherent, as possible, but when you meet the performer and try to explain what he has to do he might look at you as if you come from another planet. It is true that some performers have closed their minds to listening to something that is not what they consider as music, but in many other cases it is just a matter of a lack of unified criteria in performing contemporary music, an impossible condition considering that there are now so many different composers, idiosyncrasies, languages and so on. Consequently I believe that introducing a new piece to a performer not familiar with the composer's work is key to the success and enjoyment of the working process, a critical step when it comes to unconventional music.

Chapter 3

Object-Based Music

Instruments vs. objects

Traditional instruments have gone through a long process of development and standardization before gaining the status of *musical instruments,* as we know them today. But as with any other interface, they are essentially objects optimized to function in certain musical languages within certain aesthetic preferences and responsive qualities. The instruments from the orchestra remain very much undeveloped since the Romantic period. Nevertheless people have continued building instruments, almost always with the help of major technological advancements, and influenced by diverse socio-cultural conditions. But when does an object gain the status of an instrument and which are the borders between these two?

In my personal opinion anything that is capable of articulating music can be considered a musical instrument; however this leads us to the tedious dilemma of defining music. If for the purposes of this text we agree with the 'generic' definition of Varèse, that music is "Organized Sound", this organization would by definition imply a system or technique. As a consequence I believe that given the right technique and developing a proper system any object can produce music, hence rising to the status of a musical instrument.

Already in my instrumental works I noticed there was, at least conceptually, an 'objective' approach to traditional instruments in the sense that I always try to start working with an instrument as a virgin object, an object with no previous repertoire or preceding history, working with it by examining its properties and possibilities in combination with technique and other possible external agents. Soon was brought to my attention the question of why bother using traditional instruments in the first place? Traditional instruments are probably not optimized for the sort of music I am trying to construct and furthermore the area of action can be quite limited since they can be quite unsuited to any other use that was not intended from the beginning. But it is right in the core of these limitations and discrepancies that I find my personal interests and fascination, researching the boundaries and relationships between instrument and object, exploration, technique, notation and consequently sound and musical product, being in constant confrontation with the instruments' *cultural identity*.

In this last aspect resides one of the most significant characteristics of using traditional instruments for music composition. Instruments are loaded with a whole baggage of cultural identity as a result of centuries of development, repertoire and musical systems that ultimately have a direct influence in our conceptions of their sound and physical characteristics, mechanisms of action and symbolic representations. To confront these expectations by

creating tension between the preconceived notions of an instrument, or group of instruments, and the actual (processed) results is an interesting parameter that has both a sonic as a visual element, and which I believe has gained importance in my latest works.

As stated before, objects can become instruments if there is a proper mechanism in place allowing their effective control and eventually evolving into a technique, and from the other side, there is an appropriate compositional system organizing these elements into a meaningful musical discourse. In the last decades a number of ensembles based on the use of objects as instruments have become popular[7], however most of them employ objects as instruments simply to reproduce already existing musical genres without an interest in music composition and/or the relation between the nature of the objects involved and the sounds they produce, but simple chorographical or 'humorous' performances of well known music played with daily life objects.

Case Study XIV

Fields – for power supplies and 12 hands-

As mentioned before, in most of my recent works I try to approach traditional instruments as conventional objects, trying to find a new instrument out of an existing one. In one of my latest works I have for the first time used objects to compose a piece.

I had a commission to write a piece for six percussions. It is always a pleasure to work with percussionists as they (almost) always have a great flexibility in terms of instrumentation and technique, in other words, they can virtually play anything in any way, and they are happy to do so.

Fig. 13 Telephone tap as inductive mallet

For this piece I wanted to explore the idea of producing sound without touching or striking a physical body, contradictory to conventional percussion technique. Thus I decided that electromagnetism was a way to explore further this idea. I knew about the idea of using coils to pick up electromagnetic fields from earlier works like *Sferics* (1980) by Alvin Lucier, based on recordings made by

[7] Like the international group *STOMP*, newer groups like *The Vegetable Orchestra* or a number of other percussion groups.

electromagnetic sounds from the ionosphere, or by the work of Christina Kubisch where she uses electromagnetic inductors built-into headphones for guiding people over specific sites and devices on the city that produce sound by electromagnetic fields; in this way the person can hear the crazy and interesting sounds a cash-machine or a security door emits which otherwise are silent. Computers, televisions, mobile phones, and almost all electronic devices emanate electrical fields that can be great sound material for music composition. Electrical voltage transformers, in that respect, do not provide a very dynamic sound themselves; on the contrary, the sounds produced are almost always a static hum around 150Hz, but this limitation was from my perspective a good way to create thick textures and harmonic richness by the combination of the different harmonics of each power supply. After extensive research I could differentiate between three basic sound qualities, clean, buzz and high, confining these three different sound groups for each percussionist who, equipped with telephone pickups as mallets, is able to emit these sounds.

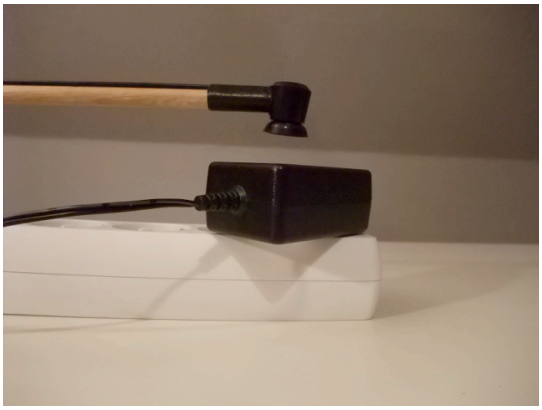


Fig. 14. Mallet picking up electromagnetic hum from a power supply, taken from "Fields"

One of the disadvantages of using objects as instruments is the difficulty of recreating exactly the right set of objects when performing the piece in a different location, especially if a certain level of determinacy is desired in the work. In this case, the idea of using three basic sound groups is definitely easier than trying to find exactly the same frequencies with other transformers or to ship the materials over every time the piece is to be performed. In this sense, it is expected that the piece will vary depending on the objects used, a way of setting the conditions for surprises, or sometimes disappointments, to occur, but also a way to keep the piece alive and changing.

3.1 Summary

Although I have experimented by building some extremely simple instruments out of found objects (Fig. 15 and 16) I do not consider myself an instrument builder, I am not good at it, I am not seduced into carpentry and I am not really interested in it. But, as I said before, I have a fascination with trying to discover sound, and then music, in objects that apparently have no musical value. In the current cultural situation much is said about bringing contemporary music closer to non-trained audiences, but making the music more accessible by compromising aesthetics or musical language I believe is the wrong way. I do not have strong opinions about this subject and I do not think it is for us, composers, to educate people, but maybe finding newer or more inventive interfaces and tools to generate music would motivate audiences to experience new music in a different way. It is probably a question of means rather than language.

Fig. 15. Wind instrument made out of a PVC tube using a piece of balloon as membrane, from POW ensemble meets.

Fig. 16. Box consisting of an oscillator driving a fan. The player controls the speed and contact with the piezo disc

Chapter 4

Computerized Instruments

Some Computer applications and problems

Computers, like any other object, can be musical instruments. And they are in fact one of the most frequently used tools for the production of music in our days. As computers get more powerful, affordable and portable they become more and more familiar (and even fashionable) instruments in the concert hall, opening a whole new fertile area of research, musical possibilities and aesthetics. But, from my point of view, when it comes to processing or coexisting with traditional instruments there are two major factors that contribute to create an unbalanced relationship: their differences in control possibilities and cultural identity.

I have previously discussed how loaded traditional instruments are in our minds, and while computers, and in general digital sound processes, are new in the production of music, instruments have been around for centuries. Furthermore, while one is based in physical vibrations of bodies (something regular in our daily lives) the other is based in intangible processes occurring inside a box. And although this might be just a matter of time to get used to it, in my opinion this interaction resembles a very young child playing with an elderly experienced man, possibly a nice subject for one piece but not more.

A way to balance this situation in my own music is to treat instruments as completely new and flexible sources of sound generation, compose their sounds in a similar way I would compose them with computer software (traditional instrumental hacking), trial and error. And in some occasions the situation is reversed: while the computer is entitled to produce just a couple of simple sounds, the instrument physically processes them. (i.e. *Espacios Encordados* or *Cones*)

Study Case XV

CONES
For two computers and percussionist

This piece was commissioned by Electronic Hammer, an ensemble based in The Hague consisting of two computers and one percussionist.

One of the most challenging and interesting aspects of this work was for me the instrumentation of the ensemble. Having two computers and one percussionist offered an infinite amount of possibilities of power and flexibility that rapidly overwhelmed the number of options to work with. On one hand it was important for me to justify the use of two

computers, when normally one is more than enough for the simple tasks I usually assign them, and on the other to choose the right instruments for the percussionist that would define the character and generate the sound material for the computer to work with. Moreover, a clear and effective interactive strategy between its members was essential to balance the instrumentation and establish the computers as instruments and not only as processing devices.

One option I was offered was to assign different transformative processes for each computer performer (a common strategy in the performance and composition of other pieces performed by them), an approach that indeed suggests a number of interactions between the instruments but that would not solve the problem of finding the right percussion instruments and sounds/processes for the computers to work with.

Following similar concepts and ideas to those I have previously applied in some other works I decided to *reverse* the process. While normally the working practice of the ensemble is to process and elaborate the sounds generated by the various percussion instruments I decided to let the computers generate the main sound material and have the percussionist physically process and transform these sounds. For this I created a simple system for the percussion player consisting of four piezo discs whose signal is received by the computer players and sent back to an array of four small loudspeakers in front of him (Fig.17). The percussionist is to tap these discs with his fingers, using thimbles, sending this sound information to be used as sound material or triggers for other sounds that feed the loudspeakers. These sounds are conversely transformed and processed by the percussionist touching the cones of the speakers, adding carefully different objects or filtering the sounds by covering them. Each computer is in control of one half of the system, receiving the incoming information from the piezos and sending three kinds of basic sound material to the speaker cones; pulses, noise or sine-waves. The three members of the ensemble are entitled to follow a set of instructions in which quick responsiveness and interaction are fundamental to the development of the piece.

Fig. 17 Cones – instrument based on piezo discs feeding loudspeaker cones via digital manipulation

A second issue is the disproportion of their control mechanisms for sound nuance, and how this can engender obstacles when interacting or controlling traditional instruments.

Solo pieces for live electronics and traditional instruments almost always engage the operation of a person behind the computer, either to trigger processes or to musically control and regulate operations in interaction with the instrumentalist, a normal situation when the music is deliberately conceived as a duet (even with the clear differences in sound control possibilities), but as the sound is controlled, and to a certain extent bound to a second human agent, it creates an obstacle for the engagement and development of an embodied technique for the solo performer in the practice of live electronic processes. A lot of research is carried out in this field, leading to describe gestural taxonomies (Wenderley, 2001), developing ergonomics and generating awareness of the various performance aspects, all this deriving from the creation of sensors, instrument-like controllers and alternative instruments. But even if to this date none of them have reached the stability or standardization of their ancestral ancestors, the investigation of the different aspects that encompass the various instrumental techniques in relation to their possible extensions can very well contribute to the immersion of new ways of expanding and developing traditional instrumental technique to control sound processes.

The first time the term Hyperinstrument was used was to designate a series of instruments created between 1989 and 1992 by MIT's Media Laboratory under the supervision of Tod Machover. This project was aimed to provide virtuoso performers with coherent extensions to their already available instrumental technique. Likewise, extensive research has been done by

STEIM in developing experimental as well as extended instrumental controllers with several successful and not so successful examples, but always in search of optimizing physical sound control working actively with several performers, instrumentalists, composers and inventors alike, immersed and focused in real musical situations and practice, rather than pure scientific or speculative research.

For two of my pieces I have developed instrumental extensions as a wish to dispense with a human computer performer/assistant and allow complete control to the instrumentalist. One way I have approached this problem is by adding physical controllers to the instrument. This controllers are attached in strategic places of the instrument or the body of the performer thus enabling an extension of the already available techniques without the necessity of extra movements, that many times create an almost theatrical (undesired) aspect and prevent the instrumentalist from creating a coherent technique of embodiment between instrument, performance, sound result and therefore musical experience. A process of development of this approach was the instrument for my piece *Enclosure* (see Permanent instrumental modifications chapter 2 number 2.4.1.1), and the extended guitar for my constant work in progress *Sessions* (set of improvisation based upon the exploration of an instrument).

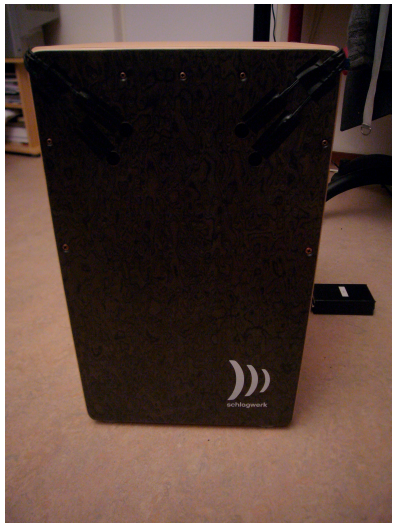


Fig.18 Cajón equipped with sensors for finger pressure control

Study Case XVI

Modified guitar *-from Sessions-*

Related to the discussion above, this instrument was created originally as a necessity to replace the computer performer and give full control to the instrumentalist.

Top your buffer, for computer and vertical acoustic guitar, 2007. The necessity of disposing of the computer performer in this case was due to logistical reasons rather than aesthetical. As the piece was encountering more performance opportunities, the idea of arranging a solo version (from the original version of duo in this case) was likely. But replacing a MIDI controller with 10 buttons and faders was a complicated procedure, specially because I refused the idea of filling the body of guitar with various accessories visible to the audience and physically to far from the hands of the performer, which in the first place would distract the audience from the music by the excessive movements of the performer and on the other will create an obstacle for the development of an efficient performance technique.

Fig. 19 Mini controller consisting of 2 pressure sensors and 7 switches

Therefore I decided to create a mini controller placed on the back of the neck of the guitar (Fig.19), invisible to the audience and yet very easy to control for the performer with the same vertical technique (holding it as a cello), however I had to limit myself to six switches and two pressure sensors, replacing the faders. This created a new instrument, but it was evident that it would be better to compose a new piece rather

Fig. 20 Guitar frets and strings completing the circuit

than trying to recreate the original one[8]. That is how the concept of Sessions was formed, a number of non-notated pieces based upon an instrument in continuous development.

A second version of the instrument came with the addition of an analogue circuit placed on the back of the body of the guitar and connected to some of the metal bars from the frets (Fig. 20 and 21). The circuit consists of a chip that produces 4 different sound oscillators that variate in frequency depending on the resistance applied.

Fig. 21 Oscillator connect to the fingerboard

Fig. 22 Photocells controlling resistance (frequency)

As an entirely different approach, this implementation tried to take advantage of the physical and architectonical characteristics of the guitar using the contact of the metal strings to the guitar frets to complete the circuit hence acting as a trigger for each oscillator, and by a series of photocells, attached to the sides of the neck, to control the resistance, pitch (Fig.22). Hence, pressing a string does not produce any acoustical sound but controls frequency and multiplication of oscillators based on the fingering (Fig.23). However, as it is also a light-dependent instrument it has some complications when playing in halls with very different light conditions.

Fig. 23 Finger combinations multiply oscillators and hand palms block incoming light, controlling frequency

[8] Mapping incoming amplitude values as data to control the different processes originally in charge of the computer performer was later developed as an implementation for the solo version of *Top your buffer*.

To solve this problem a third implementation of the instrument consisted in having a local light system that would enable a better control and predictability of the reactions coming from the circuit. For this I built a pair of LEDs (Light Emitting Diodes) that are conversely controlled by two audio signals having a direct contact with the photocells and getting rid of any light interference of the hall by playing the piece in complete darkness.

The standardization of the MIDI protocol in the 80's favored the creation of alternative controllers physically separating an input controller to the sound device, but most importantly opened up the computer to interaction with the physical world by the possibilities provided by analogue to MIDI interfaces, interfaces that have increasingly become faster with the introduction of devices that permit Ethernet or USB connection to the computer, setting the field for measuring all kinds of physical parameters. However its bandwidth can still be very limited for some applications. In the present day many instruments have been reconceived as commercially available MIDI controllers.

Study Case XVII

Commercial modified instruments -from *Valves*-

The Yamaha Disklavier is an example of a commercially available hybrid instrument. Although the idea and history of automatized musical devices can be traced down many centuries, one of the most attractive characteristics of the Disklavier is that it allows computer control by sending and receiving MIDI messages while maintaining intact its piano features.

In 2010 I was commissioned to write a piece for this instrument and pianist. I suppose that one of the first seductions of using such an instrument is to make it play all those things that for pianists are unachievable or 'un-pianistic' to realize. Thus, my first sketches were mainly focused in the performance of acrobatic and humanly impossible gestures and pitch-densities. After a lot of speculation of the real possibilities of the instrument I had the chance to work physically with the instrument, as mentioned before a form of work that I largely enjoy. I soon confirmed that the instrument was capable of reproducing all those things a pianist cannot achieve (although its possibilities of speed, responsiveness and density must be considered). However, very soon, the native features of the instrument easily blurred all those

previous interests away. I discovered a 'new' instrument with its own sounds, (very different from a piano), its own limitations and a variety of control possibilities (greatly expanded by the pianist) to be explored.

In short, I opted to compose a work based upon the electromechanical features of the instrument, a study about the musical use of its artifacts and extensions of its control possibilities. Possibly designing another instrument from an already re-designed one.

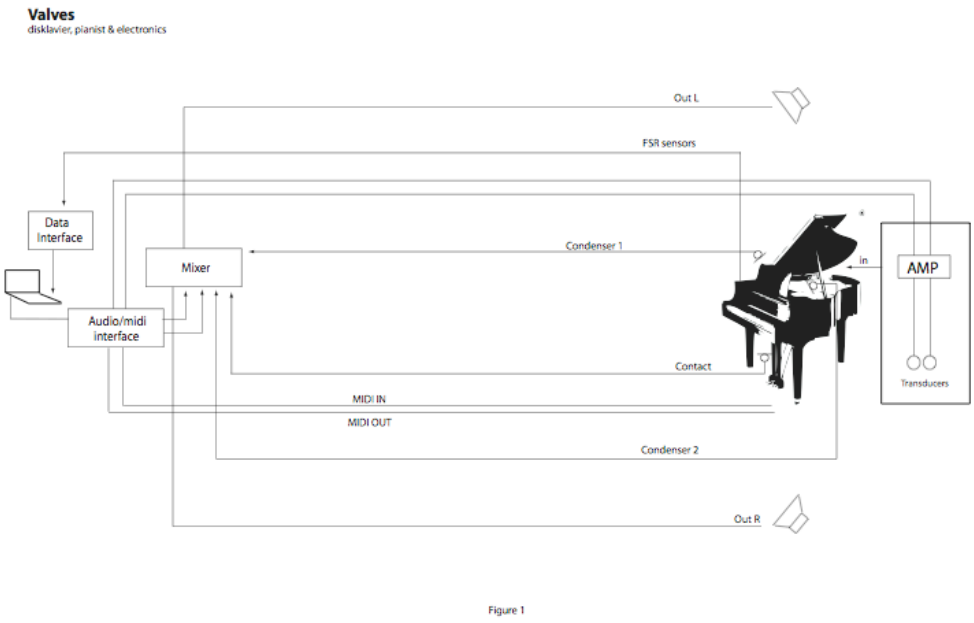


Fig. 24 I/O Diagram for Valves

Chapter 5

Description of the Submitted Compositions

Enclosure (2008)
For modified cajón and live digital process

Context

The piece was commissioned by the Mexican percussionist Jose Garcia.

Over some years Jose has developed a very rapid finger technique that has been implemented in works by Xenakis and other composers. The possibility of taking advantage of this led me to try different small instruments that he could play with his fingers wearing thimbles, but this would have added just another piece to his repertoire of finger technique. After some experimentation with different instruments I decided to use his technique in a more subtitle but no less effective way.

Instrumental Exploration

An antecedent of this piece is "_/" in which an extremely simple object like the triangle is extended in a technical and musical way. Taking the same departure point I decided to concentrate on another simple but fascinating percussion instrument.

The cajón is a Peruvian instrument that consists of an ordinary wooden box, originally designated to transport goods. A Spanish version of the instrument (cajón Flamenco) has four guitar strings attached behind the front surface, as a sort of snare, and some of them have a number of jingle bells hanging from one of the support bars inside the box. All these combined elements create the global sound of the instrument when is hit with the palms on the front consisting of two basic sounds; high, low, and by pressing the instrument (compressing the air inside) some pitch variation can be achieved.

The initial idea was to bring out all these little sounds occurring inside the box by means of amplification and technique (Fig.25). After some experimentation I decided to divide the instrument into four basic sounds.

- Two piezo discs trapped between the strings and the surface would take over the high range.
- A third piezo in contact with the jingle bells picks up the vibration whenever the instrument is shaken.
- A dynamic microphone is placed on the back of the instrument receiving most of the attacks on the surface.
- An omnidirectional microphone is placed inside the instrument taking the low register and overall sound pressure.

Conversely, each microphone is routed to a PA loudspeaker of a 5.1 surround system, and controlled by computer software. This is based upon the idea of creating a metaphoric analogy of the concert hall transformed into the inner space of the instrument.

Technique and structure

In terms of technique the piece is divided into three parts, one exploring the sounds created by the delicate touch of the fingers (Fig.26) in combination with feet pressure, a second one consisting of finger rolls exploring more textural continuous sounds and a third one based on the conventional technique of the instrument exploring the rhythmic interaction with the digital processes. The progression of these techniques exposes an immersive evolving sound environment, an instrument mutating its identity through the, sometimes imperceptible, movements of the performer.

Computer process

The computer undertakes two different tasks; on one hand it dynamically controls all the amplified sounds and routes the different incoming signals to the loudspeaker system; panning, compressing, equalizing and analyzing (Fig.27). In a second section of the piece the instrument suddenly detaches from the performer, who starts triggering and running recorded buffers via pressure sensors, these sensors control the loop duration of the buffers while the computer alternates and triggers these by detecting number of attacks.

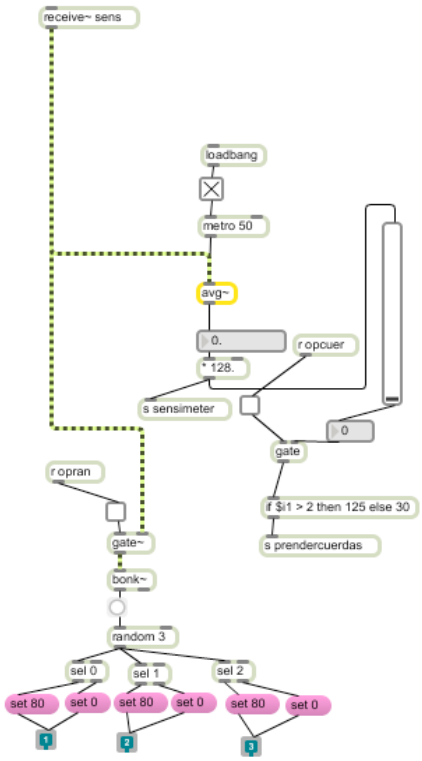


Fig. 27 Amplitude analysis value from the dynamic microphone signal as trigger for multiple other processes.

As an effort to create a self-sufficient live electronics instrumental system, the cajón is equipped with five switches, controlling the triggering of the different sections. And five pressure sensors, four glued to the front of the instrument and one on the bottom for foot pressure (Fig.28). From my perspective this system has allowed the integration of the technique to the digital domain, allowing an extension of the instrument t instrumentalist (Fig.29).

Fig.29 'Enclosure', user interface

Notation

As in the case of other pieces where the performer is directly involved in the working process, the notation of this piece was made a-posteriori, in other words, it is derived partly from the verbal instructions discussed during the creation of the piece and partly by transcribing the actions of the performer. Based on this, the notation does not depicts a deterministic result, but rather sets of notated instructions and examples from which the performer is expected to take as basic material and generate his/her own version.

Additional notes

The piece has had a good reception and as a result several performers abroad have asked me for the score to perform the piece, unfortunately the level of instrumental modification complicates the possibility of having the piece performed by many different performers (an important issue to bear in mind when using permanent modified instruments). So far I have modified instruments for two percussionists.

Fig. 28 Cajón equipped with sensors and switches for complete performer control

Fig. 25 Amplified cajón

Fig. 26 Finger technique

***Transients** (2008)*
For amplified harpsichord, violoncello and percussion

Context

The piece was composed in 2008 as a commission from the Dutch ensemble Brooomm! http://www.brooomm.nl/ with the support of the Nederlands Fonds Podiumkunsten.
The piece was originally scored for harpsichord, cello, hi-hat and turntable (as the percussionist of the group is experienced with DJ techniques and was very keen to include this instrument), however a woodblock can also replace this part.

Instrumental exploration

For this piece I worked myself individually with each instrument, exploring the different sounds that will constitute the piece, writing a score and explaining to each performer the different preparations and techniques involved.

- Harpsichord

One of the manuals of the instrument is switched leaving it in 'silent mode'. The other remains normal.

- Violoncello

Throughout the piece the instrument lies down on a stable surface and is carefully hit by soft percussion mallets (wool and rubber).
A metal bar approx. 8cm long is placed under the D string.

- Percussion/Turntable

The turntable is controlled by a Max/MSP system called 'Ms Pinky' www.mspinky.com, which allows controlling any prerecorded samples through a specialized vinyl disc.
The samples are taken from woodblocks, hence this part can be also be played by real woodblocks, with some obvious differences in technique and sound quality.
The hi-hat is hit with soft wool mallets.

- Extra instruments

3 Tuning forks (440 Hz)
5 woodblocks (6 for the acoustic version)

The use of amplification plays an essential role in the piece. Each instrument has attached contact microphones in strategic parts, bringing forward many of the micro-sounds of each preparation.

Technique and structure

- Harpsichord

One of the manuals of the instrument is in *silent mode* for the entire piece. The performer is expected to articulate the sounds of the mechanism, sometimes with one hand and sometimes with two. Additionally a pile of three woodblocks (ranging from high to low) is placed next to him; these are to be hit with the tuning fork, which is put in to contact with the harpsichord. Towards the end of the piece the harpsichordist stands up and plucks the A string inside the instrument, while continuing to strike the tuning fork on a woodblock placed in that position.

- Violoncello

(b. 1-47) The metal bar is placed under the D string and close to the bridge, allowing enough space to play with both mallets between them. As the section goes on the cellist plays louder making the bar shake and eventually slide towards the fingerboard.
(b. 48-73) The cellist pulls down the bar regularly making it bounce between the G and A strings in a continuous motion. From bar 64 he takes the rubber mallet, striking gently the tailpiece.
(b. 74-128) In one hand the cellist holds the rubber mallet and in the other the tuning fork to hit it with a woodblock (placed next to him) and put it onto resonance with the surface of the cello. He has 4 different places to hit with the rubber mallet, the endpiece, the tailpiece, behind the bridge, and on D string (where the metal bar is placed).
(b. 129-end) The part consists on three sounds, The sound of the tuning fork in contact with the woodblock, the resonance of this on the cello and an A harmonic played pizzicato with the help pf both hands.

- Percussion

Hi-hat

The instrument is played with soft mallets, varying the distance between the plates (1/4-3/4/-1/2-full) and progressively putting the stand into motion by means of attack and force. This should create an almost (depending on the instrument) continuous pulse. By bar 48 the plates are closed and the performer plays with the pedal pressure making the pitch slightly rise upwards.

By bar 130 the percussionist comes back to the instrument (after playing turntable) and outs the tuning fork in resonance with the higher plate of the hi-hat after striking it with the woodblock.

Turntable or woodblock

As mentioned before, the turntable plays a record with pulses that the percussionist can stop, leave moving forwards or move backwards which accelerates the speed. A MIDI switch triggers the different samples to be manipulated by the vinyl. As these are prerecorded woodblocks samples this part can also be played live with one woodblock, the speed and sound of the woodblock changes depending on the letters and numbers which stand before for the described processes.

Notation

After the different preparations, techniques and amplification employed, the notation of this piece might not directly relate to the resultant sounds for an unfamiliar listener, as this is realized almost entirely in a conventional fashion. However, for the purposes of synchronicity and accurateness its practical use is very effective to embrace the musical ideas and actions.

Espacios Encordados (2008)
For feedback piano and digital live process

Context

The piece was commissioned by the pianist Sarah Nicolls to be premiered at Seoul's International Computer Music Festival in the winter of 2008. The request of Sarah involved exploring the inside of the piano by possibly exciting the strings with miscellaneous objects and techniques.

Instrumental Exploration

I have always been attracted to the internal sounds of the piano, the resonance and various sounds generated by plucking, scrubbing, or scratching the strings have been subject of some pieces I have composed before. But many composers have increasingly overexploited these sounds over the years, turning them into standards of extended piano techniques. Hence the main question rapidly became, how to use the inside of the piano, or the whole piano for that matter, without sounding like one more sound cliché?

After some time I realized that the biggest obstacle was that any tactile technique that would involve touching the strings, would result in similar recognizable extended-technique-like piano sound. So the only solution was to excite the strings without touching them, with sound. For this I attached four speakers (Fig.30) to different places of the soundboard and experimented by placing an omnidirectional microphone inside the closed piano with some metal objects on the strings. The resonance of this microphone was regulated by a series of MIDI-controlled filters that would put different objects to resonate on the strings depending on their frequency. I found it a good approach to piano playing, nonetheless, pianists want to play piano, so I had to get rid of the midi controller and find technique to control this process. My solution was to attach one mini microphone to the wrists of the pianist (Fig.31); in this way she would be able to control the feedback by varying the distance between her wrist and the speaker placed inside the piano while the feedback frequencies are still controlled by computer software.

This approach created a resonant stringed box that was capable of other ways of excitation, from there the idea of creating three different techniques as three different imaginary stringed spaces.

Technique and Structure

Espacio I – this is the only section of the piece in which the keyboard, and more concretely the highest octave, is used. A short movement in which clouds of rapid attacks, created by muting the string with gum, set the rest of the instrument into resonance. The instrument is amplified with two microphones laying on the soundboard, picking up the resonance which is controlled by the sustain pedal. This movement works as a sort of introduction, or onset of the entire piece.

Espacio II - The movement starts by plucking a string, generating the initial feedback frequency. As one microphone on the pianist's wrist acts detecting the note, the other regulates the feedback pulsations (gating) amplitude by controlling the distance between the microphone and the speaker. After this process one frequency stabilizes and the distance is then mapped to pitch-shifting downwards, proportionally to the distance. As this process continues and the distance becomes smaller the pianist adds light metal objects on the strings (Fig.32), progressively transforming the sound. Once this process has been completed, different resonant feedback frequencies appear on each speaker over a period of approximately one minute, concluding with a low stable frequency on the lowest speaker, a cue to the performer to close the lid and leave the stage.

Espacio III – In this space the sound controlled by the computer takes over the instrument. As the low frequency of the previous movement is still resonating inside the instrument and the pianist leaves the stage, patterns of predefined sine-waves are routed to the different speakers inside the instrument. The duration of these structures can be controlled in real time with a midi controller by the pianist (offstage or in a table in front of the piano), by a computer assistant or automatically.

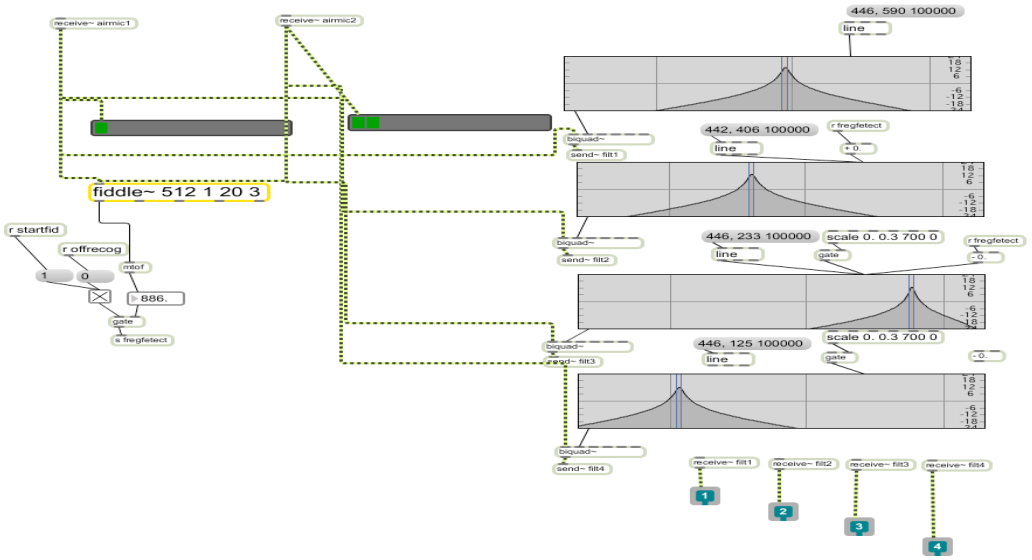
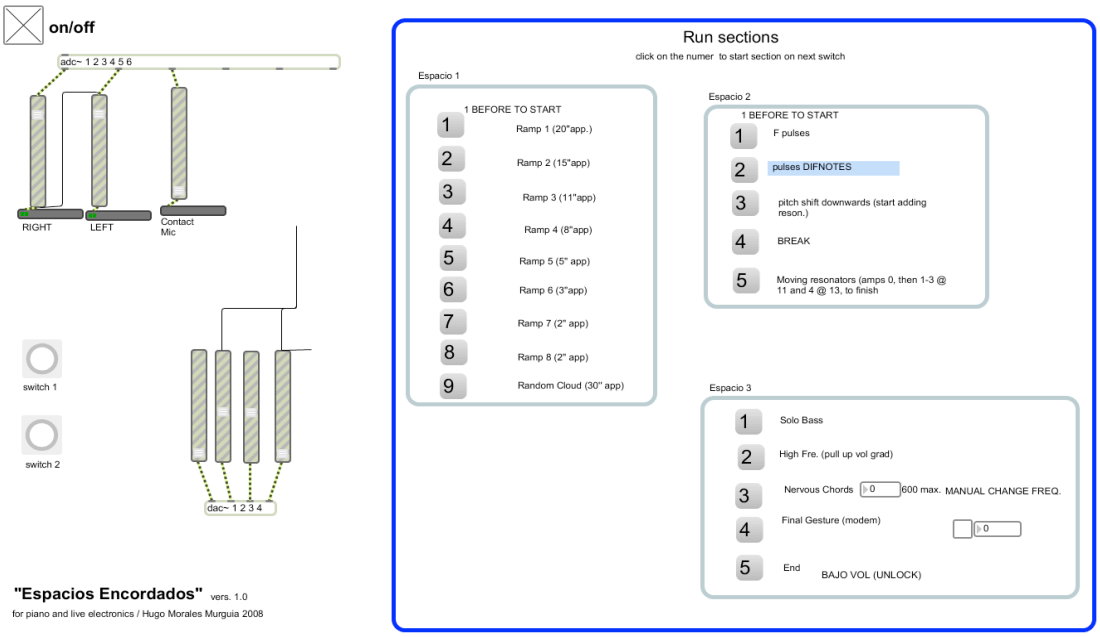


Fig. 33 Patch filtering the incoming microphone signals as well as analyzing their overall frequency content to generating filtered audio feedback

Computer process

The computer is used to control and filter the feedback of the local system (four speakers and wrist microphones –Fig.33-), as well as to generate the different sine-wave frequencies for the last space. With the use of a simple user interface (Fig.34) the performer can control the sequential processes with the help of single midi switch and a computer keyboard (for the last movement).

Fig. 34 'Espacios Encordados', user interface



Notation

Besides the first movement, this is a clear example of a piece in which techniques and sounds are not possible to notate within the conventional system. Nevertheless, I try to extract the most fundamental parameters and attempt to relate them to the standard system as much as possible. In this case the speakers are notated in a staff with for lines while the pitch transformations in relation to distance in notated in an upper line, for the third page (third part of Space II) this line is replaced by RH and LH, which illustrates the possible movements towards the speakers and the dynamic level. Space III, is just a graphic representation of the tones generated by the computer in relation to the speakers. But in general, as in the cases of other pieces the method of notation of this piece is highly referential, it does not reflect a series of actions to be followed accurately, as in the orthodox case of a score, but rather, a

series of graphical and text instructions that attempt to describe the processes and the actions of the performer, emphasizing a necessity to carefully listen, control and react, rather than reading and reproducing.

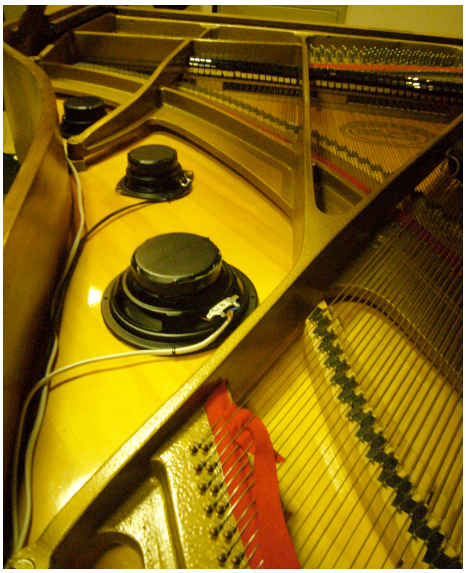


Fig. 30 Array of speakers on the piano soundboard

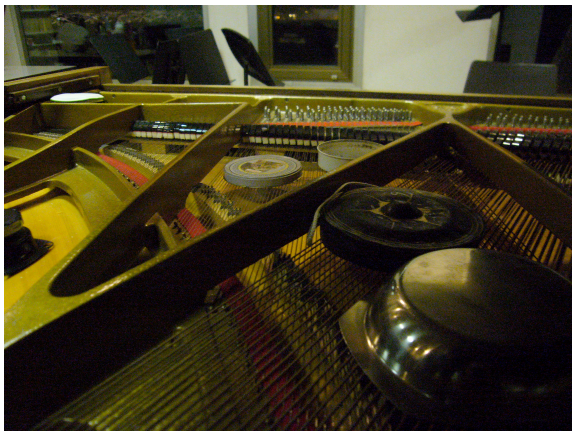


Fig. 32 Light metal objects vibrating on the piano strings

Fig. 31 Feedback System

Fig. 30 Espacio II live

Cavities (2009-10)
For seven instruments and PSP

Context

The piece was commissioned by the ensemble MAE (formerly the Marten Altena Ensemble) with support of the Nederlands Fonds Podiumkunsten.

The original idea of the piece and the project was to compose something in relation to the concept of "space". Initially the idea was to explore the internal spaces of the instruments, hence the title, but as the process developed it grew much more into a study of physical sound processing.

Instrumental Exploration

The ensemble consisted of: trombone, bass clarinet, recorder, guitar, double bass, keyboard, violin and percussion. One recurrent idea in my ensemble pieces is the possibility to unify the sounds of the instruments creating a single sound identity where it is not possible to recognize anymore individual instruments. In the case of this piece, considering such a varied ensemble, to implement this idea was not going to be a simple task.

After going through many options I decided to build a single instrument in which all instrumental identities would be intermingled becoming a single sound source: a meta-instrument consisting of resonating objects attached to speakers from which each instrument would be amplified (a sort of *Music for Solo Performer*, from Alvin Lucier, but using instruments instead of brain-waves). This idea was appealing specially because it did not require any special technique from the instrumental side and still the sounds were transformed completely.

Many objects and amplification techniques were experimented with, a time consuming and expensive process, but after all this work the final instrument consisted of four wide coils (slinkys) attached to speaker coins, two metal sheets glued to tactile transducers and one middle size speaker. Each of these objects corresponded to an instrument, conversely equipped with miniature electret microphones inside them. These objects were symmetrically positioned around the percussionist (the physical sound controller, and leader) while the rest of the ensemble was facing him (Fig. 38).

Technique and structure

The piece emerges out of the interaction from the instruments with the corresponding objects and resulting sounds, as well as the reaction to other members of the ensemble. In an absence of a conductor the percussionist, the most important figure in the piece, has to lead the ensemble through a series of cues and physical gestures but most importantly he is to decide almost always the duration of each section and hence the duration of the entire piece.

The work is developed in ten basic blocks of activities:

A- The percussionist holds two mini electret microphones (similar to the ones inside each instruments) and routed to the pair of tactile transducers attached to the metal sheets, and starts getting them closer to generate feedback (Fig.35).

B- As the percussionist explores the different feedback frequencies by going around the metal sheets, the violin, recorder and keyboard, also routed to the metal sheets (keyboard to the center prepared speaker) blend in with the feedback frequencies, by singing and playing frequencies close to these.

C- As soon as the percussionist separates his hands from the metal sheets the violin and recorder stop playing, leaving the keyboard going through the prepared speaker alone. The percussionist slowly lifts the Chinese cymbal covering the speaker, and letting the small metal ball bounce on the cone of the speaker.

D- As a cue, the percussionist touches the lifted cymbal and the double bass, trombone, guitar and bass clarinet (connected to the coils) play the lowest possible note in their instruments making them resonate.

E- The percussionist takes a pair of metal mallets and touches the sheets triggering the ensemble. Violin and recorder oscillate on an E while the group of low pitch instruments open up the range departing from a low A. The cue for the next section is an emerging frequency of 260Hz from the keyboard.

F- Irregular rhythms played on the cymbal are the cue for this section. The coil instruments pass over a pitch in circular motion alternating between that pitch and non-pitch sounds. The keyboard remains in an static 35hz frequency.

G- Is triggered as soon as the viola, or recorder, plays the notated E.

H- The percussionist touches with the mallets random objects triggering their corresponding instrument, the rest of the ensemble remains silent.

I- Light metal objects are added by the percussionist in all the different objects, transforming progressively the sound of the whole instrument (Figs.36 and 37). After all light objects have been left the percussionist starts closing the coils.

J- The resonating instrument is left alone as the percussionist leaves the stage and the

ensemble starts introducing sporadic silences decreasing the thickness of the sound mass until it completely dissipates.

Notation

As seen above, the piece develops almost as a controlled improvisation, for this reason the score functions completely as a practical reference intending to engage the performers in a constant sound immersion and awareness of the different processes and interactions.

Fig. 36 Prepared coil.

Fig. 38 Percussionist as conductor

Fig. 35 Electret microphones hold against metal sheets

Fig. 37 Prepared speaker and metal objects added.

Valves (2010)
For Disklavier, pianist and digital live process

Context

This piece was financially supported by the Nederlands Fonds Podiumkunsten as a commission from the pianist Sarah Nicolls and the Conlon Foundation from Amsterdam to be premiered in the Gaudeamus Music Week in September 2010.

The request was to write a piece for a Yamaha Disklavier DC3 pro in combination with a live pianist.

Instrumental Exploration

I had the opportunity to work physically with the instrument for a total period of three weeks in the studios of STEIM (where the instrument was temporarily kept for this occasion). The intensive experience of being confronted for the first time with a new instrument, after a long period of speculation, was very exciting and enriching. For me it was important to get to know the instrument very well, not only well enough as to be able to write a piece taking advantage of its possibilities but more importantly, to turn its impossibilities and genuine characteristics into something musically interesting.

The first day I came with all my MIDI files consisting mainly of masses of juxtaposition of fast pitches, from my view a good way to know its limits. To my surprise the instrument could not play more than five seconds of my material without getting stuck, even at half speed of the original file. Then it was immediately clear that sending steams of midi data to control the instrument was not the most attractive feature. But slowly I found out a series of native sounds and attractive features which I eventually based the piece on.

This being also a piece for live pianist, some considerations on the interaction between these two needed to be taken. Thus, more than the possibility of the instrument to retrieve midi, one feature that is not widely used is its capabilities to send midi, becoming a fully functional piano and midi keyboard. In this way many activities of the pianist can be used to trigger or manipulate accurately electronic material. Another unforeseen interesting aspect was the unintended, but noticeable sounds of the processors as well as the very attractive *silent* function, intended to practice with headphones, but which reveals all the interesting sounds from the solenoids in combination with the piano hammers and keys.

Technique and structure

The piece can be divided into four main sections.
A. The keyboard is in silent mode and it is automatically controlled trough an algorithm consisting of two elements, a cluster on the three lowest notes from the keyboard, which opens up a gate for pink noise, and an irregular movement of keys starting in the highest note and progressively speeding up proliferating towards the lower register. This movement is occasionally interrupted at irregular time intervals leaving some sustained notes. The processing device in charge of transforming the incoming MIDI data into electromechanical information to drive the solenoids produces a high frequency "noise" every time, and as long as a note is sustained, I wanted to use this sound as an *authentic Disklavier sound* and attach a contact microphone for his amplification in this section. Additionally, an E-bow is placed on an E string, which is set in motion every time the keyboard coincidentally stops depressing this key.

In this section of the piece I was particularly interested in introducing the instrument to the audience without the presence of the performer, trying to emphasize the fact that even if it looks like a normal piano it is not a piano, by revealing some of its unique sounds and the 'chorographical' semi-random movement of the keys as a pure visual element.

B. The E string is pressed and as a result the E-bow sets the string into motion, at the same time a beam of filtered noise emerges while the pianist walks towards the instrument and hits the lowest A which automatically triggers an irregular repeating pattern on the highest A. The rest of this section consists of three basic elements; pulses, noise and a frequency set in motion by the E-bow.
The pulses are triggered every time the pianist hits the indicated G, their speed is proportional to the force applied (from demisemiquaver to crotchet) and their volume controlled with the una-corda pedal which sends continuous midi values. The noise is controlled by pressing the low G, and the sustained E by either pressing the E key or the sustained pedal.

It was interesting to me how relating actions to certain musical parameters (i.e. force with speed, pedal with volume or pressing a key without attack to produce a sustained note) extended the conventional technique requiring a different mechanical level of precision.

C. This section is triggered by maintaining the sostenuto pedal half way down continuously for five seconds. Subsequently the pianist lets the fallboard (keyboard lid) close itself -

another feature of the Disklavier- showing three pressure sensors on its surface (Fig.39). These sensors send velocity values to predetermined notes, which change by pressing the sostenuto pedal. A progression of harmonic units constantly appears and disappears in relation to the pressure applied to the sensors and progressively opens up in range, with some strategic notes damped with Bluetack. Conversely, the computer triggers sine waves matching the frequency of those notes played by the Disklavier (Fig.40).

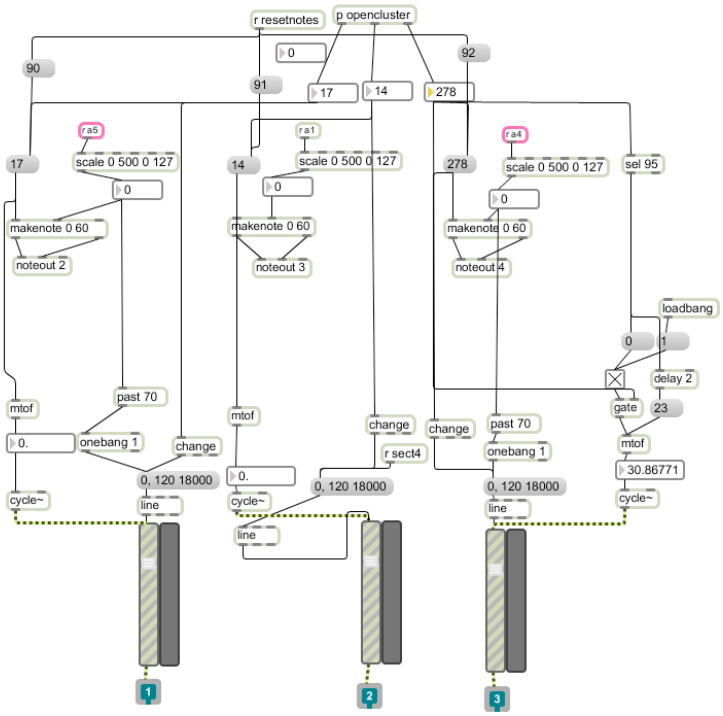


Fig. 40 Scaled values of data mapped from pressure sensors sending velocity values to the Disklavier and triggering sine wave oscillators which frequency is equivalent to the midi note values

Probably the most pianistic section in terms of sound, definitively the least pianistic in terms of conventional technique, and technically the most delicate as the instrument can easily get stuck with the streams of incoming MIDI values.

D. As a final section of the piece, the pianist walks towards the inside of the piano, where a pair of tactile transducers is placed upon the soundboard. The computer sends to the Disklavier random spaced notes, which simultaneously are sent as sine-wave frequencies to the transducers (Fig.41). The pianist plays the strings by holding the transducers against them, going from a stable to a more complex chaotic texture. The system as well as the structure of the piece is completely controlled by the pianist (Fig.42).

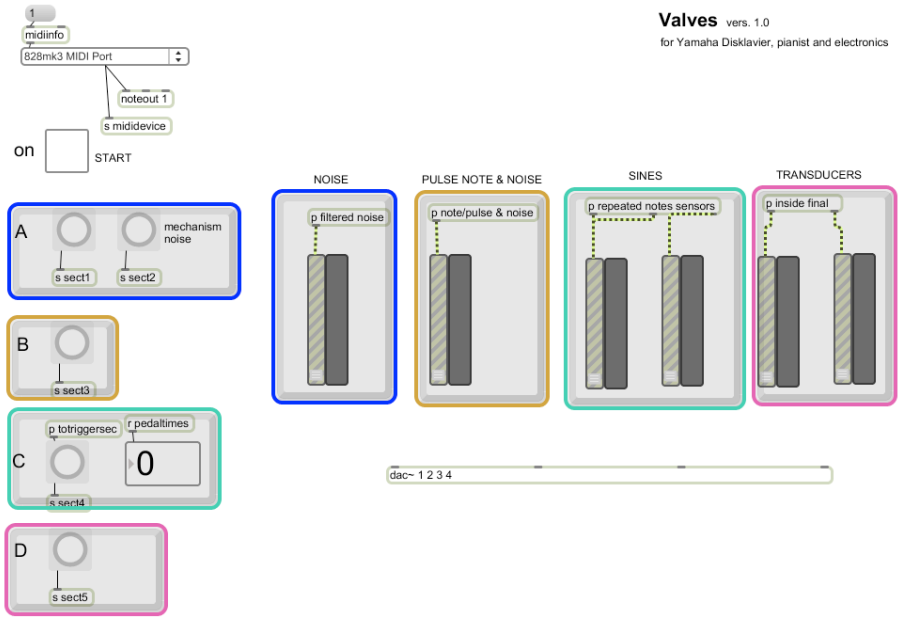


Fig. 42 'Valves', user interface

Notation

With the exception of the first section, which is simply a graphical description of process, the rest of the piece is carefully notated in three lines of action, Disklavier, electronics and pianist. This in order to guide the performer about the actions in relation to the results as well as to achieve a high level of precision and synchronization between the two elements of the piece.

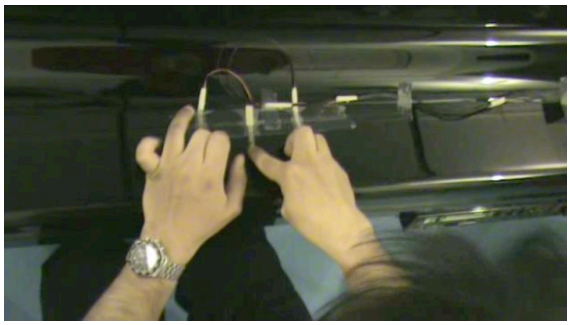


Fig. 39 Pressure sensors on fallboard

Fig. 41 Tactile transducers hold against the strings

Aushtentatic (2009)
For prepared ensemble and computer narrator on tape

Context

The piece was composed as a commission from the ensemble Klang using the text *Sigaret komt van zuig eruit* by the Dutch writer Ilja Leonard Pfeijffer. Supported by the Nederlands Fonds Podiumkunsten.

The request was to write a piece using a Dutch text as interpreted by a foreigner living in Holland. I have been living in the Netherlands for almost ten years, and since my arrival in that country English has been the main language of communication, on the streets as a foreigner and with colleagues as a foreign community. For this reason, rather than using the voice to read or sing the poem, I found it amusing to re-interpret the Dutch text read by a computer whose language is set to English.

Instrumental exploration

The piece is scored for trombone, two saxophones, piano, electric guitar, percussion and male voice.

Saxophones- They are prepared by a cardboard cup filled with light metal objects (small balls or coins) placed on the bell of the instruments. They are asked to play a Db, as a result of the preparation the pitch raises up to a G.

Trombone – A similar preparation than the saxophones is used, however to be able to maintain the cup in place it is necessary to hold the instrument vertically by blowing straight into the slide's receiver. A mute serves as a natural filter for the preparation.

Electric guitar – Is to be played sitting down with and E-bow. The guitar player is to articulate rhythms by switching the pickup of the guitar.

Piano – Originally the piano was to be played with an E-bow and a coin placed on the string right after it, which is supposed to shimmer whit the vibration of the string, but this was not always as effective in different pianos (a classic problem with pianos). We finally decided to articulate the rhythms by slightly pressing the E-bow on the string.

Percussion and voice – The singer is to use a microphone connected to a small speaker that

the percussionist uses to excite the membrane of a snare drum, hence using this as a resonator for the voice.

Technique and structure

As a short piece the material is quite restricted, the piece basically consists of the same note (G) alternating octaves. Until bar 58 the tape part "reads" parts of the poem at a slow pace giving space to the instruments to emerge and diffuse constantly. In the rest of the piece the tape part consist of the rest of the poem read at double speed and in several layers, the instrumental part becomes a thick layer at a constant level of activity, the percussionist articulates fast rhythmic patter with the speaker cone over the snare drum while the electric guitar creates a distinctive rhythms by switching the pickups on and off from the vibrating string.

Notation

The notation of the piece is entirely conventional. Nonetheless, as the interest is mainly in rhythm and dynamics it is possible to write almost all the instruments on a single line, not a very crucial decision considering the duration of the piece.

POW Ensemble meets …Me (2010)

Context

The project was a commission to organize a concert based on my own music as a one-day guest leader for the POW ensemble.

I was invited to put together a concert based on my musical ideas and concepts, but rather than performing a number of my works the request was to structure about an hour of music based upon improvisation with some of the instruments I have used in previous works. For this I could use two members of the ensemble and invite a third performer. The final template of musicians was: keyboardist, wind player, percussionist and myself. Rather than specifying instruments I opted to use musicians with specific skills and training in order to manipulate the different unconventional instruments for the performance.

Instrumental exploration

Although I planed and structured the performance months before, one of the conditions was to be able to build and rehearse the concert in only one afternoon in the concert space. I believe that to a great extent the level of dexterity and refined skills that a performer has over its own instrument measures the success of good set of improvisation, a major problem in this case considering the very limited time they would have to get familiarized with the techniques and instruments given. However, I trusted the sensitivity of the performers to be able to respond, control and articulate the different instrumental sounds given the proper guidance and structural frame.

For this performance I used many previously implemented techniques and instruments plus a couple of new ones.

Technique and structure

I divided the performance into three sets, each one exploring certain physical manipulations and sound structures.

Set I

After an excerpt of my piece _/ for amplified triangle, as an introduction, the set develops over layers of rapid mechanical articulations generated mainly by vibrators of different kinds and progressively evolving into more static sounds created by electromagnetism and tactile transducers. Instruments used are: triangle, piano, wind instrument made by PVC and balloon

membrane (Fig. 43), snare drum (Fig.44), berimbaou (Fig.11).

Set II

It takes electronic/acoustic-generated impulses as basic and initial musical material. After an excerpt of my piece *Espacios Encordados*, a duo consisting of a muted piano and a speaker-based instrument (Fig.45) from *Cones*, interact to be progressively joined by a prepared saxophone (from *Austhentatic*) and a box consisting of an analogue circuit that drives a small fan in contact with a piezo (Fig.16).

Set III

Opens up with a piano excited by feedback, (Fig.46) from *Espacios Encordados*, progressively joined by the hum of power supplies picked up by inductors and a resonating metal coil connected to a metal sheet in a feedback loop.

Notation

Even though the piece is based mainly on improvisation there are certain guidelines over the structure of the sets. Thus every performer receives a page for each set indicating the actions and transitions in the form of block structures, creating instrumental groups. Within these general guidelines the performers are free to interact and respond deciding on the specific timing of their own processes and hence the duration of the global structures.

Fig. 43 PVC tube with mini vibrator inside, played by Luc Houtkamp, The Hague 2010

Fig. 44 Snare drum played with vibrating mallets. Juan Martinez, The Hague 2010

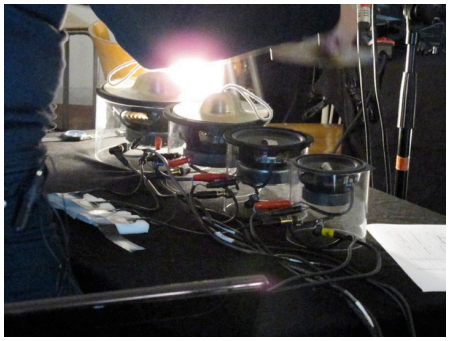


Fig. 45 Speaker--based instrument

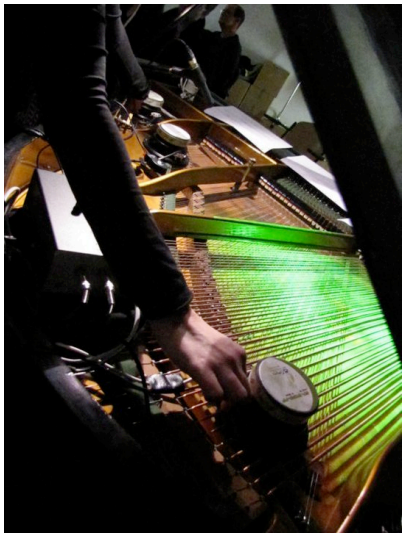


Fig. 46 Feedback piano

Chapter 6

Some Final Thoughts

Sound does not necessarily means music (and does not need to), but for me it is the fundamental ingredient of all music, and perhaps where my main frustration with traditional European instruments begins. Conventional instruments experienced a long process of development focused on certain musical characteristics and aesthetical assumptions where pitch articulation was probably the main parameter of consideration. And even though pitch perception is one of the most sensitive functions of the human auditory system it is just one aspect of the complex sound spectrum.

Yet, the discussion between "pitch and sound-oriented music" is a trivial and sterile one, I find important to bring it forward when it comes to the use of traditional instruments in a sound-oriented musical context. In that respect I consider traditional instruments are not longer necessary to create music nor a great instrumentalist with a solid knowledge on the possibilities of the instrument and the repertoire composed for it. On the contrary, it is of more value to have musicians with no fixed preconceptions about their own instruments but rather a wide perspective of them as complex and multifaceted sound producing devices, at the same time as possessing a great dexterity and artistic sensitivity to transform any primitive object into a sophisticated musical instrument,

Conversely, sound organization (in other words composition) is essential to define what constitutes music in the first place. Exploring, defining and ordering the specific sound elements generated by a physical vocabulary (instrumental technique) that articulate any given object resulting in a meaningful musical discourse. In short, a violin, a drum, a computer, a cheap DiY circuit, an expensive sound controller, a spoon from the kitchen, all have the same potential to become musical instruments, as long as they are able to produce music.

In any case I think we have the fortune of being surrounded with a bunch of alternatives to choose from and, when it comes to making music it ultimately depends on where, when and how to use the right tool, method or system for the right occasion. Personally, one of the things I value the most is experimentation and observation as main processes of making and

discovering music based upon specific necessities. Nonetheless, “Experimental Music” for me is a misleading term giving the impression that these works are in a never-ending development of becoming music, but they are not music yet. In that respect I try to avoid presenting works that are still in an experimental stage and put all my emphasis on the final musical result as a product of a process. Therefore my interests are centered in music composition and the entire derivative processes involved in its creation, performance and experience.

Improvisation, computers, electronics, visuals, multimedia, installation are just some ways in which contemporary art is manifested nowadays. Technology is everywhere, and it is exciting to experience how it moves so rapidly in front of our eyes. But I am also a firm believer on the genuine search for tools of expression beyond fashion. Pushing their limits and exploring their boundaries at the same time as favoring development and having lots of fun in the process.

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