



Case-Specific Electroacoustic Systems

A compositional approach to
electroacoustic systems design



ALEJANDRO MONTES DE OCA

EST 65

MuTri Doctoral School

THE SIBELIUS ACADEMY OF THE UNIVERSITY OF THE ARTS HELSINKI 2022

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Sibelius Academy of the University of the Arts Helsinki

EST 65

Arts Study Programme

MuTri Doctoral School, Department of Music and Technology

Doctor of Music Degree

2022

Case-Specific Electroacoustic Systems

A compositional approach to electroacoustic systems design

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Cover design: Satu Grönlund

Cover image: Photo by Jaime Culebro. Design by Daniel Malpica

Layout and design: Daniel Malpica

Printhouse: Hansaprint Oy

ISBN 978-952-329-277-2 / ISSN 1237-4229 / (printed)

ISBN 978-952-329-278-9 / ISSN 2489-7981 (PDF)

<https://www.uniarts.fi/en/units/department-of-music-and-technology/>

<https://urn.fi/URN:ISBN:978-952-329-278-9>

Helsinki, 2022



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below.

<https://www.researchcatalogue.net/view/930674/930675>

Abstract

Alejandro Montes de Oca (2022)

Case-Specific Electroacoustic Systems: A compositional approach to electroacoustic systems design.

Sibelius Academy of the University of the Arts Helsinki. EST 65.

This composition-based project of artistic research introduces the term *Case-Specific Electroacoustic Systems* to describe a set of electric, digital, and acoustic devices that are interconnected in a particular way to embody a specific sound work. The artistic research states that when the sound composition process occurs in tandem with the electroacoustic system configuration and design process, a particular creative practice is engendered. The main research questions are how the development of such a system becomes another parameter of sound creation, and how this influences the artistic ideas and process elaborated around a specific sound work. In the course of the doctoral trajectory five new sound works were created and presented, thus forming the artistic portfolio of this doctoral project. Each work included the composition, design, and creation of a case-specific electroacoustic system. An introduction to the concept of *Case-Specific Electroacoustic Systems*, its contextualisation, and an analysis of the artistic practice and the outcomes of each of the five artworks are presented in this written thesis. The complete scope of this doctoral project, including the media material of the artistic portfolio and this artistic doctoral thesis, is contained within the exposition *Case-Specific Electroacoustic Systems*, published and archived in the Research Catalogue online database.

Keywords: Sound composition, sound art, electroacoustic music, acousmatic music, installation, sculpture, performance, artistic research, artistic practice, cross-disciplinary collaboration, interdisciplinary education

Tiivistelmä

Alejandro Montes de Oca (2022)

Tapauskohtaiset elektroakustiset järjestelmät: *sävellyksellinen lähestymistapa elektroakustisten järjestelmien suunnitteluun.*

Taideyliopiston Sibelius-Akatemia. EST 65.

Tämän äänitaiteen ja sävellyksen alan taiteellisen tutkimuksen hankkeen keskiössä on termi ”tapauskohtaiset sähköakustiset järjestelmät”, joka kuvaa ääniteoksia varten luotuja sähköisten, digitaalisten ja akustisten laitteiden järjestelmiä sekä niiden välisiä kytköksiä. Tutkimus osoittaa, että sävellysprosessin nivoutuminen yhteen elektroakustisen järjestelmän konfigurointi- ja suunnitteluprosessin kanssa avaa laajoja luovia mahdollisuuksia. Hanke tarkastelee erityisesti miten sähköakustisten järjestelmien kehittämisestä muodostuu sävellyksellinen parametri ja miten tämä vaikuttaa ääniteokseen liittyviin taiteellisiin ideoihin ja prosessiin. Taiteellisen tohtorintutkimuksen aikana luotiin viisi uutta ääniteosta, jotka muodostavat tämän tutkimushankkeen taiteellisen osion. Jokainen teos sisälsi tapauskohtaisen elektroakustisen järjestelmän säveltämisen, suunnittelun ja rakentamisen. Tämä tohtorintutkimuksen kirjallinen osio esittelee tapauskohtaisten elektroakustisten järjestelmien käsitteen, pureutuu sen kontekstualisointiin ja analysoi käsitettä tohtorintutkimuksen taiteellisen osion viiden ääniteoksen kautta. Tutkimus kokonaisuudessaan on julkaistu Research Catalogue -verkkotietokannassa taiteellisen tutkimuksen eksposition muodossa, käsittäen tohtorintutkimuksen taiteellisen osion dokumentaation sekä tämän kirjallisen osion.

Acknowledgements

First, I would like to express my sincere gratitude to all the artists who collaborated in the different projects that are part of this artistic research: Marianne Decoster-Taivalkoski, Alejandro Olarte, Satu Tuomisto, Saara Töyrylä, Fornier Ortiz, Daniel Malpica, Petra Poutanen, Ahmed Kakoyi, and Juan de Dios Magdaleno. Without your contributions and our exchange of ideas this would not have been possible. Secondly, I would like to thank to the two supervisors I had along this path, Professor Andrew Bentley, who let me be myself and never pushed me into any specific direction, and Professor Jan Schacher, who helped me to put it all together and conclude this written component. A special thanks goes to the artistic committee, Professor Otso Lähdeoja, Caspar Stracke, Taina Riikonen, Professor Bill Brunson, Professor Päivi Takala, Kalev Tiits, Professor Juhani Liimatainen and Patrick Kosk, who evaluated each of the artistic projects I presented; the discussion sessions and written feedback provide invaluable materials for this research. Further, I would like to give thanks to the community of the Music and Technology Department of the Sibelius Academy; it has been a pleasure to get to know my colleagues, students, and staff and learn from them. I would also like to thank the people working at the University of the Arts Helsinki as technicians and producers, thank you for respecting my experimental approach to art creation and for helping me to present the artistic outcomes of this research project to the public. A special thanks goes to the University of the Arts Helsinki and The National Council of Science and Technology of Mexico for their financial support in the realisation of this artistic research project.

Finally, I would like to dedicate this work to my mother and my sister, they are the happier ones with these things.

List of Figures

Figure 1: Aquarmonio – Installation plan Black Box	39
Figure 2: Half Full – Installation plan Black Box	66
Figure 3: Superguitar_03 – Installation plan Black Box	84
Figure 4: Lap-dog Machines – Installation plan Black Box	104
Figure 5: Acoustic Paths – Installation plan Black Box	120

List of Photographs

1. Aquarmonio. Photo by Jaime Culebro.	26
2. Aquarmonio’s water flower. Photo by Jaime Culebro.	26
3. Aquarmonio’s installation at the Oaxaca Post Museum. Photo by Alejandro Olarte.	37
4. Aqutrio playing the Aquarmonio. Photo by Jaime Culebro.	40
5. Half Full promotional pictures. Photo by Tero Tuomisto.	50
6. Half Full promotional pictures. Photo by Tero Tuomisto.	56
7. Half Full working team. Photo by Tero Tuomisto.	60
8. Half Full live performance at Artlab. Photo by Tero Tuomisto.	60
9. Half Full’s installation at the Black Box. Photo by Paola Guzmán.	65
10. Superguitar_03. Photo by Jaime Culebro.	74
11. Superguitar_03. Photo by Jaime Culebro.	74
12. Superguitar_03’s installation at the Black Box. Photo by Jaime Culebro.	83
13. Superguitar_03’s installation at the Black Box. Photo by Jaime Culebro.	83
14. Lap-dog Machines. Photo by Jaime Culebro.	92
15. Lap-dog Machines. Photo by Jaime Culebro.	92
16. Lap-dog Machines. Photo by Jaime Culebro.	100
17. Lap-dog Machines’ working group. Photo by Jaime Culebro.	100
18. Acoustic Paths. Photo by Jakob Johannsen.	110
19. Acoustic Paths. Photo by Jakob Johannsen.	110
20. Acoustic Paths’ installation at the Black Box. Photo by Jakob Johannsen.	119

Contents

<u>Abstract</u>	2
<u>Keywords</u>	2
<u>Tiivistelmä</u>	3
<u>Acknowledgements</u>	4
<u>List of figures</u>	5
<u>List of photographs</u>	5
<u>Context and state of the art</u>	9
<u>I. Introduction</u>	11
<u>II. Electroacoustic composer, performer, and sound artist</u>	12
<u>III. From musical instruments to electroacoustic systems</u>	16
<u>IV. Case-specificity standpoint</u>	20
<u>V. Creative assemblage and techno-social</u>	21
<u>VI. Outcomes</u>	23
<u>1. Aquarmonio (2015)</u>	27
<u>1.1 Introduction</u>	29
<u>1.2 Context</u>	30
<u>1.3 Project description</u>	34
<u>1.3.1 Initial ideas</u>	34
<u>1.3.2 Artistic and aesthetic goals</u>	35
<u>Case-specific electroacoustic system</u>	35
<u>Sound sculpture</u>	35
<u>Sound installation</u>	38
<u>Sound performance</u>	41
<u>Sound composition</u>	41
<u>1.3.3 Technical and technological implementations</u>	44
<u>Capture and performance of water sounds</u>	44
<u>Creative signal routing</u>	45
<u>Sound transformations</u>	45
<u>Water flowers</u>	46
<u>1.4 Public presentation</u>	47
<u>1.5 Conclusions</u>	47

<u>2. Half full (2017)</u>	51
<u>2.1 Introduction</u>	53
<u>2.2 Context</u>	53
<u>2.3 Project description</u>	59
<u>2.3.1 Collaboration</u>	59
<u>2.3.2 Case-specific electroacoustic system</u>	63
<u>2.3.3 Sound installation</u>	64
<u>2.3.4 Sound composition</u>	67
<u>2.3.5 Black Box presentation</u>	69
<u>2.4 Performances</u>	70
<u>2.5 Conclusions</u>	71
<u>3. Superguitar 03 (2017)</u>	75
<u>3.1 Introduction</u>	77
<u>3.2 Contex</u>	77
<u>3.3 Project description</u>	80
<u>3.3.1 Sound sculpture</u>	81
<u>3.3.2 Sound installation</u>	85
<u>3.3.3 Sound composition</u>	86
<u>3.4 Public presentation</u>	88
<u>3.5 Conclusions</u>	88
<u>4. Lap-dog machines: Pre.sa.uro (2019)</u>	93
<u>4.1 Introduction</u>	95
<u>4.2 Context</u>	95
<u>4.2.1 Artistic references</u>	97
<u>4.2.2 The author's previous works involving voice</u>	99
<u>4.2.3 Narrative and multilinguist</u>	101
<u>4.3 Project description</u>	102
<u>4.3.1 Collaboration</u>	102
<u>4.3.2 Three lap-dog machines</u>	103
<u>Future: spatial sampler</u>	105

<i>Past: vocoder rupestre</i>	105
<i>Present: poliglota type machine</i>	106
<u>4.3.3 Sound composition</u>	106
<u>4.4 Public presentation</u>	108
<u>4.5 Conclusions</u>	108
<u>5. Acoustic paths (2012, version 2019)</u>	111
<u>5.1 Introduction</u>	113
<u>5.2 Context</u>	114
<u>5.2.1 Acoustic ecology</u>	115
<u>5.3 Project description</u>	116
<u>5.3.1 Initial ideas</u>	117
<u>5.3.2 Case-specific electroacoustic system</u>	117
<u>5.3.3 Sound installation</u>	118
<i>Zoom in - zoom out</i>	121
<u>5.3.4 Sound composition</u>	122
<u>5.3.5 Social relationship</u>	124
<u>5.4 Public presentation</u>	125
<u>5.5 Conclusions</u>	125
<u>6. Final conclusions and reflections</u>	128
<u>7. Bibliography</u>	135

Context and State of the Art

I. Introduction

This art-based research project started from my need to understand what constitutes an artistic practice wherein the creation of a sound work is intimately related with the composition, design, and creation of an electroacoustic system for it. In general terms, the object of enquiry is how my artistic practice can reach its full potential through an electroacoustic system specifically intended for an artwork. Moreover, the research introduces the term *case-specific electroacoustic systems* and explores it, bringing forth a set of five cases developed by the author in collaboration with other artists. This research aims to contribute to the study of contemporary practices in the field of sonic arts that are occupying the attention of electroacoustic composers and sound artists. It studies the creative process involving the composition, design, and creation of electroacoustic systems used for presenting specific artworks. This project should be understood as aesthetics research, involving knowledge acquisition and method development through artistic and aesthetic processes. Aesthetics in this context is understood as a “concept of experience, which not only makes possible a new relation to artworks, but also implies a transformed idea of thinking and subjectivity as such” (Wallenstein, 2013). In this way, we can talk about an aesthetic experience that creates a relation to an artwork, which might affect our concepts, observations, and ways of seeing things.

The artistic thesis is structured as follows: the section on **context and state of the art** starts with this **general introduction**. Then follows a presentation of my personal trajectory as a music practitioner, with the intention of establishing the starting point for this artistic research and the motivation behind it. It will continue with a contextualization of musical instruments and electroacoustic systems, followed by the argumentation for a case-specificity standpoint. After this, the concepts of *creative assemblage* and *techno-social*, which are used in the conclusions of the projects and in the final conclusions of this thesis, are introduced. The context and state of the art ends with a short presentation of the cases developed. The section on the **body of research** contains the presentation of each case study, including an individual abstract, introduction, context, project de-

scription, and conclusions. A final **general conclusion** is then presented, where I come back and answer the research questions opened by the artistic research.

II. Electroacoustic composer, performer, and sound artist

My path as a musician has been a metamorphosis. I started my music practice through the acoustic guitar, and it was just a mere causality that I went in that direction. It was my friend of my early teenage years Christian Lozano who started playing the guitar and then introduced me to it. I became captivated by its sound and started learning and practicing as well. I did not know that I was perhaps a bit too old to start an instrumentalist's career, but I also did not start with the idea of becoming a guitarist. It was at the end of high school that I took my musical studies more seriously, and I decided to apply to the Superior School of Music in Mexico to pursue a professional education. I was accepted to study a bachelor's degree in classical guitar; I was still fascinated by its sound, and I enjoyed practicing and playing in different ensembles. In the second year of studies my courses moved to the National Center of the Arts, which held the academies of music, theatre, dance, fine arts, and cinema, plus a multimedia centre and an art research centre. Here I found the electroacoustic music studio, and even though it was not part of my education, the teacher accepted me to study, and I began composing music with the computer. The technology we had there was very basic: a computer with Digital Performer¹ and Max², and two monitor speakers. However, the possibilities for collaboration were plenty, especially with the dance and cinema community. As a result, the electroacoustic studio was fully booked, and I ended up spending more of my time there than practicing the guitar.

Musically speaking, the electroacoustic studio opened my mind and imagination to work with all kinds of sounds. The inclusion of all sorts of sound material, its recontextualization, and the proposition of new meanings

¹ <https://motu.com/en-us/products/software/dp/>

² <https://cycling74.com/products/max>

found in the Music Concrète that I listened to in the courses was the most relevant encounter that I had at that time (Schaeffer, 1966; Schafer, 1977; Chion, 1983; López, 1997). I remember listening to *Agon* (Vaggione, 1998), where the search for a complexity of timbre, a spatial dimension and a musical structure, introduced me to other forms of musical construction and discourse.

In the middle of my education, I wanted to change to a composition degree, but because the director of the school told me that I would have to start from the beginning I decided to continue with the guitar education and, on the side, I kept to my compositional studies as a listener in different courses. It was in 2005 that I received a scholarship from UNESCO to go to the Institute of Electroacoustic Music in Bourges, France, to take part in a residency and make contact with the arts professionals and musicians from that institution. In their studio I was introduced to the Cybersongosse 7MI, an electroacoustic music instrument for sonic and musical work, specially designed for the music and sound education of children (Clozier, 1973). I also encountered the Cybernéphone, “a huge acoustic synthesizer, and interpretation instrument that the composer plays in concert” (Clozier and Olsson, 2001). These two instruments, one meant for compositional purposes and the other for the interpretation of a final piece, had a strong influence on me. Inspired by the music of Luc Ferrari, I borrowed a portable DAT-recorder and a stereo microphone and went out to make my first field recordings. I have kept up this practice until today, and it has been very important to my artistic work. Finally, I had the opportunity to perform my composition during their Synthèse festival with a loudspeaker orchestra, experiencing the incredible spatial possibilities of the live sound diffusion of a stereo acousmatic composition. It was not only possible to move the sound all around the hall - left, right, front, back, up, down, near and far away; it was also possible to experience how this expanded spatial dimension can improve the perception and reception of a sound work.

Until this time, I had felt more comfortable working with the computer and DAW, being in direct contact with the sound material. I also focused more on composing music than on performing, since using the tools around me

(computers) did not feel like playing an instrument. The computer was a good tool to trigger a sound, or a sequence of sounds, and to listen to it, but felt far away from the experience of playing the guitar. There were no microphones or sound interfaces in the electroacoustic music studio, and therefore my electroacoustic practices pulled me away from the physical and tangible work that could be created with acoustic instruments. I realized that I was missing something from my instrumentalist side, and in my travel to France I bought a Pro Tools Mbox sound card and a microphone to start experimenting with mixed music and live electronics. Due to my close relationship with the guitar and my guitarist friends, and inspired by works like *La corde cachée* for guitar and tape (Mary, 2017) and *Temazcal* for maracas and tape (Álvarez, 1984), I made some pieces for dance performances with guitar and tape, and guitar and live electronics.

After finally finishing my instrumentalist education, I started combining my passion for listening with my passion for playing. I moved to Vienna, where I started to study at the University of Music and Performing Arts, pursuing an education in computer music and electronic media. It was there where I first encountered analogue synthesizers and digital instruments. I started improvising with them in a group setting, and I also used them to create material for my sound compositions. I became acquainted with and performed pieces such as *I am sitting in a room* by Alvin Lucier from 1969 and *Pendulum music* by Steve Reich from 1968. These works again modified my vision of sound composition, opening the plasticity of the electroacoustic medium to the configuration of systems that explore composition, performance, and the behaviour of sound in space and time.

A sense of curiosity and nomad spirit took me away from Vienna, and I went to study in a one-year course called the European Course for Music Composition and Technology. It was organized by the IRCAM, and took place at the Sibelius Academy, Finland, and the Catalonia College of Music, Spain. There I was exposed to new ideas and technologies regarding sound composition, live electronics, electroacoustic instruments design, music improvisation, and sound art. I was also introduced to digital

instruments such as the Reactable³, an electroacoustic music instrument with multi-user capabilities (Jordà *et al.*, 2005), and the Omax, an improvisation-oriented musician-machine interaction system (Assayag and Bloch, 2006). In addition, the improvisation courses and Max workshops guided me towards building my first digital instrument, which I called the *Granular Impro Kit*. It was built in Max and allowed me to process live sound sources and sound files in real time with a set of granular synthesis tools and midi controllers with faders, knobs, and joysticks.

At the same time, the contact I had forged with the field of Sound Art, in particular sound installation and sound sculpture, made a radical impact on me, as did the *Musique Concrète*. I was able to escape the concert format and enrich my artistic practice with the possibility of imagining and building pieces through the electroacoustic medium. After this one-year course, I went to Sweden to finish my master's degree at the Music Academy in Stockholm. There I had at my disposal state-of-the-art studios and tools, in addition to a community around EMS and Fylkinging that facilitated the encounter of musicians and sound artists from all around the world.

It is impossible to mention everything that influenced me during those years of formation, but I am very grateful that I learned to play different roles, i.e., performer, composer, producer, sound artist, EA instrument/system designer, music teacher, and sound technician, among others. It is this path, together with my professional work as a freelance composer and sound artist and my collaboration with artists of different disciplines, that lead to my need to pursue this research project. I started to imagine instruments or systems that already tell me something, which embody the theory and the technologies that express it, in order to shape an idea. With this artistic research, I want to be able to develop my artistic practice by building an aesthetic, theoretical, and practical framework that allows me to imagine, create, and transmit what I call a case-specific electroacoustic system: a composition of electronic, acoustic, and digital devices that embrace an aesthetic and conceptual idea.

³ <https://reactable.com/>

III. From musical instruments to electroacoustic systems

All throughout the history of humanity, there have been musical instrument developments that in one way or another challenged and changed the way we perform, think, and experience music and sound (Montagu, 2007). These developments have been carried out either by instrument-makers or musicians, and in general they have been done through the creation of new musical instruments. Through a process of refinement and dissemination, a new instrument becomes established and obtains a standardized form. These standardized musical instruments are able to define musical practices influenced by their associated cultural heritage, the lives and minds of the musicians and composers. Once the musical instrument is established in a musical context, it can be practiced by different people, can be played along with other musical instruments, and can be commercialized. These musical practices can either be transmitted orally or written down in a score, with the goal of being able to be reproduced again. In most cases, a specific instrument, or a combination of them has been carefully chosen by the composer. This reproducibility of music has aided in the standardization of musical instruments and practices. A clear representation of this social establishment are music academies, where in most cases students learn to play instruments that carry with them long traditions, well defined practices, and canonical repertoires.

Going a step beyond what I am trying to elaborate here, I think it is important to first think about what is understood by musical instrument, be it in everyday life, or in established domains of knowledge and creation. In the existing literature about musical instruments there are many examples of classification, history and performing techniques, but seldom can we find clear definitions of the concept of “musical instrument”.

The Grove’s definition of musical instrument is a clear departure from the vague nature of the concept: “‘Musical instrument’ is a self-explanatory term for an observer in his own society; it is less easy to apply on a world-wide scale because the notion of music itself in such a wide context escapes

definition" (Wachsmann, 2001). Here, the tight relationship between the concept of musical instrument, music, and a particular context or culture is stressed. This definition suggests as well that if it is not possible to agree on what is music itself, then neither is it possible to agree on what a musical instrument may be. Nevertheless, we can say that there are as many possible musical instruments as there can be different types of music.

Another well-known definition, now from Hornbostel, who has created an extensive classification of musical instruments, states that "For purposes of research everything must count as a musical instrument with which sound can be produced intentionally" (Hornbostel, 1933, p. 129). From this, we can think that any object or device can be a musical instrument when there is a clear intention to produce some sort of agreed-upon musical idea. I would like to remark on the intentionality of the action, the action of using an instrument (playing or performing).

Furthermore, Lysloff and Matson's definition stipulates that a musical instrument is "any device or human behavior constructed or carried out for the primary purpose of producing sound, whether musical or otherwise" (Lysloff and Matson, 1985, p. 217). In contrast with Hornbostel's definition, here the intention in the construction of the instrument is stressed rather than the use of it. The addition of human behaviour as part of the constructed instrument is very important for the elaboration of the idea of electroacoustic systems. It opens the concept of musical instruments from an isolated object or device to a system of interactions and intentions that includes human behaviour or action as part of the constructed instrument.

These two last definitions stress intentionality as the border line of what can be considered a musical instrument, either in the construction or in the use of the device. Without having the intention of producing a sound in a certain musical context, we cannot define a sounding object as a musical instrument. This is particularly important for the present time we live in, where electronic devices can have different roles. To give one example, we can look at the turntable. A typical turntable in a private home, used to play music while we enjoy our daily activities, can not be considered a

musical instrument. On the other hand, a turntable used by a DJ in a club becomes a musical instrument. There are clear intentions in the DJ's actions: choosing a particular LP, locating the needle in a specific part, changing the rotating speed of the motor, scratching, and so on (Eshun, 1998).

This last example can also help me to illustrate my idea of a musical instrument as a system more than a device. Seldom do we see a DJ playing with only one turntable; they might need at least another turntable, a mixer, an amplifier, speakers, and of course the audience. All these devices might be interconnected in certain ways to produce the intended musical idea that the DJ wants to give to the public. In addition, particular human behaviours might be used by the DJ to express these musical ideas. But the interconnection can be different, and the human behaviour as well, thus creating other possible musical outputs.

At this point it is pertinent to briefly contextualize what is considered a system, which might be traced back to the second half of twentieth century culture, when cybernetics, systems theory, and technology involving electronics devices and computers became familiar to the imagination of artists. Firstly, cybernetics, a term coined by Norbert Wiener, is defined as "the study of control and communication in the animal and the machine" (Heylighen and Joslyn, 2001, p. 156). Cybernetics' main concern is the organization, control, processing, and transmission of information (Rodríguez and Arnold, 1990). In this sense, cybernetics could be considered an interdisciplinary study of the structure of complex systems such as learning, cognition, and communication. Inspired by the Chilean biologist Humberto Maturana's and Francisco Varela's idea of autopoietic systems, systems that reproduce themselves from within like the cells of a plant, Niklas Luhmann built his theory of social systems. For him, social systems, as biological systems, were conceptualised as systems that reproduced their own elements on the basis of their own elements. This systems theory separates the system itself from its environment. Furthermore, researchers such as Andy Clark, N. Katherine Hayles, and Mark Hansen "embrace the 'technical distribution' of cognition and perception as a way of understanding the complex couplings between humans and machines that are typical in our contemporary world, but that have, in fact, been part of

human techno-genesis since the very origin of the human” (Hansen, 2012, p. 32). Here, the technical distribution model sacrifices cognitive and perceptual mastery in order to enfranchise the environment as a source of enaction. Coming back to the field of arts, Jack Burnham stipulated in his text from 1968, entitled *Systems Aesthetics*: “We are now in transition from an object-oriented to a system-oriented culture. Here change emanates, not from things but from the way things are done” (Burnham, 2015, p. 113). This idea represented a change in the way society envisioned things, being less concerned with the essence of things than with their behaviour. Finally, Christoph Cox mentions in his article *Beyond Representation and Signification: Toward a Sonic Materialism* that “Culture is construed as a field or system of signs that operate in complex relations of referral to other signs, subjects, and objects” (Cox, 2011, p. 146). This takes a contemporary approach to culture in general and art creation in particular, where different disciplines and actors operate as inter-relational processes.

The concept of electroacoustic systems is emphasized by the plasticity of the electroacoustic medium, which extends from sound creation and processing, to signal routing and mapping (Roads, 2015), to epistemic tools that serve as instruments of thinking, externalising our thoughts into systems of discrete elements (Magnusson, 2019). My choice to use the term *electroacoustic system*, as compared with *digital instruments* as used by Thor Magnusson, was based on the fact that the focus of the cases in this research project sometimes falls more on the acoustic or electronic material, rather than the digital. For example, in the Half-Full project, the multichannel loudspeaker system and amplifier has more relevance than the laptop and software used to play back the sound composition. In the Superguitar_03 case, the focus falls on the sound sculpture created by augmented acoustic guitars. Going further, the use of the word systems instead of instruments is due to the reason that the five artistic cases developed in this research lie at the intersection of sound installation, sound sculpture, sound performance, and sound composition. They are not only musical performances with musical instruments. Therefore, it is more convenient to use the term electroacoustic systems to present the ideas and findings in this artistic research project.

IV. Case-specificity standpoint

The Pygmy Gamelan (1973) is “a piece in which that is the score – that is, the instrument, that is that object that does that thing. [...] I thought of myself as thinking much more in the culture of art, making objects that were pieces, sometimes requiring performances, sometimes not, sometimes standing alone.” (DeMarinis *et al.*, 2010)

Already at the end of the 1960's, Eeton L. Manford wrote a guide that enabled persons interested in electronic music to design and evaluate electronic music systems. For him, sound practitioners too frequently “invest in commercial electronic music equipment which is incapable of fulfilling their needs. They find themselves inventing ways of composing music which the instrument is capable of generating instead of specifying the characteristics of a system which will generate the music they wish to compose” (Eaton, 1969, p. ii).

A traditional western view since the classical period of the mid-1800s specifies a clear separation between instrument builder, musician, and composer. However, there are many people that take on all of these three roles themselves, challenging the traditionally separate concepts of instrument constructor and composer (Jensenius, 2012). Performers become part of the instrument, the audience becomes part of both the instrument and the composition, and the instrument may also become part of the composition. A composed instrument, for example, is defined as an instrument where the gestural controller is independent from the sound synthesis model (Wanderley, Schnell and Rován, 1998; Fiebrink *et al.*, 2012). This is identical to the definition of a Digital Musical Instrument (Wanderley, 2001). Conceptually, the composed instrument has been described as an instrument embodying some kind of pre-composed musical work (Schnell and Battier, 2002).

My idea of a case-specific instrument or system (it can be applied to both) is perfectly encapsulated in Magnusson's book, when he states that “the instruments become epistemic, composed, often directly fusing the

instrument with the composition [...] the instrument constitutes the piece [...] or [...] a specific technique becomes the theory and aesthetics of a new piece” (Magnusson, 2019). The idea of case-specificity is central to this project; it refers to the variability of an instrument’s or system’s performance across compositional works, expanding the creative process through the instrument or system composition, and design and creation as additional creative parameters. Taking the specificity of a system into account, the term *case-specific electroacoustic systems* is thus elaborated; it is defined as a composition of electronic, acoustic, and digital devices that embraces an aesthetic and conceptual idea.

Here it is important to mention that this thesis uses the term composition in a wider scope than is usually done for music composition. For the creative practice examined in this research, the compositional process does not only involve the sound organisation in a temporal line (Landy, 2007); it also looks at the organisation of the electronic, acoustic, and digital devices. How can this electroacoustic medium take shape? What elements configure it? How do they connect to each other and interact?

V. Creative Assemblage and Techno-social

The core concepts used in the conclusions of this thesis are *assemblage* and *techno-social*. In this section I present the conceptual frame of these two notions, which I arrived at towards the end of my doctoral research, and that are important in formulating and analysing my artistic practice.

The case-specific electroacoustic system is a creative assemblage of ideas-techniques-aesthetics. In formulating this, I borrowed the *assemblage* concept from Gilles Deleuze and Félix Guattari, which was elucidated particularly in their book *A Thousand Plateaus*. For them, the assemblage idea was developed “as part of a materialist and realist ontology along with other metaphorical conceptions – such as rhizomes, strata, and bodies without organs – that emphasize the specificity of topological [or transversal] forms” (Mar and Anderson, 2010, p. 37). In this formulation, the assemblage concept represents a direct critique of Western

philosophy since Plato and Aristotle, where “the hylomorphic model conceives every natural body or entity as a compound of an external form and an inert matter, whereas a materialistic model opts instead for a theory of self-organization” (Cox, 2011).

Moreover, the term assemblage, or body, can be used to articulate a view of production as an immanent process, without external factors affecting its emergence. Deleuze thus describes that “a body can be anything; it can be an animal, a body of sounds, a mind or an idea; it can be linguistic corpus, a social body, a collectivity” (Deleuze, 1988, p. 127). In this sense, my case-specific electroacoustic systems are a body or assemblage. Furthermore, as Katherine Hayles notes, when talking about nonconscious cognitive assemblages and distributed cognitive systems, “the power of these assemblages [...] is maximized when they function as systems, with well-defined interfaces and communication circuits between sensors, actuators, processors, storage media, and distribution networks, and which include human, biological, technical, and material components” (Hayles, 2017, p. 2). Ultimately, she prefers the term *assemblage* over that of a *network*, because the configurations in which systems operate emphasise fluidity, exchangeability, and rearranging connections (Hayles, 2017).

If the creative assemblage of ideas-techniques-aesthetics make reference to Deleuze and Guattari’s concept of assemblage, the techno-social concept might refer to Gilbert Simondon’s understanding of the relationship between the technical and the social, between being and technology (Simondon, 2017, 2020). Or, as Mark B. N. Hansen observes: “What Simondon depicts then is a co-evolution between two independently-evolving domains, the technical and the human” (Hansen, 2004). In this light, the development of the case-specific electroacoustic system evolves as a relational construction between the artwork, the spectator, and in some cases the performer. At this point, I have to mention Latour’s Action-Network theory, which departs from Simondon’s ideas, proposing that any model or construction of our social and natural worlds (human individuals, non-human or non-individual entities) exists as a network of relations – nodes that have as many dimensions as they have connections – in

constant exchange. In doing this, Latour suggests “that the messiness of a distributed model corresponds more accurately than the tidiness of a systems distinctions to the experiential realities of our hybrid lifeworlds” (Hayward and Geoghegan, 2012, p. 32). Furthermore, the technical distribution model suggested by researchers such as N. Katherine Hayles and Mark Hayward embraces cognition and perception to understand the relationship between humans and machines. Their models consider the environment as the source of ‘enaction’. These ideas are closely related to my way of thinking about the case-specific electroacoustic systems presented in this thesis. They are techno-social constructions arising through a dynamic interaction between the creators and our environment, where the social comes to the foreground.

VI. Outcomes

The five projects that form the artistic outcomes of this artistic research are: *Aquarmonio*, *Half Full*, *Superguitar_03*, *Lap Dog Machines: Pre.sa.uro*, and *Acoustic Paths*. They encapsulate the main research aspects of my artistic practice:

- A compositional approach to the electronic, digital, and acoustic domains, which is considered to be the electroacoustic medium.
- The electroacoustic medium as a system that goes through metamorphoses when exposed to new ideas and practices.
- The case-specific electroacoustic system as the composition and design of the electroacoustic medium that embraces a specific aesthetic and conceptual idea.
- Sound composition and spatialisation used to explore hybrid forms of presenting the work: composition-installation, composition-installation-performance, composition-installation-sculpture, and composition-installation-sculpture-performance.
- A compositional approach to the listener’s experience, from the sweet spot, to a non-fixed listening point, to shared listening experiences.
- Two modes of sonic translation, as the interplay between the given and artificially added overtones of the sound source.

1. ***Aquarmonio*** (2015), a project developed together with Marianne Decoster-Taivalkoski and Alejandro Olarte, is a sound composition-installation-sculpture-performance that was inspired by the cenotes found in the Yucatan peninsula of southern Mexico. The main idea in this project was to create a case-specific electroacoustic system that captures, processes, and amplifies water sounds in real-time, allowing us to play with water's sonic characteristics and their poetic implications. Four metal water containers were carefully chosen and set up as cenotes. Two floating speakers represented the cenote's water lilies. The *Aquarmonio* functioned as a sound composition-installation-sculpture most of the time; a performance took place at an established time only once a day. Then the performers played with the sound sculpture and started augmenting it with different objects. The system remained in its new state after the performance, with the installation continuing to play back its own soundtrack, but now all the resonances of the different objects had been added.

2. ***Half Full*** (2017) is a sound composition-installation with a portable custom sound system made for a dance performance with the same title (Puoliksi täynnä in Finnish). The dance performance's choreographer, Satu Tuomisto, had the intention of taking contemporary dance to all kinds of places, such as supermarkets, sport centres, parks, schools, companies, etc. The theme was happiness and was discussed in the group in order to build the piece. For me the idea of sea and beach, with its sand and palm trees, just like some places on the coast of Oaxaca, Mexico, represents an idyllic place that makes me feel good. From there came the idea of making a set of sixteen portable hanging speakers using coconut shells as enclosures.

3. ***Superguitar_03*** (2017) is a sound composition-installation-sculpture that studies the possibilities of adapting a traditional instrument to our contemporary world, dislocating it from its old mode of existence. The *Superguitar* series is an ongoing project rooted in my long history with the guitar and my path as a musician. The guitar is a traditional musical instrument that I have used to objectify the metamorphoses that my artistic practice has gone through. Or, in other words, the practice has

metamorphosed together with me. In this piece, four acoustic guitars are suspended, forming a circle, and sixteen different structure-borne transducers are attached to them. A visitor entering the installation space triggers the composition by pushing a button, and the composition then plays a multichannel sound sequence that combines specific frequencies in the transducers to make the body and strings of the guitar resonate. Four speakers on the edges of the space play back a soundscape in very soft volume, inviting the audience to move closely to and far away from the sound sculpture.

4. **Lap-dog Machines: Pre.sa.uro** (2019) is a sound composition-installation-performance intended to explore translation processes through technology. Three case-specific electroacoustic systems, the “Lap-dog machines”, were especially developed to electrify and transform voices and text in real time, resulting in: *Spatial Sampler*, *Vocoder Rupestre*, and *Poli-glota Type Machine*. It was developed in collaboration with the poet and spoken artist Daniel Malpica, singers Petra Poutanen and Ahmed Kakoyi, and modular synthesizer performer Juan de Dios Magdaleno.

5. **Acoustic Paths** (2019) is the fifth and last project of my artistic doctoral research. It is a twenty-minutes-long acousmatic sound composition-installation set for two listeners at a time. It encapsulates my interest in the compositional processes of forms that lie between installations and concert situations. It also plays with the role of the audience in two ways; one where it is possible to move and explore the sound world, and another where one must sit still and listen from a particular perspective. Finally, it explores a particular situation by inviting two persons, who do not necessarily know each other, to experience a work of art together, opening a moment for sharing and communication.



1. Aquarmonio (2015)

Aquatrio, an electroacoustic ensemble:
Marianne Decoster-Taivalkoski, Alejandro Olarte
and Alejandro Montes de Oca

1 - *Aquarmonio. Photo by Jaime Culebro.*

2 - *Aquarmonio's water flower. Photo by Jaime Culebro.*



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below:

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1.1 Introduction

Aquarmonio is a sound composition-installation-sculpture-performance that was inspired by the cenotes found in the Yucatan peninsula of southern Mexico. Cenotes are natural pits or sinkholes that expose the underground water system pervading the landscape of this region (Rojas, 2015). They represent a medium of connection to other worlds: underworlds, previous and futures worlds, underwater and fantastic worlds, etc. Here, as in other cultures, water is a medium of transition between two states, like between life and death. Using the Maya culture as a reference, the project also aims to remember that there are different worldviews than the one we are used to live in.

With this work, the Aquatrio wanted to develop approaches to music that continued our performance-installation in Venice from October 2012. Since then, we had been interested in finding listening environments that enhance the audience's experience by exploring encounters between sound installations and electroacoustic music concerts. The idea this time was to invite the audience to experience the case-specific electroacoustic system as a sound installation with a non-fixed listening point. The audience is able to change their position in the space, and thus their point of listening, by moving around inside this installation of non-conventional loudspeakers or sound sculptures. The sound installation exhibition was either opened, interleaved, or concluded with a live performance of the trio on the *Aquarmonio*.

Aquarmonio, the system, is a set of four sound sculpture "cenotes" that receive our sound offerings, sometimes amplifying them, sometimes transforming them, and sometimes storing them in their depths for future revelation. *Aquarmonio*, the composition, takes these offerings and creates a space and an atmosphere to live in, coexist with, and die. In this way, *Aquarmonio* relates closely to the ancient Maya culture and the roles played by the cenotes in it, for example as the sacred places and recreational areas that were fundamental to Mayan daily life (de Andas, 2010).

This project included the composition, design, and creation of a case-specific electroacoustic system for the sound composition-installation-sculpture-performance. The system was formed by the four metal water containers “cenotes” with structure-borne transducers and contact microphones; stone, metal, and rubber legs to support the “cenotes”; two floating metal elements “water flowers” with a Bluetooth amplifier and one structure-borne transducer each; stones, marbles, metal springs, seashells, and mallets to play with the cenotes during the performance; computer, soundcard, multichannel amplifier (for the structure-borne transducers), multichannel PA (for extra amplification of the live sounds); two sound sequences (one for the installation and the other for the performance); and one performance score.

1.2 Context

The music of the Aquatrio is for live electronics and live water sounds, playing with memories and impressions of an underwater sonic world, where huge ferries and motorboats, industrial and urban activities leave their traces among the vibrations of nature. Aquatrio started on August 20th, 2011, with an outdoor concert on the shore of the Aura River in Koroinen, Turku, in connection with a sound installation related to the Baltic Sea. Since then, the Aquatrio has presented its work at the Helsinki Music Centre, in Weimar at the Studio for Electroacoustic Music of the Franz Liszt School of Music, in Ljubljana for the International Computer Music Conferences (ICMC), in Venice on the Island of Giudecca, in Mexico at the Mexican Center for Music and Sonic Arts (CMMAS), and in Colombia at the International Symposium on Electronic Art (ISEA), among others. Aquatrio’s work has been encouraged and supported by the sonic art community and some institutions in Finland, especially the Centre for Music & Technology at the Sibelius Academy.

With this project, the Aquatrio working team was interested in researching its artistic practice. We have arrived at a point where our creative process involves conceptualising, thinking about, and creating a specific instrument or system to embody a specific compositional work.

In this way it relates to my doctoral project and my own artistic practice. The fundamental questions associated with this particular work, which are also closely related to my artistic research area, are diverse: can we fulfil our artistic practice more profoundly through the composition, design, and development of an electroacoustic system specifically conceived of for this artwork? What strategies and facts in this process make the electroacoustic system more case-specific, and how do they influence the artistic aims of this particular project? What strategies and factors are more generally and commonly used in electroacoustic systems? What kind of new knowledge do we need to acquire in order to work in this way and satisfy our needs? What technology can we use, and why? Are we conscious of the materials we use and our environment?

Cenote (dzonot in the Maya language) are geological structures dispersed around the Yucatan peninsula. The semi-circle of cenotes outlines a complex network of natural pits or sinkholes. They are surface connections to subterranean water bodies. Some of them can be found at ground level, while some are to be found under the sea in the north of the Yucatan peninsula (de Andas, 2010). There is a theory that says that when the peninsula was still under water, sixty-five million years ago, the impact of an asteroid produced a crater in this area (Alvarez *et al.*, 1980). The same theory proposes that the impact of the asteroid created an enormous layer of dust in the air that covered the earth, producing a greenhouse effect that led to the extinction of the dinosaurs and a change in the flora and fauna via changes in temperature and light (Alvarez *et al.*, 1980).

The cenotes played a fundamental role in Mayan life and culture, not only as the main source of water but also through what they symbolized. They represented one of the entrances to the underworld, called Xibalba, the house of the twelve gods or powerful rulers, known as the Lords of Xibalba. They were places for human sacrifices, but they were not only associated with the dead; they also represent fertility, a place for the engendering of life (de Andas, 2010). One of the most important cenotes is the sacred cenote of Chichen Itza, where archaeologists have found artifacts of gold, jade, pottery, etc., as well as human remains (Rojas, 2007).

We chose the metaphor of the cenotes because of their multifaceted role in Maya society, similar perhaps to the role of art. The idea of cenotes as sacred or ritualistic places could relate very well to the idea of a performance space. Moreover, when viewed as a recreational area, cenotes could play the role of an interactive sound installation, for example. Cenotes can be interconnected, and in consequence they can affect each other. That metaphor was also important for us; we thought of a system formed by different interconnected parts that interact with each other.

Although there is a connection between the *Aquarmonio* project, the cenotes, and Maya culture, our aim was not to come back to the aesthetics, thoughts, and intentions of the nationalist school in Mexico and Latino-America from the first half of the twentieth century. The Aquatrio working group engages in creating a particular rich synergy of the superimposed processes of assimilation and resistance of its multicultural background (Saavedra, 2001). Musical examples such *La Noche de los Mayas* from Silvestre Revueltas, which contains an explicitly quoted ancient Maya tune Xtoles (Hernández, 2009), inspired us on a conceptual level rather than on a merely musical one. Moreover, the *Tláloc Fountain* from Diego Rivera, made in 1952, which was meant to be observed from the sky, directed us towards an installation approach where the sound sculptures we made for the *Aquarmonio* project seemed to point mainly at the sky.

Another aspect explored during the *Aquarmonio* project was what is often referred to as Chladni figures. Described initially by Robert Hook in 1665 and in more detail by Ernst Chladni in 1787 (Wade, 2005), the Chladni figures are visual representations of sound. Later called cymatics by Hans Jenny (Jenny, 2001), the patterns created by particles, paste, or liquid in contact with the surface of a vibrating plate, membrane, or diaphragm have been implemented in the artistic work of diverse artists around the world. As an example, we can see the work of Lisa Park, *Eunoia* from 2013, where the attention to and meditation of her performance become values detected by a brainwave sensor. The data capture from the sensor is mapped to the volume, pitch, and panning of a sound that produces the Chladni figures in five aluminium plates filled with water (Park, 2013).

Another point of reference is Grönlund-Nisunen's *Untitled Still Waters* from 2004, a sound installation where "water is pumped through a plastic hose up to the ceiling, from where it drips slowly back into the [three circular aluminium] basins. The sound of the dripping water is recorded by underwater microphones in each basin, and played back in real time" (Grönlund *et al.*, 2017, p. 31). During the *Aquarmonio* project, a systematic study of water sound amplification was carried out. Based on our own research and the above-cited works, the Aquatrio working group arrived at a specific amplification system using contact microphones and structure-borne transducers, which will be explained in more in detail in the following section.

Tan Dun, the composer of the *Water* concerto for water percussion and orchestra, "asserts that, at this time in history, humans have lost this oneness with nature, and that this has resulted in the destruction of both nature and folk tradition [...] Lamenting the decline of shamanistic cultures which included rituals involving water and paper" (Hung, 2011, p. 615). The performative aspect of the *Aquarmonio* project can be linked to Tan Dun's ideas, and to the connection between water and rituals. Finally, based in the idea that a ritual is action, not beliefs (Lucero, 2006), a study of performative actions playing with water was carried out and implemented in the live performance.

Inspired by installation art, and in particular the sound installations produced since the late 1960s and 1970s, *Aquarmonio* aims for a spatial composition that takes into account audience, space, and experience. The different sound sculptures are treated as events for positioning artist and audience, form and content in a loop of self-reference, opening to other forms of experience and information (LaBelle, 2015). Moreover, the term *site-specific* "brings the idea in which space embraces more than geometrical properties: materials as well as the history they can elucidate, architectural contexts, and even the cultural and social conventions that regulate the place of exhibition, all become constitutive elements of the art work." (Campesato, 2009, p. 28). The *Aquarmonio* project had to adapt and explore the acoustic properties of different locations, as well as to include field-recordings from the places where we planned to present it.

1.3 Project description

1.3.1 Initial Ideas

During 2014 and 2015 our working group met regularly in order to implement a project plan, discuss the ideas we wanted to develop, contextualize our artistic research, and build the case-specific electroacoustic system. The ideas that we decided to explore within this project were categorized in two different areas: *artistic and aesthetic goals and technical and technological implementations*.

The first category was intended for experimenting with the relationships between the roles of the work of art, the creators, the performers, and the public. Following Rancière's thesis asserting that "aesthetics is not the theory of the beautiful or of art; nor is it the theory of sensibility. Aesthetics is an historically determined concept which designates a specific regime of visibility and intelligibility of art, which is inscribed in a reconfiguration of the categories of sensible experience and its interpretation" (Rancière, 2006, p. 1), we wanted to expand our work of art with the composition of a case-specific electroacoustic system. We aimed for a contemporary approach to sound composition, sound installation, sound sculpture, and electroacoustic performance. We wanted to dissolve the borders of these four disciplines, reconstituting them into one object of thought that demonstrates a certain idea of knowledge.

The second category corresponds to the technical requirements needed to achieve our artistic and aesthetic goals. Dissolving the borders of the four mentioned disciplines and merging them into one object of study also requires a reconfiguration of their individual techniques. In this sense, we aimed to find original and creative combinations of the technology available around us. Having this in mind, the strategy was to create a case-specific electroacoustic system built with known technologies, and with a recycling approach to the materials used. The most important objective was that the technologies and techniques used should serve the artistic aims.

The following section provides a more detailed description of the entire artistic practice process of the *Aquarmonio* project. It is divided into the two categories of ideas, *artistic and aesthetic goals*, and *technical and technological implementations*. Each of these areas was subdivided into different subjects where the Aquatrio working group focused its research.

1.3.2 Artistic and aesthetic goals

Case-specific electroacoustic system

In the *Aquarmonio* project, case-specific and site-specific aspects interleave, the former being the electroacoustic system's composition in relation to a particular artistic idea, project, or concept, and the later the disposition of such an electroacoustic system in connection to a particular place. The installation setup was not fixed or predetermined; rather, the electroacoustic system and the music was adapted to each site where the project was presented. This required a preview study and exploration of the acoustic qualities and the sonic environments and soundscapes that existed in each location. In some cases, particular attention to the sonic environment present had to be considered, as well as any other events happening in the space during the performance, since some of them were public spaces or galleries and not quiet concert halls.

Sound sculpture

The idea of the modularity of the electroacoustic system was important, in order to make it easier to move and install in different locations. After developing several ideas and sketches⁴ of the sound sculptures, we arrived at the solution of using a set of four recycled metal water containers (cenotes) to produce the live sounds and play back sound sequences. Three of these cenotes had almost the same diameter and height, while the fourth cenote was larger in diameter but smaller in height. The decision to use metal was taken since we wanted something durable, solid, and safe for the installation-performance, and portable and resistant to potential damage

⁴ <https://www.researchcatalogue.net/view/930674/944122/0/3150>

during transportation. We also liked the resonances that metal containers can have, affecting the sound of the water in them.

The setup was planned with the large cenote in the centre and the three smaller cenotes around it.⁵ Seen from above, it seemed obvious that there was something floating freely inside the large cenote. We moulded sheets of metal by hand to create two kinds of water flowers, which could contain some water as well. The water flower idea also provided a good metaphor for the Nicté-Ha, a water flower from the *Nimphaea* family and the subject of a Maya legend that explains why the cardinal-grosbeaks come to these water flowers to sing (Cardos, 2020).⁶

The next questions concerned the spectrum of the sound sculptures when used for amplifying sound. After several tests using recordings of the Aquatrio, live sound sources, and sound synthesis through different structure-born transducers, the following conclusions were reached:

- Large cenote: subwoofer structure-born transducer and frequency response of 20hz - 300hz.
- Small cenotes: full range structure-born transducer and frequency response of 200hz - 10000hz.
- Water flowers: full range structure-born transducer and frequency response of 9000hz - 20000hz.

Finally, the question regarding the placement of the cenotes came to our mind. It was necessary to create a system that let the cenotes vibrate as freely as possible, without attenuating the vibration by the structure holding them up, but stable enough so that they could not fall down. After different trials with the large cenote filled up with water, we decided to use six legs made from stones, iron, and rubber. For the other three smaller cenotes, which did not have water, three rubber cabinet feet lifting and holding each of the metal containers on the floor were used.⁷

⁵ <https://www.researchcatalogue.net/view/930674/944122/0/4800>

⁶ <https://www.researchcatalogue.net/view/930674/944122/0/3900>

⁷ <https://www.researchcatalogue.net/view/930674/944122/0/5700>



3 - Aquarmonio's installation at the Oaxaca Post Museum. Photo by Alejandro Olarte.

Sound installation

As a sound installation, *Aquarmonio* invited the public to move through the space and explore the sounds emanating from the four cenotes and the water flowers with their structure-born transducer. The disposition of the four cenotes allowed the visitor to create their own trajectory and their own sound spatialization. Moreover, the fixed sound composition was carefully spatialized across the entire electroacoustic system. Some sound material moved between the different speakers, but some was specifically composed for the sonic qualities of each of them. The two water flowers floating in the large cenote played a stereo sequence that was dynamically spatialized as they moved in the water.

During the installation part it was possible to achieve an immersive experience, whereas in the live act the spectator position was outside and around the installation space, facing the centre, creating a listening experience focused on the direction of the performance. The live sounds coming from the large cenote needed to be amplified with contact microphones under it in order to be heard by the audience. It was not possible to amplify the live sounds with the same large cenote due to feedback problems. Adding conventional PA speakers inside the installation space would have created a visual disturbance of the atmosphere we were aiming for. In the end we solved the problem by adding a sound system outside the installation space. The challenge here was to avoid the feeling that the amplified sound comes from other places than from the direct, live sound source. In the Black Box presentation, a quadraphonic system placed behind and above the audience, together with the other three speakers under the chairs, were used for amplification. In other locations, the installation setup, the position of the audience, and the amplification PA had to be organized differently according to the space itself and the equipment available.

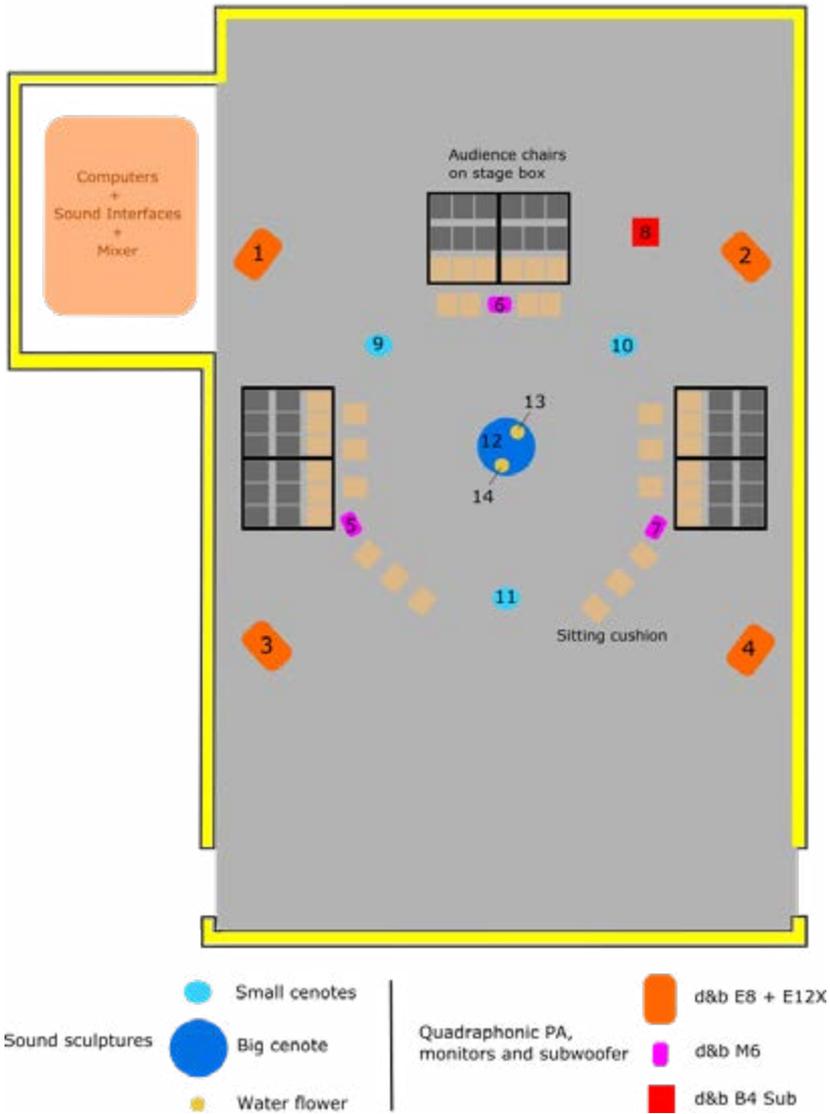


Figure 1: Aquarmonio – Installation Plan Black Box



4 - *Aqutrio playing the Aquarmonio. Photo by Jaime Culebro.*

*Sound performance*⁸

Some of the sound ideas used for the fixed sound composition and the live performance were inspired by different water processes such as melting, running off, boiling, dropping, moving, falling, and bubbling. A process of sonic exploration playing with these ideas and the *Aquarmonio* was carried out. We started with the use of stones, marbles (glass and wood), and seashells, which could produce sounds by throwing them into the water or moving them inside it. Moreover, three long plastic tubes used as straws produced sounds by blowing into them while inside the water, producing bubbly sounds. Rubber, wooden, and metal mallets were used to produce sound by striking and rubbing them in the water, the objects inside it, or directly on the edge of the cenotes. Finally, we tried to play with some metal springs attached to the border of the large cenote. By either striking them with mallets or rubbing them with hands, it was possible to create resonances and sounds that we liked. At the end of the sonic exploration, a set of sound typologies of the different techniques used to play with the case-specific electroacoustic system was defined.⁹

Sound composition

Audio-visual documentation of the performance at Black Box can be found in the following RC link:

<https://www.researchcatalogue.net/view/930674/944122/0/1600>

The sound composition process started even before the case-specific electroacoustic system was composed, designed, and built. The electroacoustic system composition kept in mind the sounds that we wanted to play, either because we had already used them, we liked them, or because we had been dreaming about them and we wanted to try them. However, a process of sonic exploration, searching for sounds made with the materials we were still finding, was also implemented. This is one of the most crucial points of this process and of my doctoral research. Being able to establish a

⁸ <https://www.researchcatalogue.net/view/930674/944122/0/9000>

⁹ <https://www.researchcatalogue.net/view/930674/944122/0/11000>

feedback process between sound composition and its electroacoustic system composition, apart from bringing particular sonorities and dispositions of materials, enriches our art practice with another set of creative decisions and approaches. We could alter, for example, the spectrum of any live or played back sound by modifying the form of the metal water container, or we could try to move the audience by playing with some specific sound spatialisation techniques and the disposition of the electroacoustic system in the space.

Moreover, the feedback process between the sound composition and the electroacoustic system composition helped us to arrive at a work somewhere in between a sound installation, a sound sculpture, a live electroacoustic music performance, and an electroacoustic composition. Considering sound as a temporal and spatial element, the structure of the work had basically three states or parts, with the first and last ones being a modification of one another in a basic A-B-A' form. The installation part A, of indeterminate duration, was followed by the performance part B, which was announced for a specific time and duration, followed again by the installation in a modified form A'. The Installation part A had no springs attached to the large cenote and no objects placed inside the water (stones, marbles, and seashells). Part of the performance was to position them and start playing with them, leaving them in place after the performance ended. In the installation part A', the spatial sound composition was then reproduced, but this time with the vibration of the large cenote with springs and objects inside it adding particular acoustic sound modifications. The second installation part A' became a transformation or a transfiguration of the first installation part A. This well represents a metaphor related to the idea of water as a medium of transfiguration, like in the Mayan culture where the cenote acts as a medium of transit from the human world to the underworld.

After several sessions of experimentation, sound recording, and conversations with the Aquatrio, I composed two fixed sound compositions, one for the sound installation and a second one for the performance part. The sound material used originated from recordings of the Aquatrio playing the *Aquarmonio*, and field recordings from the Aquatrio archive. The installation part consisted of a repeated sound composition lasting twenty-

six-minutes. The live performance had as a background another fixed sound composition lasting thirty-four-minutes. We tried different versions of the sequence, and I made modifications to adapt it to each location.

Across all the sections composed for the sound installation, two different types of soundscapes, natural soundscapes, and abstract soundscapes, were combined. Moreover, the spectrum of the soundscapes was enriched with the acoustic properties and resonances of the different cenotes. Here it is important to note another system composition approach that was influenced by an artistic idea or intention. We wanted to take the visitor closer to the cenotes using a tactic of sound composition that we had been exploring in some other works, and that is related to the *intimacy of sound* (Batchelor, 2019). This compositional parameter plays with very soft, organic, sonically attractive and distinctive material, which is spatialised in the custom-made speakers, trying to elicit curiosity in the listeners, inviting them to approach closely and move around the space.

The fixed sound composition of the performance included the same strategy of combining natural soundscapes and abstract soundscapes, plus the addition of the live sounds performed by the three members of the Aquatrio. Since we wanted to provide a feeling of cohesion to both parts, the installation and the performance, the strategy was to crossfade them with the first section of the installation part. This allowed the entrance of the performers into the installation space without a cut or intermission. In this case, the reference to Caronte's ferry in the first section brings three actors to the cenotes to play with their waters. Through an iterative process of the Aquatrio improvising with the *Aquarmonio*, I composed a performance score that has clear sections with actions that guided the performers to improvise with the system. Moreover, the live sound sources were processed in real-time by a Supercollider patch developed specially for this project by Alejandro Olarte. Different live processing techniques were synced to the fixed spatial sound composition.

Finally, some of the sound materials used in the two playback tracks were particularly developed to interfere with the resonant nodes of the large cenote. In this way it would become sonically distinctive because of their

own acoustical sound characteristics, and visually attractive because of the Chladni figures created by the nodal lines from the fundamental modes of the large cenote.¹⁰

Both the installation and the performance parts were subdivided into different sections:

Sound installation: La barca de caronte, Ranas, Organia viva, El grillo cantor, Buceando bajo el mar, Pájaros dentro del cenote, Koroinen,

Performance: Introduction (La barca de caronte), The sacrifice, Interlude I, The procession, Interlude II, The game, Cadence.

1.3.3 Technical and technological implementations

Capture and performance of water sounds

The Aquatrio had previous experience amplifying and recording water sound, but this time the intention was to go more in depth, experimenting in the recording studio with the cenotes. In connection with the set of sound typologies used to play with the large cenote, microphones with different characteristics and brands were tested to compare their performance, potential, and practicalities. These microphones were: mini DPA microphones, diverse condenser microphones (Rode and Neumann), self-made and commercial contact microphones (K&K), hydrophones (Aquarian), and double coil pickups. After a process of recording and analysing the sound material, we decided that the best way to capture the live sounds from playing the large cenote was to use three contact microphones placed underneath it. This placement, and the use of contact microphones, helped to avoid the feedback that could have been caused by the amplification system being set up around the installation. They were also easier to hide, less technically obvious or visually distracting, and prevented problems with the water.

¹⁰ <https://www.researchcatalogue.net/view/930674/944122/0/3550>

Creative signal routing

One problem to tackle was the feedback produced by the large cenote in the performance part, since it was working both as a speaker and as a microphone. The large cenote's metal surface had three structure-born transducers for transmitting the sound waves below 300 Hz. However, we also attached the three contact microphones to the same surface. This meant that it was not possible to amplify the sound that we were playing by using the same large cenote. The solution was to spatialize the spectrum of the sound captured by the contact mics. The high part of the spectrum was sent to the two water flowers, the mid part was sent to the three small cenotes, and the bass part of the spectrum plus some of the mids and highs were amplified by the multichannel PA sound system around the installation. The final creative signal routing solution to avoiding this problem is what we considered the feedback principle of the *Aquarmonio*.¹¹

Sound transformations

The acoustical characteristics of water sounds are very rich and have a wide and colourful spectrum that allows for a broad range of signal processing possibilities. Since the formation of the Aquatrio, we have experimented with these possibilities in diverse software and hardware systems. For this occasion, we concentrated on investigating and developing a system based on digital tools for sound processing. We also researched algorithms that enabled us to process sound in relation to information obtained from its analysis, basically spectral content and amplitude. Both old and new techniques for sound processing were used, and a custom-made mapping of control parameters (Hunt *et al.*, 2002) with a creative signal routing (Lähdeoja and Montes de Oca, 2021) was developed. This allowed us to organically play with the spectromorphology of the sounds (Smalley, 1997), and with the formal and temporal organization of the sonic events in the live performance (Young, 2004).

¹¹ <https://www.researchcatalogue.net/view/930674/944122/0/6030>

We mainly focused on two pieces of software: The Pro Tools¹² sequencer for organizing the sounds in a timeline and building the sound composition of the installation and the performance part, and SuperCollider¹³ for the real time sound processing of the performance. Commercial plug-ins such as GRM Tools,¹⁴ RX Izotop,¹⁵ and Waves¹⁶ were also used to process the sound recordings for the sound composition. I was in charge of composing the sequences in Pro Tools, and Alejandro Olarte developed the tailor-made SuperCollider script.

The intersection point between both platforms was a MIDI track in Pro Tools that sent information to each processing unit of SuperCollider's bus processor. These MIDI tracks with different control envelopes could change some parameters of the sound processing units in either an abrupt or smooth manner.¹⁷

Water flowers

The final aspect of this section concerns the experiments and implementations carried out in order to arrive at the final version of the water flowers speakers. As mentioned before, the aim was to have these two speakers floating on the surface of the large cenote, and for this purpose wireless sound transmission would be the ideal solution. We investigated different options for audio wireless transmission, such as radio, Bluetooth, audio over wifi with Raspberry Pi,¹⁸ and wireless internet. We also hacked an in-ear wireless system to send the audio signal in real time. Some of these options were discarded because we needed something very light and battery powered. In the end we arrived at a solution using a bluetooth receiver attached to a miniature amplifier, with a Nokia mobile

¹² <https://www.avid.com/pro-tools>

¹³ <https://supercollider.github.io/>

¹⁴ <https://inagrm.com/en/store>

¹⁵ <https://www.izotope.com/en/products/rx.html>

¹⁶ <https://www.waves.com/>

¹⁷ <https://www.researchcatalogue.net/view/930674/944122/0/13000>

¹⁸ <https://www.raspberrypi.org/>

phone battery powering both. We also needed to have two custom-made bluetooth emitters sending the signal from the computer's sound card. And finally, two light metal plates worked as a ferry for the water flower speakers.

1.4 Public presentation

The public presentation of the project as a doctoral concert was realized at the Black Box, Musiikkitalo, Helsinki on April 17th, 2015. After this, the work was presented in Mexico in September 2015 in four different locations: the Museum of Oaxacan Painters, the Oaxaca Post Museum, the Mexican Center for Music and Sonic Arts (CMMAS), and the Amate Museum, Cuernavaca.

1.5 Conclusions

The artistic research work presented in the *Aquarmonio* project addresses a type of artistic practice that involves the creation of a case-specific electroacoustic system in tandem with a sound artwork. Through the project description presented here, I have demonstrated an artistic practice in which the composition of an electroacoustic system becomes a mouldable techno-social network, which designates a specific sound work that is inscribed in a creative assemblage of ideas-techniques-aesthetics.

Firstly, on a general level, the *Aquarmonio* project dissolved the borders between sound composition, sound installation, sound sculpture, and sound performance, reconstituting them into one object of thought and imagination that reconfigured their techno-social aspects on three intermingled levels: the spectator, the artwork, and the performers. Secondly, with the creative assemblage of ideas-techniques-aesthetics, an electroacoustic system was developed with the intention of embodying a specific compositional work, and thus merging the sensible experience of the four areas of artistic practice.

To concretise some aspects of the artistic practice elaborated during the *Aquarmonio* project, the following points can be emphasised:

- The art practice, which involved the processes of conceptualising, thinking, designing, composing, and sculpting a specific electroacoustic system to embody a specific sound work, demonstrates a contemporary approach to art creation where different artistic disciplines operate as inter-relational and transversal processes.
- The configuration and design of the large cenote, the three small cenotes, and the water flowers, together with the sound composition specially created for them, constitutes an example of a feedback process between sound composition and electroacoustic system composition. This feedback process, apart from producing particular sonorities and dispositions of materials, enriches our art practice with another set of creative decisions and approaches.
- The installation setup allowed us to identify particular and original listening environments that enhanced audience experience, reconfiguring the techno-social aspects at the level of the spectator.
- The water flowers and their connection with the Nicté-Ha water flower and the Mayan culture elucidate how a metaphorical idea and aesthetical concept can influence the composition process of a case-specific electroacoustic system.
- The transfiguration of the installation part A into the installation part A', by adding the objects and metal springs to the large cenote during the performance, also represents how the distinctions between sound composition, sound installation, sound sculpture, and sound performance can be erased, reconfiguring the techno-social aspects at the level of the *artwork*. It also connects to the idea of water as a medium of transfiguration, like in the Mayan culture where the cenote acts as a medium of transit from the human world to the underworld.
- The definition of a set of sound typologies to be performed on the large cenote represents another example of the feedback process between sound composition and electroacoustic system composition, on a technical, metaphorical, and aesthetical level, reconfiguring the techno-social aspect at the level of the *performers*.
- The sound composition specifically made for the spatial disposition of the electroacoustic system and its distinctive acoustic characteristics

fulfilled our intention of letting the audience experience the piece from non-fixed listening positions.

- The concept of intimacy of sound used in the composition of this work exemplifies how it is possible to influence the audience's placement in the space and their listening focus. This was achieved by carefully placing and moving the sound sources inside the installation of non-conventional loudspeakers.
- The process of tailoring sound processing techniques and mapping parameters to the *Aquarmonio*'s particular sonority, sound spatialisation, and sound performance is considered a core aspect of my artistic research.

Finally, according to the positive feedback we received from the jury, the work was "found to qualify admirably for the concept of 'case-specific electroacoustic [systems]', and articulate well the central questions of the genre such as: 1) the instrument as a spatial interactive installation, 2) objects of non-musical origin transformed into sound sources and input devices, 3) multiple performers playing the same instrument, and 4) the 'case-specific' performative potential of such an instrument".¹⁹ An email received after the performance from an audience member and a critic who wrote in the *Amfion* e-magazine (Hynninen, 2015) agreed on the work's achievements, remarking on the beautiful, relaxed, mysterious, and contemplative aspects of the composition.

Critical points from the jury members were regarding "the stage presence of the ensemble's members and the theatrical quality of the performance."²⁰ One audience member commented that she missed the opportunity for the performance to involve the public in becoming part of the ritual. Others felt a lack of interactivity in the system, and would have appreciated some kind of interaction, or being able to actually play with the instruments.

^{19,20} Comments from the jury assessment written by the jury's chair
Otso Lähdeoja, 17.4.2015



2. Half Full (2017)



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below:

<https://www.researchcatalogue.net/view/930674/952113>

2.1 Introduction

HalfFull is the second project of my doctoral artistic research. It is a sound composition-installation with a custom-made portable multichannel sound system, developed for a contemporary dance performance with the same title (Puoliksi täynnä in Finnish). The dance piece's intention was to take contemporary dance to all kinds of places, hence the need for a portable sound system. The title of this project took the name from the choreographic piece and reflects the theme around it: happiness and its implications in our body, mind, and spirit. The working group included the choreographer Satu Tuomisto, dancers Saara Töyrylä and Fornier Ortiz, and myself as composer and sound artist.

The result was a forty-minutes soundtrack (stereo and multichannel) and a portable sound system of sixteen loudspeakers made from coconut shells. The coconut-loudspeaker orchestra, an amplifier, and a player with the sequence form the case-specific system. The music is a set of electroacoustic dance sequences fitted with rhythmical bits, soundscapes, and lovely human sounds. I made a live diffusion of the tracks in some places, as well as multichannel versions for some locations. From schools, libraries, supermarkets, sport centres and offices to the forest, parks and city theatres, the case-specific instrument had to adapt and work in each public presentation.

2.2 Context

Dance is something that has touched me deeply at my roots, first as a spectator since I was a child, then as a composer, and lately as a dance enthusiast. The use of electroacoustic music for dance performances is an area that fascinates me. I began my career as a composer, doing music for contemporary dance. I developed my skills in direct contact and dialogue with choreographers and dancers. Looking at the dance movements and listening to the dialogue between the choreographer and dancers, I become inspired with sound ideas.

In western, European music from the classical and romantic eras to serialism and post modernism, the connection between the mind and body was broken. Moreover, the relationship between performer and listener moved away from each other (Small, 1998). The instrumentalist focuses on performing perfectly a notated musical piece made by a composer. The audience is required to keep extremely quiet and listen to the magnificent performance of the brilliant composition.

Dance brings me back to the connection between mind and body and forces me to think about its relation to music. For example, choreographer Fernando Anung'a in the TV series *Why Do We Dance?* mentioned that "in Masai dance and music, which in a way is the same thing, there is no music without dance and the other way around. The lead singer tells the story, and the rest of the group needs to rhythmicise the story, the dancer makes the beat breathing in and out. It is a collective experience where everybody contributes, there is no clear division between the role of performers and public" (Pianigiani, 2019). At the folk music band Festival in the centre of Oaxaca, four bands, one in each corner of the main town square, take their turn to encourage people to dance, one after another. It is some kind of competition to find the band that best moves the bodies of the active listeners.²¹ The fandango music from the gulf area of Mexico, where everybody is welcome to contribute by playing, dancing, or both, each to their own degree of expertise, is a participatory shared action, inviting everybody to perform (Williamson, 2017). Finally, the electronic dance scene, where the DJs are the ones that follow and listen to the people that are dancing (Gates, Subramanian and Gutwin, 2006), is another example of how the old passive concert situation can be broken and a bodily active listener needs to be present to fulfil the mind and body relationship.

Dance and performance art in general have opened my mind to other ways of presenting spatio-temporal works as well. For example, in the work of Amelia Rudolph and her vertical dance choreographies, the dancers are at the same time expert climbers. The mountain's walls or trees becomes a

²¹ This was a personal experience from 2005. No research was found to use as a reference.

natural stage, and there is no classic theatre construction, although the spatial division between spectators and performers is maintained (Rudolph, 1992). Butoh dance alters time perception with its characteristic slowness and stillness; it empties the minds of the spectators of their own emotions and then fills them again with the performance's emotions, which takes the spectators into a trance state (Perena, 2011). The La Fura Dels Baus company "redefined the space by moving [the public] to non-conventional ones - and changed the public role from passive to active" (Gatell *et al.*, 2014). Finally, dance as an improvisation practice inspires me with the play between balance and energy found, for example, in contact improvisation (Paxton, 2008).

The electroacoustic medium is for me the ideal way to explore the connection between sound and movement. Acousmatic music aesthetics and techniques open up a set of possibilities to interact with the dancers. Equipped with a laptop and software, an electroacoustic composer can take the sound laboratory to the rehearsal space and directly try things there. The plasticity of the electroacoustic medium and the plasticity of the body can interact in real time. This interaction can come along, making direct connections between dance movement and sound activity or materiality: fast, slow, active, laugh, skin contact, etc. Or, on a metaphorical level, where dance and sound can have interpretations of different ideas that can then trigger the imagination: with fun, excitement, get crazy, happy alone, etc.

Already in the 1950s, Pierre Henry and Pierre Schaeffer created *Symphonie pour un Homme Seul* with choreography by Maurice Béjart. This was an acousmatic work that was made to give sound to a dance piece. *Torse*, from 1978, is another example of a collaboration between choreographer Merce Cunningham and composer Maryanne Amacher that used the electronic sound medium and the body as its main materialities. The Chunky Move company, in their *Mortal Engine* piece from 2008-2012, expanded the electroacoustic medium with video projection interaction (Mullis, 2013). In the choreographic work *Anima Ardens* of Thierry Smits, with music by Francisco Lopez, naked men use their body, their breath, and their voices surrounded by an organic sound environment made from field recordings



6 - Half Full promotional pictures. Photo by Tero Tuomisto.

and clear acousmatic aesthetics. This piece, from 2017, is a recent example of how composers have continued to use the aesthetics and techniques of electroacoustic music composition, and more, in particular acousmatic music compositions of sound tracks for dance performances (Ramsay, 2011).

In my encounter with electronic dance music, my need for moving my body was satisfied. And with the introduction to the tools and techniques to produce this music, my palette of compositional possibilities was extended. Just as with the extended techniques in an instrumental practice, for example in Lachenmann's music, the use of other syntaxes or the addition of extra elements can reconfigure a sound source (Tsao, 2014). Samplers, drum machines, effect pedals, mixers, and modular synthesizers gave another form to the electroacoustic medium, with the possibility to play and interact directly. The sequencer still can record and store the sound material for later organisation but is not used as the only source of sound creation. These techniques allowed me to combine my needs for an investigation into timbre and rich micro-sonic textures with the exploration of rhythmic structures that produce the feeling to dance. These new tools opened to me a window to live performance with the electroacoustic medium. From live sound diffusion to live electronics and DJ gigs, the number of possibilities that we encounter now for real time interactions between sound and movement are endless.

While assisting in performing the live sound of Satu Tuomisto's *Riisuttuna* choreography at the Joensuu National Theater in 2014, I used for the first time a multichannel surround sound system for a dance performance that had a frontal stage. In my own experience, and listening to the opinion of the audience, it was strange to hear sound coming from another direction than from the dancer's performance place. This feeling of discrepancy between visual field and sound space could be one of the reasons why multichannel music for dance performance has not been explored much. With this particular project, I wanted to explore this aspect and find opportunities where a multichannel sound system might enrich the experience of a dance performance.

Portable sound systems are something we see every day. In a gathering of people that want to have music at a picnic, car stereos, boomboxes, street musicians' sound systems, telephones, bicycle sound systems, a CD seller in the metro of Mexico City, etc. They have incorporated music into every day human life. Their quality and battery consumption has improved over time, but most of them are restricted to at most a stereo signal. I wanted to expand this possibility with a portable multichannel sound system. The inspiration came from the loudspeaker orchestra of the GRM (Tutschku, 2002) and IMEB (Clozier and Olsson, 2001). I wanted to create a mini loudspeaker orchestra, but portable. Instead of a big PA and powerful equipment, a number of small speakers that could be easily transported, connected, and set up could be used for the situations we were going to face. With more speakers, the sound could be projected into the location for both the dancers and the audience.

Looking at the work of Peter Batchelor's *DOME(s)* and Nye Parry and Jamie Campbell's *The Exploded Sound* at ICMC 2012, I had my first encounter with multichannel sound systems that could literally travel in a suitcase on a plane trip. In the first case the structures that support the twenty-six speakers change according to the materials found in the place where they are to be set up. The system uses speaker elements embedded in plastic boxes, and the public can select the tracks to be heard with an iPad. The geodesic dome structures, meant for one person at a time, are also "designed to be unenclosed, and thus are acoustically transparent, enabling a listener within to experience the soundscape beyond the playing loudspeakers [...] as an extension of that presented by the dome itself" (Batchelor, 2013, p. 7). In *The Exploded Sound*, there were thirty-two speaker elements hanging at various heights in a four meters square space above the audience. The audience could walk under them and listen to the spatialisation of the sound spectrum. Individual frequency bands were given independent positions in the field of multiple small loudspeakers (Parry, 2014).

Michael J. Schumacher's Portable Multi-Channel Sound System (PMcSS) "is a unique musical instrument [...]. It sets up in less than an hour and can be

carried in a single suitcase, yet provides 12 fully discrete audio channels, complete with speakers, amplifiers and sound sources” (Schumacher, 2019). Finally, a piece I experienced in the Venice Biennale of 2019, *For, In Your Tongue, I cannot Fit* from Shilpa Gupta, uses 100 dynamic microphones as speakers. The “100 sheets of paper are pierced by vertical metal spikes, laid out in a grid with overhanging microphones emitting a recitation of the written texts below; the verses are from poets, across several centuries and cultures, all detained for their political views” (Clarke, 2019, p. 25).

All of these cases exemplify the use of multichannel sound systems in the context of a sound installation. My intention with the case-specific electroacoustic system for this project was to create a portable multichannel sound system for a dance performance. It had to be related to the theme and fulfil the needs of the dance project. It needed to be easy to set up, allowing me to explore the sounds in relation to architectural space. Finally, it had to let me diffuse the soundtracks over the speaker-array in live situations or create multichannel versions of the sound composition.

2.3 Project description

2.3.1 Collaboration

In 2015 I was contacted by the choreographer Satu Tuomisto with an invitation to collaborate with her. The proposal was to compose a soundtrack for a performance and to create or find a portable sound system for a project she had in mind. At that time, because I was at the beginning of my doctoral research, I thought the project could fit perfectly into my research about case-specific electroacoustic systems, in particular if I elaborated more on the idea of the portable sound system. This is why I decided to include it as the second case of the artistic outcomes. I transformed the idea of a portable sound system into a multichannel loudspeaker system. The case-specific electroacoustic system helped me to reflect on my own approach to sound composition and sound installation for dance performances, and my own artistic practice.



7 - *Half Full* working team. Photo by Tero Tuomisto.

8 - *Half Full* live performance at Artlab. Photo by Tero Tuomisto.

I like to first go with an empty mind into a meeting with a choreographer and dancers. I listen to what they have to say and watch some dance movements. Then I can propose a sound idea that could come from the inspiration of the project's theme, or broader concept, or be directly inspired by the dance movement. The sound idea can also come from interpreting the dance and sound language on a literal or metaphorical level. For example, if the dancers move fast, the music could do the same and increase the tempo, or, if the choreographer asks the dancer to get crazy the music can get metaphorically crazy, e.g., with a sound recording of people shouting in an amusement park when they are on a roller coaster.

In the words of the choreographer Satu Tuomisto, the dance piece deals with the theme of happiness: "a body, psychological and spiritual feeling of happiness, happiness, self-happiness and with another person, the feeling of happiness in your own body." The collaboration started with a dialogue around these subjects, between all of the participants, the choreographer, both dancers, and myself. We first asked ourselves: what do we understand by happiness? How does it feel in our own particular experience? Where does it feel? What produces happiness and what not? What kind of levels or types of happiness can we experience?

After this dialogue, terms were highlighted that represented our thoughts: "excitement, peacefully, without trying, fully, little by little, letting go, instigating, daring, at their own pace, confidently, slowly, happily". These words were used for the predefined choreographic script for the dancers to move to, and I also used them as a starting point and inspiration for the compositional process (more about this in the description of each section).

The development of the piece continued through rehearsals with the dancers and myself. As an electroacoustic composer my toolkit includes analogue, electronic, and digital instruments, normally a laptop and a sound card. It might include the sound system if I am working on a sound installation or in more specific situations. In this particular project, the portable sound laboratory that I took to the rehearsals consisted of a modular synth case, a laptop, sound card, a small multi-channel amplifier, and small speakers and actuators. I tried different sound materials in

the rehearsals. Looking at the dancers' movements and listening to the dialogue between the choreographer and dancers, the sound material obtained shape, dynamics, and rhythm. The feedback from the dancers was important in this process, because we needed to agree about each section's beginning and ending, the cues, and whether the music was supporting the choreographic ideas and feelings.

"It is usual that contemporary dance works get the chance to be performed only a few times, they cannot grow or develop with performances, and they do not deepen with the help of the performance arc. *Half Full* was also a conceptual question about performance, its repetition, nature, and impact through the multiple presentations. The rehearsals never replace the performance situation - the feeling of the performance, the excitement, the experience and dialogue with the audience, only arise in the performance situation."²²

I took a similar approach to the sound composition-installation and the case-specific electroacoustic system. As the rehearsal period was short, just two weeks, I modified and adapted the sound composition all throughout the performances period. Through direct observation of the spectator reactions and the feedback collected from them, it was possible to improve the sound composition each time.

In collaborative work between a choreographer and composer, there is a balance between total freedom for the composer and a more deterministic and directive attitude from the choreographer (Stiefel, 2002). In this particular case, I consider that we were on the pivot point of this line. Satu had some precise ideas and strong references about the music she wanted, and I proposed different solutions from within my own musical ideas and aesthetics, and then we both decided what was working and what needed to be improved. One of the strongest inputs I received from the choreographer was the desire for music with some Latino-American touch, in particular regarding the Samba music from Brazil and its connection to festivities and

²² From the *Puoliksi Täynnä* (Half Full) project's work plan (Puoliksi täynnä työsuunnitelma) by Satu Tuomisto. Translated by the author.

happiness. That is the reason why, in the last movement of the piece, I decided to make an electroacoustic samba based on some traditional rhythms.

2.3.2 Case-specific electroacoustic system

Since my responsibility was to provide the sound system and the music for every performance, I needed to think of a solution that would be easy to transport, even in a tram. It also needed to be easy and fast to set up, and with the possibility of being powered by a battery if there was no electricity at the location. Therefore, I decided to use only the laptop and sound card, in addition to a custom-made multichannel sound system that could be used in different configurations. The live sound act would consist of, as in an acousmatic concert, thoughtfully setting the location of the speakers for sound projection, and the live sound spatialisation.

Before I finalized the composition and design of the *Half-Full* case-specific electroacoustic system, I explored different ideas about it. I made some trials with transducers: I thought I could put them on the surfaces of the places we would visit, but of course there were not going to be places to locate them everywhere, and it would take time to attach them. I also thought about bringing some sound machines with which I could play some tracks, like a radio or a portable cassette player, or a portable phone player with its own speaker. I also thought of a sound bicycle; I had already done one with a christiania bike for a sound and light walk in the Assistens Kirkegaard cemetery in Copenhagen in 2012. But some of the performances were not going to be outdoors, and it could be difficult to transport the bicycle when the location was far away. Another idea was to have a playback stereo track in a commercial portable loudspeaker and install different sound objects in the space that could be easily played by the dancers, or even the audience. This idea was also discarded, because the sound objects had to connect to the dance performance, not only through the dancer's actions but also in a visual or scenographic way.²³

²³ <https://www.researchcatalogue.net/view/930674/952113/0/2950>

In my own personal experience, the idea of a sea, beach, sun, sand and palm trees, just like some places on the coast of Oaxaca, Mexico, represents an idyllic nature that makes me feel good. From there came the idea of constructing a set of sixteen portable hanging speakers using coconut shells as their enclosure. The colour yellow emerged in the working group as a representation of happiness, perhaps because of its relationship with optimism, enlightenment and creativity, sunshine and spring. This is the reason why the costumes of the dancers were yellow, and it is also the reason why I decided to use yellow speaker cables.

In addition to the inspiration from palm trees, the idea of creating a multichannel sound system made of small hanging speakers was also an exploration of acoustics. On the one hand, I wanted to have a system that could work in different public dispositions (frontal, around, divided, etc). On the other hand, I wanted to test how a multichannel sound composition could work in a dance context. I needed the dancers and the public to be able to listen to the music, but I was not sure where the public was going to be situated.

For a live performance of my *Acoustic Paths* project in 2013, I installed a multichannel sound system setup with actuators attached to the windows, furniture, and different surfaces of the space. The performance consisted of the live spatialization of a multichannel track over the multiple speakers installed in the space. I decided I wanted to do something similar with the coconut-loudspeaker orchestra. I used a four- and eight-channel custom-made amplifier with individual gain knobs, which was a very indispensable part of the system. It allowed me to spatialize the soundtrack and play in real time with the volumes of each channel.

2.3.3 Sound Installation

Performing the piece in several different locations opened up a question about dance in relation to the performance space. For me, it was a way to explore the relationship between the sound composition, sound installation, and the performance space. Having a multichannel sound system allowed me to direct the sound in multiple directions, to have at



9 - *Half Full's* installation at the Black Box. Photo by Paola Guzmán.

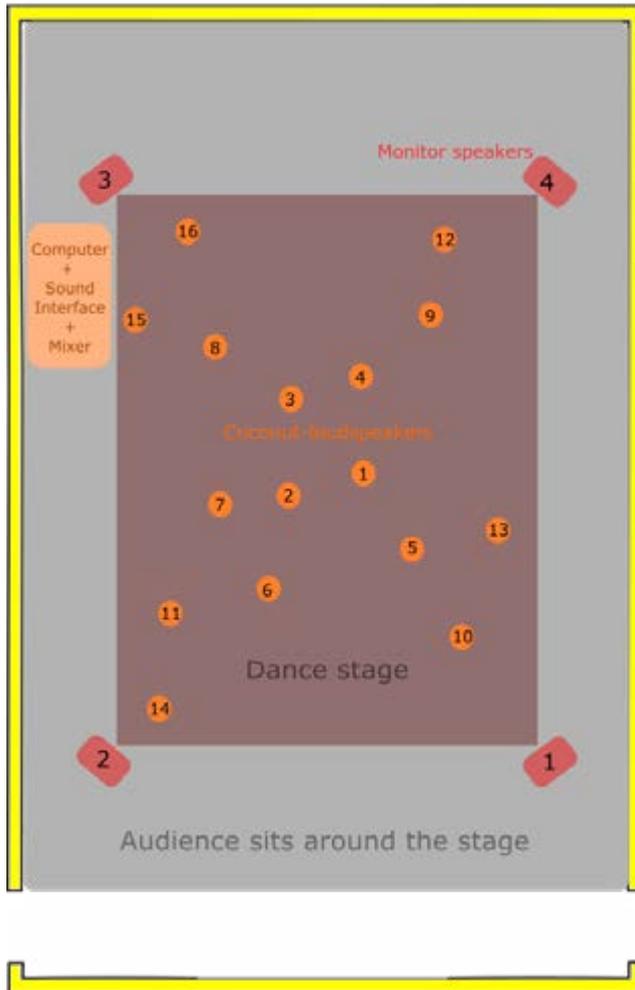


Figure 2: Half Full – Installation Plan Black Box

the same time some speakers directed at the dancers, others towards the public, and perhaps others towards some surface that could add interesting acoustic reflections. In addition, it was safe and easy to hang the small speakers in different places at each performance location. If the location did not allow me to hang them from the ceiling, I could also put them on the floor near the audience and the dancers.

Every time we entered a new performance venue into the calendar, I tried to visit it beforehand, or tried to find out as much as possible about its characteristics, size, materials, and surroundings. After this investigation I planned and implemented new spatial dispositions of the sound material and of the coconut-loudspeakers. In addition, when it was time for the sound check I also experimented with the space to find the ideal place for each coconut-loudspeaker. I learned that this was very important, because the speakers were not very powerful, but if they were placed in the correct location, they could work better to make the audience and the dancers listen to the sound composition. This process allowed me to apply and expand my knowledge in room acoustics and multi-speaker sound diffusion in a very practical way.

2.3.4 Sound composition

Audio-visual documentation of the performance at Black Box can be found in the following RC link:

<https://www.researchcatalogue.net/view/930674/952113/0/2100>

The choreographer wanted the duration of the piece to extend to forty-minutes, which she divided into four sections. Dividing the whole piece into four sections with different modes and energy helped me with the compositional process. In my own artistic practice, I am used to structuring the works in sections and then subdividing each section again into smaller parts. It is a natural process that has evolved from analysing and composing music. Having clear sections and cues also helps the dancers to situate themselves on the timeline of the piece. This also allows the use of specific sound material in one section and its development or recontextualization in another part of the piece.

Section one was the introduction, a movement with energy and rhythm. The name given by the choreographer was "Side by Side". The dancers moved next to each other throughout the whole section and had a relaxed feeling of happiness. The main sound materials were of two types, as in most of the piece. A jungle night field-recording from Nueva Alemania, Chiapas, in Mexico was mixed with a five-voice synthesizer counterpoint with rhythmical and staccato sequences. The rhythm of the crickets and the night went side-by-side, and the singing of all those multiple little insects created that beautiful and characteristic soundscape that Schafer called a keynote sound (Schafer, 1977). The crickets' sound is used as an archetypal sign of warm weather, as it is so deeply imprinted on the people listening.

The second section had the main intention of being energetic and transmitting that energy to the public. It had a slow and soft beginning, but the instruction was to make it grow until its end, when it should get "crazy". The name we used for it was "energy tennis". The section was meant to transmit a playful and exciting feeling. The dancers separated from each other at the sign of a sound cue and started playing tennis with a metaphoric energy ball. In this case I used two morning soundscapes, one from Valle de Guadalupe and other from San Pedro Martir in Baja California North, Mexico. I combined these soundscapes with another synthesizer counterpoint. In this section I tried to play with the rhythm and the timbre of the different voices, with the intention to create a feeling of playfulness and being rushed.

The third section's name and metaphoric idea was "skin contact". The choreographers direction was to have a sweet, playful, tender, and amorous feeling. The dance movement was soft and slow, like in a sleepy mood. The dancers were literally in skin contact all throughout the section. I chose to start after a long silence with sound material not used before in the piece. I recorded some bodily caresses and breathing sounds, trying to produce material with a soft feeling and rhythm inspired by the dancer's movement. After two-minutes of these human sounds, I changed to a soft sequence where I slowly introduced seven synth voices. These melodic and rhythmic patterns faded in and out with timbrical transformations but kept up the general tempo and mood of like being in a dream. I also added wind sounds

to the polyrhythmic synthesizer sound sequences in addition to the skin and breathing sounds; they all were some kind of filtered noise material.

Finally, the last section was the electroacoustic samba. The name we used was “unisono”, and the direction from the choreographer was to have a festive feeling, of people celebrating something together. She also suggested the samba idea, and I decided to take her up on the challenge. I based the section on a samba batucada rhythm I found called *samba enredo*. I recorded the Helsinki-based batucada percussionist Markus Jaatinen on his original batucada drums. Then I combined the acoustic patterns with synthesizer patterns triggered by following the amplitude envelope of the acoustic percussion tracks. The section starts from silence with a field recording of a festival in Tecate city in the north of Mexico. People laugh, and shouts and voices are combined with a soft batucada acoustic sound material. I tried to create the feeling that the music was an original, in-the-field recording, and slowly started approaching the listener, becoming louder and louder until it got out of the picture, and it took up its own space and volume. The desired form was clear for the choreographer; it had to grow until a maximum climax, with two short breaks in between and a fast decay with a short release at the end, where I left the Tecate field recording on for a few seconds more.

In the multichannel versions of the piece, I spatialized each synthesizer’s voice and field recording individually. One approach was “pointillistic”, where I chose specific speakers for each voice (synths, field recordings, effects) so that the counterpoint obtained a spatial dimension. I liked this technique for the rhythmical parts in particular since it made it possible to hear each voice more clearly and as individual characters. I also moved some of the sound material through different loudspeakers, and this especially worked well with the wind, skin caresses, and long synth sounds.

2.3.5 Black Box Presentation

After 20 public presentations in very different locations - theatres, sports halls, forest, libraries, outdoors public spaces, schools, playgrounds, and digitally streamed live - *Half Full* was performed at the Black Box,

Musiikkitalo on 28.03.2017 as part of my artistic doctoral examination. The system with the hanging coconut-loudspeaker was originally conceived for this space. The metallic grid in the Black Box ceiling had given me the idea of hanging the small passive coconut-loudspeakers from their own speaker cables. The stage reserved for the dancers was in the centre of the hall, and the audience was placed around it. I decided to install the sixteen coconut-loudspeakers floating above the dancers, filling up the entire area. The sixteen-channel amplifier was installed at the centre of the grid and the sixteen coconut-loudspeakers were all directly attached to it and hanging from their yellow, cloth-covered wires. I organized the cables and speakers like plants or tree branches, upon which the fruits hung. In addition, the coconut-loudspeakers were placed at different heights and facing different directions. I divided the sixteen coconut-loudspeakers into four sections; each group had the speakers directed to one side of the stage to cover all of the audience. I also had a pair of stereo PA on the sides of the public space to reinforce the coconut-loudspeakers' power. There were two reasons for doing this: firstly, I wanted to spatialize and listen to the music like a "constellation of voices" above the heads of the performers; secondly, I wanted to give the audience a feeling of sound distance and spatial location without disturbing the visual focus. By doing this, I could test out whether the multichannel system improves the listener experience from the perspective of both the dancers and of the public.²⁴

2.4 Performances

At the end of the project, we had carried out twenty-five public presentations in Finland from 2016 to beginning 2017.

The date and place of the public presentations are:

21.4.2016 school, private

22.4.2016 at 17 Kirjasto 10

26.4.2016 at 18 Asematila

²⁴ <https://www.researchcatalogue.net/view/930674/952113/0/4150>

27.4.2016 Artlab Productions / Kasi
28.4.2016 MLL Perhekahvila
29.4.2016 at 14 Arena Center Myllypuro sählykenttä (indoor floorball field)
2.5.2016 at 12 Esplanadin puisto
3.5.2016 at 12 Keskuspuisto, outdoors next to the basketball court
4.5.2016 private
11.5.2016 at 12 Kaapelitehdas yard
12.5.2016 school, private
14.5.2016 experimental music festival
8.2.2017 at 13 Kisahalli
16.2.2017 at 13 Finland Tennis Club
16.2.2017 Periscope
23.3.2017 University of the Arts Helsinki (private)
24.3.2017 at 12 Circus Helsinki
28.3.2017 at 19 Musiikkitalo, Black Box
29.4.2017 at 16 Kansalaistori
29.5.2017 Ballet School, Finnish National Opera (private)
10.8.2017 at 17 Plagen Hanko
11.8.2017 at 14.30 Billnäs Ruukki
12.8.2017 at 13.20 Lohja tori, Lohjan kesä tanssii Festival
12.8.2017 at 17 Lohja Prisma, Lohjan kesä tanssii Festival

2.5 Conclusions

Half Full is a contemporary dance performance developed by the choreographer Satu Tuomisto for which I made a sound composition-installation. Diluting the borders between dance performance, sound composition, and sound installations helped to reconfigure their techno-social aspects on three interlaced levels: the artwork, the spectator, and the performers. On the level of the artwork, apart from the fact that the choreographic work was intended to bring contemporary dance to all kind of places and took its final form during the rehearsals and the multiple presentations, the sound composition-installation made for it was a hybrid form that recombined its techniques and its spatial-temporal dimensions. For the spectator, the techno-social reconfiguration happened in the ways that they approached, experienced, and interpreted the project. It

is not the same to attend to a dance performance on a frontal stage with a stereo sound system on the sides than to experience the show in your working place with multiple coconut-loudspeakers all around. Finally, for the performers, the reconfiguration happened in the multiple different locations that the work was presented, and in how they listened to the music, for example as a sound constellation above them.

One challenge of this project was the diversity of spaces where it had to be performed. By looking at the electroacoustic medium as a mouldable techno-social network, the case-specific instrument had to adapt, taking into account the predefined idea of the place and a very quick estimation of the location's acoustics. We did 25 presentations in total, through which I gained experience and knowledge regarding room acoustics and sound amplification. Each individual coconut-loudspeaker is not very powerful, but adding to them gives better results, and the possibility of spreading them out within the space and in accordance with its acoustic characteristics can reinforce their efficiency.

Moreover, in the Black Box presentation, one of the challenges I faced regarding the position of the coconut-loudspeakers above the central dancing area was that the audience was divided into four sections arranged around it. Placing the coconut-loudspeakers above the dancer gave the best immersive experience to the dancers. The decision of directing four coconut-loudspeakers and two PA speakers to each side of the audience gave a different perception to the public. For them, the constellation of voices or coconut-loudspeakers above the dancers fitted well into their perspective. This added sound distance and localization without creating a visual-sound decorrelation.

The sculptural and scenographic aspect of the coconut-loudspeakers, with their yellow cables hanging above the dancers, was well received by the jury and the public. Visually and conceptually, the sound composition-installation fitted the choreographic theme of "happiness". The coconut-loudspeakers are not imposing, heavy elements of sound gear - they invite people to get closer and listen to them. This validates my need

to consider the electroacoustic medium as a creative assemblage of ideas-techniques-aesthetics, where the aspects of a case-specific electroacoustic system can be developed according to the artist intention, necessity, and choices.

To conclude this chapter, I would like to mention that another challenging part in this project was to make “happy” electroacoustic music. Perhaps this is a very subjective area, but what is “happy music”? By going through the process of providing examples to the choreographer, it turns out that many of them were interpreted as scary, sad, weird, or interesting, but not very uplifting. The collaborative process brings challenges in communication with the choreographer, especially if they are not familiar with the particularities of acousmatic music and electroacoustic music in general. In this project I found myself following paths that perhaps I will not try again. I am not particularly interested in reappropriating traditional Latin-American music and turning it into an electroacoustic mix. However, I considered it an interesting experiment, and I learned much about samba and batucada. Finally, I just want to mention that I was very surprised at how the audience reacted to the soundscape materials, in particular to the field recording of the last section with the festival in Tecate city. The sound of people laughing, shouting, and talking, with its authentic positive emotions, did bring out similar feelings in the listeners.



3. Superguitar_03 (2017)

10 - *Superguitar_03. Photo by Jaime Culebro.*

11 - *Superguitar_03. Photo by Jaime Culebro.*



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below:

<https://www.researchcatalogue.net/view/930674/952132>

3.1 Introduction

Superguitar_03 is the third project of the artistic component of my doctoral degree. It is a sound composition-installation-sculpture that studies the possibilities of adapting a traditional instrument to our contemporary world, dislocating it from its old mode of existence. It is part of a series of acoustic guitars that I have augmented, performed on, and composed with since 2009. I do believe in the notion that art can influence society by allowing us to imagine other possible ways of being (Greene, 1995; Albers, 1999; Mancini, 2004). These guitars question the interpretation of a traditional object, in this case a sonic object, through a reconfiguration and expansion of its aesthetical and technical resources.

The sound composition-installation-sculpture electroacoustic system is configured by four hanging acoustic guitars with sixteen structure-borne transducers attached to their bodies and strings, a quadrasonic sound system located around them, a multichannel amplifier and playback device, and a trigger button. A precomposed multichannel piece of twelve-minutes is played through all the speakers. There is no real performer; the idea is that the public starts the piece by pushing a button next to the sound composition-installation-sculpture and then experiences it from a flexible listening point. When the sound composition ends, the installation stops playing until someone else starts it again. *Superguitar_03* aims to find new listening environments that enhance audience experience by exploring encounters between sound installation, live electronics, sound sculpture, and electroacoustic music.

3.2 Context

As mentioned in the introduction to this thesis, my musical practice started with learning to play the acoustic guitar. This particular instrument is very popular in Mexico, where I grew up, and in Latin America in general. There are many people playing it, and it has a very rich original Latin-American repertoire. In Mexico there are towns and places, like Paracho in Michoacan, that are famous for their guitar builders and

festivals. There are several reasons for the popularity of the guitar: the ease with which it can be learned, its portability, its capability as an accompanying instrument, its ability to provide rhythm, the affordability of the instrument, and that it can fit any personality imaginable (Egbert, 1967). I consider the Superguitar series a personal project, and its name comes from my feeling for these instruments as my superhero. These superguitars have guided my musical path and have been a laboratory for sonic experimentation and research. The Superguitar series provides clear answers to my questions as a musician and sound artist.

The other two previous works in this series are Superguitar_01 and Superguitar_02.²⁵ The first was located in the realm of augmented instruments, defined as “a network of sound production and processing units, spatially extended and configurable by the player according to the desired sonic results” (Lähdeoja *et al.*, 2010, p. 37). It is composed of a table guitar, MIDI controllers, contact microphones, and a computer. The performer plays the guitar that is laying on a table, and uses MIDI devices to control the real-time manipulation of the acoustic sounds processed in a purpose-made software-patch made in Max. I performed with this augmented acoustic guitar in improvisation ensembles and in the Coco Duro Duo together with Alejandro Olarte.²⁶

The second case is a robotically augmented acoustic guitar for shared control. The superguitar_02 project represents my own exploration into robotic musicianship, incorporating elements of musical mechatronics and machine musicianship (Bretan and Weinberg, 2016). The instrument utilizes three DC motors with propellers that vibrate the guitar’s strings, a contact microphone to capture and process its sound in real-time, and a built-in ambisonics sound system with piezo elements and one structure-borne transducer attached to its body. Conceptually, it can be situated between the Robotically Augmented Electric Guitar by Ogata and Weinberg (Ogata and Weinberg, 2017) and the GuitarBot by LEMUR (Singer, Larke and Bianciardi, 2003). The DC motors’ velocity, real-time sound

²⁵ <https://www.researchcatalogue.net/view/930674/952132/0/7000>

²⁶ <https://vimeo.com/12892640>

manipulations, and sound spatialization can either be performed live with MIDI controllers or through a pre-programmed sequence, or with a combination of both. It is possible to either trigger the DC motors briefly, vibrating the strings in a similar way as plucking the strings with the fingers, or to rotate the DC motors continually, creating drone sounds with a rich overtone structure. I used this instrument in group improvisations, and I also composed a piece for it.

Superguitar_03 goes beyond the live performance of an augmented instrument. Four guitars are augmented, composed for, and installed in a particular way, configuring the case-specific electroacoustic system. The project is situated between the areas of sound composition, sound sculpture, and sound installation. Working between these three fields opened my imagination to other possible ways to interpret the guitar's identity and to work with sound.

“The eye and ear traversed the space as a merged experience. Time and space relationships concerning the context of the object informs the object's identity. The object's presence is expanded through the fourth dimension, time, with the sound articulating many points and expanding the nature of the sensory experience.” (Bandt, 2001, p. 53)

This quote from Ros Brant aptly illustrates the concept of sound sculpture. The four guitars with the structure-borne transducers and their cables are the object, which becomes articulated in time through the sound composition. Moreover, the sound installation, a term coined by the sound artist Max Neuhaus (Seiffarth, 2012), takes place into account, establishing a dialogue with the surrounding space (Rocha, 2004). The addition of a quadraphonic sound system located around the sound sculpture, playing a field recording from Tijuana, Mexico, aimed to bring both the real space and my personal space into consideration, inviting the listener to shift their perspective to a different point of view.

Inspired by the work of Rolf Julius, who combined speaker elements playing 'small sounds' with sculptural objects, graphics, or performative forms (Balit, Scriba and Zeitz, 2020), the connection between sound and the

visual aspects of the *Superguitar_03* are more poetic than musical. In this case, I did not use pre-recorded guitar sound material, nor did I make use of mechanics that play conventional guitar sounds. Instead, I fed structure-borne transducers with analogue synthesizer sound material that excites and resonates the guitar's body. Although there is a synesthetic connection between the physical objects and the acoustic field, my intention was to establish the relationship on a poetic, metaphorical, and imaginative level that can only exist in the mind of the audience.

Going further in this contextualisation of *Superguitar_03*, the 2011 work of Janet Cardiff and George Bures Miller, the Killing Machine, needs mentioning. In their work, the audience has the choice to start the machine by pushing a big red button that glows in the dark. This agency given to the audience is combined with an empty chair to “suggest that this work is about the audience and the relationship that the audience has to their combined role as torturer and spectator” (Kappel Blegvad and Cardiff, 2014, p. 51). Moreover, after starting the Killing Machine, the spectators can walk around the installation work, looking and listening to it from different positions, allowing them to decide how to experience the work. Inspired by this installation piece, I wanted to add the element of spectator agency to *Superguitar_03*. As the guitar quartet does not have real performers, the spectator is the performer; at a minimum someone needs to push the button next to the four guitars in order to start the piece. And once the performance starts, they can get as close as possible to the sounding objects, discovering all the parts of the clustered multichannel sound sources, or observe them from far away, as a mass of sound.

3.3 Project description

The artistic research activities and the development of the project was carried out during 2016. The Black Box in the Helsinki music centre was reserved to present the project, using it this time as a gallery-type space.

The intentions of the project were:

- To create a piece situated between sound installation and sound sculpture without being site-specific.

- There would neither be a real performer, nor a generative sequence that is continually playing.
- The sound composition should instead have a formal structure in the music domain, with a fixed duration and clear structure.
- The audience starts the piece and is able to experience it by moving around it.

3.3.1 Sound sculpture

The first question that arose from the project concerned the augmentation of the instrument. One option was to physically expand or explode the body of the guitar, but it became clear that this was rather difficult to do in the time frame available, and with my wood-working abilities. After exploring different ideas, and inspired by Picasso's *Guitar of 1912*, a sculpture that "instantiates the new processes of construction and assemblage as opposed to traditional techniques of carving or modeling solid masses" (Poggi, 2012, p. 274), I started creating a guitar assemblage combining the bodies of four second-hand acoustic guitars. By suspending the guitars on nylon twine, they could float in space in different ways. Furthermore, by combining the four of them, I created a visual composition that still retained the original instruments with their resonance box, neck, and the strings attached to it, but with a shift that expands and supersedes the traditional idea of the guitar.²⁷

In order to play with the guitars sonically, I started from the *Superguitar_02* case and a comment made by a member of the audience at the concert where it was presented in Weimar, Germany. This person was surprised by the pre-recorded field recordings played back through the structure-borne transducer located behind the guitar's body. The body encapsulated the field recording, adding some resonances and filtering the sound in a particular way.

²⁷ <https://www.researchcatalogue.net/view/930674/952132/0/3300>

Because one of the general motivations of these guitar series is to break the traditional idea of the object, this unexpected sound material emanating from the guitars was appealing to me. I started to explore the possibilities with multiple structure-borne transducers placed in different parts of the guitars, playing field recordings and analogue synthesiser sounds. After several experiments, the decision to use only the analogue synthesiser as sound source for the sound sculpture was taken. With this sound material it was possible to vibrate the body and the strings, bringing out sounds either close to the traditional guitar sound or to the analogue synthesiser, which were different and unexpected. Moreover, by playing analogue waveforms with specific frequencies it was possible to vibrate the strings with sympathetic resonances, adding particular overtones that enriched the timbre of the instrument. This technique creates a visual effect that surprises the listeners and draws them closer to the guitars.

After this sonic exploration, I arrived at the decision to mount four structure-borne transducers of different sizes in different places on each guitar.²⁸ I used a structure-borne transducer with a low frequency response²⁹ at the bottom of the guitars' body, one transducer with full range frequency response³⁰ at the top of the guitars' body, and two small structure-borne transducers with high frequency response³¹ above the strings of the guitars. All these transducers together formed the *clustered multichannel sound system*, which allowed the listener to sonically localize each independent sound emanating from the guitar sound sculpture.

Finally, I used a transparent speaker cable with silver and copper color wires to connect all the structure-borne transducers to the multichannel amplifier. The cables are considered part of the sound sculpture since they are visually important, and they are the carriers of the electric current of the sound composition that feed the transducers.

²⁸ <https://www.researchcatalogue.net/view/930674/952132/0/4200>

²⁹ Fischer-Amps, Bass Pump III.

³⁰ Tectonic, TEAX32C30-4/B.

³¹ Tectonic, TEAX13C02-8RH.



12 - Superguitar_03's installation at the Black Box. Photo by Jaime Culebro.

13 - Superguitar_03's installation at the Black Box. Photo by Jaime Culebro.

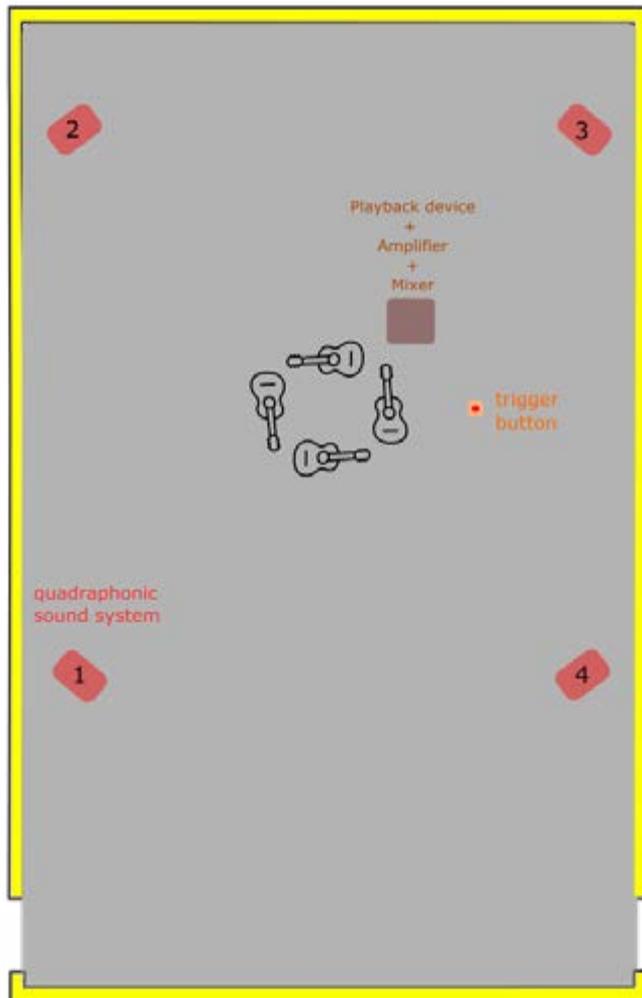


Figure 3: Superguitar_03 – Installation Plan Black Box

3.3.2 Sound installation

The four guitars suspended in the air in a square formation, together with the clustered multichannel sound system, formed the sound sculpture. The listener could move around the piece, and modify the sound spatialization through their own trajectory, creating a flexible listening place. The height of the guitars and their horizontal placement let the audience come close, allowing them to be in the intimate space of the guitars, as a normal guitar performer would, and to listen from up close to the sound sources.

Through the quadraphonic sound system placed in the corners of the space, a field recording from Tijuana, Mexico was played that contextualized the piece, connecting to my personal relationship with the instrument. The field-recording is from a sound walk through Independencia street, where musicians play different kinds of music on each corner and where it is possible to distinguish guitar sounds. The volume of the quadraphonic sound system is very low, almost imperceptible, because I also wanted the audience to move away from the four guitars, to explore the space and the sound that was present at the periphery. This would change the perception of the guitars' sound sculpture, by listening from a distance and at different angles.

The trigger button, the multichannel amplifier, and the multitrack player were located two meters away from the four hanging guitars. The start button was mounted on a small wooden box that was on a microphone stand, at one meter height. The rest of the equipment was kept in a closed black flight case, so it was not possible to see what was inside.

The light-design of the installation served to enhance the sonic experience. The four guitars were lit from underneath and from above, to illuminate the speaker cables and the guitar bodies. In particular, the transparent speaker cable with its silver and copper wire reflected the light in a way that made the sound sculpture resemble a campfire for the audience to move around. The trigger button that was used to start the sound composition was lit from above with a spotlight, with the intention of inviting the audience to

push it. Everything else around the space was in almost complete darkness, creating a comfortable and intimate space at the centre of the exhibition space.

3.3.3 Sound composition

Full video documentation can be found at the following RC link:

<https://www.researchcatalogue.net/view/930674/952132/0/2300>

As mentioned before, one of the goals in making this piece was to explore the poetic, the metaphorical, and the imaginative aspects offered by a clustered multichannel sound system and the sound material emanating from it. The twenty-channel sound sequence is composed of four sections and lasts twelve-minutes. It added the fourth dimension to the sound sculpture: time. I specifically wanted to create a sound sequence that has a clear structure, and once triggered by the audience autonomously stops after its ending. This gave some agency to the listener, and from the outset created a surprise by responding to the triggering action with a first strong tapping sound from inside the guitar's body.

The first section has a slow tempo and is composed of strong tapping sounds with time between them. This material does not come from a pre-recorded human tapping of a real acoustic guitar, but rather from square wave forms at very low frequency produced by an analogue oscillator. This sound signal produces an abrupt movement of the transducer's coil, which hits the body or the strings. As a counterpoint to the strong tapping sounds there are multiple soft click sounds that increase and decrease in dynamics, like soft echoes of the taps. These two materials enter into a dialogue and are articulated as action and reaction. The third material is more continuous and feels like the hands of a ghost performer touching the tuning pegs and the guitar's body. The final material of this section is a bass sound with a constant gentle rhythm that starts in the middle of the section and accompanies the punctual sounds that are spatialized through the four guitars. This section is probably the one that I can best associate with a real acoustic guitar performance, however the sounds reveal a certain uncanniness, as they cannot be the result of actual human fingertips.

The following second section generates contrasts with drone-type sounds. It introduces the sympathetic resonances of the guitar strings, which are created with specific frequencies that are related to the string tones. To create this effect, each guitar string had to be tuned to specific frequencies related to the analogue synthesizer waveform. The drones are played across all sixteen structure-borne transducers and are made of different synthesizer waveforms. They increase and decrease in amplitude, reaching the point where they manage to make the strings vibrate, in an interplay between natural and artificially added overtones, what I would call *two modes of sonic translation*. The association with the traditional guitar sound is broken in this section, as a human performer could not physically produce this kind of sound with the instrument. The section concludes with a strong tapping sound and a short silence after it.

In the third movement, the sound composition returns to the tapping sounds, but this time some interplay is added between these staccato sounds and different filtered noise sounds that emanate from the guitars' fingerboard, almost as if the fingers of a real performer would be making noises after tapping the strings. The sound material feels like the hands of the ghost performers touching the tuning pegs as well as the guitar's body, or like some minute creature living and walking inside the guitar's body. The climax of the sound composition arrives at a later moment of this section and consists of a bass sound in slow rhythm that increases in amplitude and dynamics and starts to get longer in envelope. After some time, the lower E string of one guitar is excited to such an extent by the bass pump transducer that it absorbs all of the visual and auditory attention. This section ends again with an abrupt cut, after which the field recording can again be clearly perceived from the periphonic quadraphonic system.

The fourth moment starts slowly and quietly. The click sounds of the beginning are used again, but now begin to multiply and are distributed spatially across the whole clustered multichannel sound system. This multiplication reaches such an extent that the sound resembles granular material emanating from the entire clustered multichannel sound system. The sound composition ends with a strong tapping sound that renders the resonance of one of the guitar's bodies audible again.

3.4 Public presentation

The public presentation of the project took place in December 2017 in the Black Box of Musiikkitalo, Helsinki. The sound composition-installation-sculpture piece was opened to the public for two days, eight hours each day. The sound sculpture in the middle of the empty hall and the guitars were hanging with nylon wires from a metal grid in the ceiling. Everything apart from the sound sculpture and the trigger button was almost in darkness. The intention was that the audience would enter the hall with the composition-installation-sculpture silent, and first observe the situation from afar. There were no instructions or signs that indicated that one should push the button, because I thought that it would be obvious just by lighting it. The quadrasonic sound system was placed close to the side walls of the hall, at equal distance from the centre of the sound sculpture. A very soft light filling the entire hall allowed the audience to move safely.

3.5 Conclusions

The Superguitar series has as a main conceptual idea the reinterpretation of a traditional musical instrument, adapting it to our contemporary world and dislocating it from its old mode of existence. They make use of the electroacoustic medium to reconfigure and expand the ideas-techniques-aesthetics behind a classical acoustic guitar. With this new iteration of the Superguitar series, I was able to explore, learn, and understand new aspect of my artistic practice. *Superguitar_03* dissolved the borders between sound composition, sound installation, and sound sculpture and merged them into one sound composition-installation-sculpture, reconfiguring its techno-social aspects on two interweaving levels: the artwork and the spectator.

In *Superguitar_03* the electroacoustic medium became a creative assemblage of ideas-techniques-aesthetics that were configured in a particular way to express my intention, necessity, and choices. In this particular case, the creative assemblage of ideas-techniques-aesthetics encompassed four aspects:

- The composition of the sounding object itself.

- The spatial disposition of a network of sound production and processing units.
- The temporal dimension of the sonic material.
- The listener's experience.

The creative assemblage of ideas-techniques-aesthetics form what I call the case-specific electroacoustic system, confirming to me that this way of working is a very fruitful place for my imagination and conceptualization of ideas, which allowed me to express myself better. At the same time, I was able to situate this practice in our contemporary world by taking an interdisciplinary approach. Moreover, I have been able to use the movement of the audience in the space, their expectations and the agency given to them, as creative parameters, thus expanding the traditional approach of mere sound organisation into composing an entire experience for the audience. This expanded creative process exemplifies how the electroacoustic medium can be perceived as a mouldable techno-social network that can take on different shapes and interconnect in multiples ways according to any specific idea, situation, or intention.

Another subject that became an important part of the *Superguitar_03* project is what can be called the *two modes of sonic translation*, which is relevant to my overall artistic research. An acoustic guitar is mainly formed from an acoustic wooden body and the strings attached to it. By adding structure-borne transducers with waveforms produced by analogue electronic oscillators to this system, it is possible to create two effects, depending on their frequency and amplitude. At lower frequencies, for example below 20Hz, the strings could start to vibrate by themselves without anybody physically playing them. It is then possible to perceive sounds close to the guitar's original timbre, but with some added overtones. By increasing the frequency of the analogue electronic oscillator, the synthesizer sound starts to be audible, but not in the same way as when using air-borne transducers (i.e., loudspeakers), which would attempt to reproduce the electronic sound as linearly as possible. In this configuration the electronic sound starts to be modified by the guitar's strings vibration, materials, and acoustics. Working in this way exemplifies that establishing a feedback process between

sound composition and electroacoustic system composition can bring out particular sonorities and dispositions of materials, apart from enriching my art practice with another set of creative decisions and approaches.

Finally, with this project I was able to better define and confirm the use of what I call the *clustered multichannel sound systems*. This way of working with a multiple number of sound sources allows the listener to have at least two different sonic perspectives. One close to the sound sources, listening to all of the independent sonic constellations, and one from far away, where all the different parts become more diffuse and create a sonic amalgam.



4. Lap-dog Machines: Pre.sa.uro (2019)

14 - *Lap-dog Machines/Ahmed Kakoyi. Photo by Jaime Culebro.*

15 - *Lap-dog Machines/Juan de Dios Magdaleno and Petra Poutanen.*

Photo by Jaime Culebro.



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below:

<https://www.researchcatalogue.net/view/930674/952133>

4.1 Introduction

Lap-dog Machines: Pre.sa.uro is a sonic-literary performance intended to explore translation processes through technology. Three electroacoustic systems – “Lap-dog machines” – were especially developed to electrify and transform voice and text in real time. The sonic-literary machines aim to build a bridge between technology and the performer, using pre-recorded text, voice improvisation, singing, recitation, real-time sound transformation, electronically generated sounds, and sound spatialisation.

Pre-sa-uro is an invented term based on a concrete poem by Augusto de Campos (*Viva vaia*, 1979) that combines the Portuguese and Spanish words for Present, Past, and Future. At the public presentation, the multichannel sound composition-performance-installation and the architectural space blended together in a sonic-literary experience where the audience inhabits a non-conventional concert setup.

The lap-dog machines are three electroacoustic systems composed by a complex network of sound devices that have been studied, collected, and chosen carefully to compose each sonic-literary machine. Vocoders, oscillators, cross-modulation effects, auto-tuners, VCAs, LFOs, random generators, filters, delays, sequencers, Max patches, controllers, mixers, microphones, and speakers are connected and controlled in a specific way. Together they form a hyperinstrument, musically intelligent, interactive performance and creativity systems (Machover, 1989), or what I prefer to call a case-specific electroacoustic system, in order to expand the concept to sound installations and spatial compositions. Altogether, this network was specially configured to interact with singing and the spoken voice.

4.2 Context

The idea of Lap-dog arose in 2007, when I created my first lap-dog sound object-instrument, which had as its main concept the idea of creating a metaphor of digital sound: something continuous becomes discontinuous

and then continuous again. The sound object-instrument interacted with the human voice and worked particularly well with whistling sounds. The Lap-dog sonority was produced by six motors that used propellers to play fixed material attached adjacently, creating a pulsed and repetitive sound that changed depending on the amplitude and frequency of the voice signal. When the propeller moved at low velocity it was heard as a discontinuous pulse, but when the velocity increased the sound became increasingly continuous. In a way, one could say that the instrument worked as a translator, from human voice to machine voice. It was called Lap-dog because, in the end, the reaction of the sound object was so effusive and strident that it reminded one of a happy dog welcoming its owner, wagging its tail and shaking its whole body. In Mexico, the term lap dog (*perrito faldero*) has an extra meaning, perhaps not as positive as the dog itself. It signifies a person who is extremely servile to another person, out of either submission, affection, or interest.

Regarding the literature project *Mutanttikieltä* (Mutant Language), to which the *Lap-dog Machines: Pre.sa.uro* project is connected, Daniel Malpica wrote the following in the program notes of the concert:

“Mutanttikieltä is a project that aims to explore the relation and implications between literature, translation processes and transdiscipline through the development of hybrid productions involving authors, designers, sound artists and researchers; questioning how language mutates in relation to different mediums and expositions. Created in 2018 and financed by Kone Foundation that same year Mutanttikieltä project has also explored the case of transnational language literature in Finland throughout art collaborations, concept design and curatorial practices in the form of multimedia literature events, published discussions, seminars, and networking group sessions.”³²

³² *Lap-dog Machines: Pre.sa.uro*, Black Box presentation’s program notes.

4.2.1 Artistic References

There is a long tradition in the intersection of human voice and sonic arts, from sound poetry, radiophonic composition, acousmatic composition, voice, and live electronics to sound installation and sound performance. An example in this area is the work of composer Manuel Rocha Iturbide, *Pocos Cocodrilos Locos*, from 1998 (Jasso and Usabiaga, 2012). It is a sonic reconstruction of a concrete poem with the same name of an unknown Mexican poet from the 1930's, which Mathias Goeritz made into a mural in Mexico City in 1967 (Rocha, 2020). Rocha's sound poetry piece uses the formal technique of theme and variation and starts with the presentation of the original poem read by the actor Diego Jáuregui. After introducing the original poem at the centre of the stereo image, the second variation uses the poem with a new organisation of the words, shifting their position between left and right. The third and last variation opens up the poem to three polyphonic voices with the rhythmical use of short loops of words; one of them moves between the right and left channel while the other two stay at the left and right, respectively.

In the domain of radiophonic composition, Sarah Boothroyd's piece *All In Time* is a beautiful "mix of archival audio, field recordings and vocal material [that] illustrates several time machines: the clock as machine for measuring time; language as a machine for conceiving of time; and the mind as a machine for travelling across time – backwards through memory and forward through imagination" (Boothroyd *All In Time* [CD], 2011). The piece of the Canadian sound artist was inspired by H. G. Wells' novella *The Time Machine* from 1895 and takes the listener on a sonic journey through science and science fiction. During the piece, voice and text are used to denote literal sound references, for example when the word 'doors' is presented, sounds of opening doors are introduced. Another approach is the use of voice and text to inspire sonic images or scenes, like when the narrator voice says, "You can only see the past as a movie" and an old video recording of a birthday party with people singing the "happy birthday song" is introduced. In addition, the use of voice and text related to time in physics, philosophy, and poetry inspired the composer's sound sequences both rhythmically and

melodically, as well as spatially. As an example of this last concept, when the narrator is talking in the final part of the piece about the fact that time travel is irrelevant because it is an illusion, the composer introduces a rhythmic sonic collage including slices of much of the sound material presented over the whole piece. Finally, throughout the piece there is a continued playing with doubling the narration voice, originally from professor of physics Peter Watson, with the voice of a child and a mature female, which can be seen as another metaphor of time, in this case the human lifetime.

Works such the *Encounters in the Republic of Heaven* by Trevor Wishart are a good example of the area of acousmatic composition, using the human voice as the main sound material. In that work, Wishart recorded stories of fishermen, farmers, and city-dwellers in the northeast of England, “as each story subsides, we encounter a sea of human voices organised in unusual ways - speech that waltzes, speech that harmonises, clouds of speech that circle the audience. In the finale of each movement, the colours of the voices are developed purely musically, culminating with speech transforming into song”.³³

Janet Cardiff’s sound installation *The Forty Part Motet* is a reinterpretation of Thomas Tallis’ moving choir piece entitled *Spem in alium nunquam habui* (I have never put my hope in any other) from 1573. The recording of each of the forty individual choir voices from the original renaissance score is played from one of forty independent speakers. The speakers were located on stands and placed in an oval shape on the floor to allow the listeners to either position themselves in a fixed place or move around freely among the voices. Moreover, Cardiff’s piece does not just play back Tallis’ piece in a loop; there is a section at the end where it is possible to listen to the singers chatting together, whispering, and even laughing, giving a personality to each of the loudspeakers. Finally, at a certain point of the song, the choir director makes an abrupt interruption, “it constitutes a small tear, a sublime element of human error in an otherwise harmonious and perfect piece of music” (Kappel Blegvad and Cardiff, 2014, p. 53).

³³ From the concert’s program notes. Acousmatica V: Trevor Wishart – Encounters in the Republic of Heaven. Helsinki Music Centre, Black Box, September 24, 2012.

4.2.2 The author's previous works involving voice

In my own personal work, there are also sound projects that have a relation to the human voice, with a special interest in multilingual context. *CorresponTrans*, from 2013, is a “radiophonic piece about love correspondence. Correspondence is seen as the connection between two people that share a special feeling and express it by writing to each other. During the piece there are three love stories that interlace in space and time. The voices of the lovers create interrelated sets of situations and characters that form a multi-narrative sound-drama. There is a Japanese story inspired by the tale called *Double Suicide* of Yasunari Kawabata. A second one evokes different historical love correspondences of the French culture (De Beauvoir, Sartre, Stendhal and D’Eulalie). And the final story is a contemporary romance from the globalized world about a summer encounter between two people from different nationalities. This work tries to explore the sonic qualities and images, and the particular atmosphere and feelings that surround these love correspondences, rather than narrating the stories literally. Voices and synth sounds were recorded at La Muse en Circuit Studios (Paris, France).” (Montes de Oca *CorresponTrans* [CD], 2013)

Do you understand me? from 2008, is a piece involving spoken voices, live electronics, and a multichannel sound system. The live electronics part is a custom-made Max patch that captures the voice of each performer with an individual microphone and then processes them with granular synthesis techniques based on the granular synthesis tool kit by Nathan Wolek (Wolek, 2003). The composition is a guided improvisation for five performers speaking different languages and one live electronics performer. Its main instruction is for the spoken voices to choose a text, in their own language - this could be their own work, or a quotation from somebody else - that they would like to share in a public reading, out loud on stage. The live electronics performer is instructed to start from no process at all to extreme sound process in six to seven-minutes, *ad libitum*. The piece is a cacophony of voices that becomes a sea of electronics voices surrounding the audience. It is about listening, understanding, and empathy.



16 - *Lap-dog Machines/Montes, Malpica and Magdaleno. Photo by Jaime Culebro.*

17 - *Lap-dog Machines/Magdaleno, Kakoyi, Poutanen, Montes and Malpica.*

Photo by Jaime Culebro.

It poses a question to the globalised world, where people from different backgrounds meet and coexist. Do you understand me? Can I make myself become understood? What is formed from this sea of voices that coexist in our contemporary world?

Finally, *Cracked Voices* from 2009 is an electroacoustic piece for one actor, a tape-machine, and live electronics. It is based on the one-act play called *Krapp's Last Tape* by Samuel Beckett. This theatre piece is about a man called "Krapp" who has a sound diary where he saves his memories. During the performance he is going to record what is supposed to be his last recording, but as he starts listening to his memories, he starts a journey through time. While reading this beautiful play, I was fascinated by two things: the sound allusions and descriptions, as well as the temporal logic used by Beckett, moving forward and backwards in time. These ideas inspired a music composition of my own. The temporal logic used in the theatre piece was a starting point for me to explore different kinds of musical time concepts and musical form structures. The piece *Cracked Voices* does not attempt to represent the theatre play by Beckett, but rather tries to explore our sound world and our concepts of time. It is a journey through memories that, in this case, are sound memories. Apart from the tape-machine sound material, my own field recordings of spoken voices in Spanish, French, English, and German of kids, adults, and seniors represent the sound memories. The case-specific system involves a tape-machine that is performed as a musical instrument. It is a "magical machine" that is able to preserve sounds from the past and is confronted with its own sounds.

4.2.3 Narrative and multilinguist

As shown in some of the previous examples, literary context can create a space for sonic creations. In particular, acousmatic music can be a rich medium to explore on the narrative level.

"Where instrumental music, broadly speaking, accesses this narrative level primarily through the use of metaphor, acousmatic music, while maintaining access to the more programmatic elements found in instrumental music, also has the capacity to enact experience much more directly, through the explicit use and application of real-world

sound and motion. This ranges from the use of referential sound imagery, to a broader use of gesture and action enacted via acousmatic music's phenomenologically-grounded syntax". (Andean, 2014)

Moreover, multilinguistic works can play dual roles, depending on the listener's perspective. With some degree of understanding of the language this can be done on the narrative level, or when there is no understanding of the language, it can take the listener to a more abstract place.

4.3 Project description

4.3.1 Collaboration

Departing from the *Lap-dog* sound object-instrument of 2007, this new version of the project was originally conceptualized in my doctoral research plan as lap-machines, stand-alone electroacoustic instruments to be held in the lap, although meant to be played by the performers and to interact with their voices. After being contacted by Daniel Malpica in 2018 with a proposal to collaborate on a multimedia literature performance connected to his *Mutantikieltä* project, I decided to expand the lap-machines into three electroacoustic systems that could take the voice into different spatial dimensions. The three main factors that attracted me to this collaboration were:

- The use of voice as the main sound material
- The multilinguistic and multicultural context of the *Mutantikieltä* project
- The use of literature, and more specifically poetry, for the spoken and singing voices

The collaboration started with Malpica's suggestion to take inspiration from the "concrete style" poem *Pre-sa-uro* from Augusto de Campos (Campos, 1979). As mentioned before, the poem combines the Portuguese and Spanish words for Present, Past, and Future. I found the work of de Campos, and concrete poetry in general, fascinating because of how it uses the textual material visually, phonetically, and kinetically (Solt and Barnstone, 1980). It is also related to concrete music aesthetics, which "deliberately forgets every reference to

instrumental causes or pre-existing musical significations, seeking to devote entirely and exclusively to listening, to discover the instinctive paths that lead from purely ‘sonorous’ to the purely ‘musical’” (Schaeffer, 2004, p. 81). Moreover, the idea of combining in one word the three temporal aspects of present, past, and future relates very well to “the essence of time to be in process of self-production, and not to be; never, that is, to be completely constituted” (Merleau-Ponty, 1962, p. 482). This is why the name of each system is linked to a temporal dimension and a process of self-production. Finally, we used *Pre.sa.uro* as a script plan which, in the words of Malpica, is described as follows:

“Conceptually, the poems in the performance as such were thought to create a dialogue between the present, the past and the future. Each tense was written to match its assigned system by the usage of poetic collage (Vocoder Rupestre); a ‘combinatorial of text’ and mash-up based on Enrique Verástegui’s 90’s poetry scheme (Políglota Type Machine); and poetic prose, live translation into Swahili and vocal improvisation.” (Spatial Sampler)³⁴

The literary translations Spanish-Finnish, Spanish-English, and English-Spanish included in the performance were done by Taina Helkamo, Aurelio Meza, and Malpica respectively. The texts in their original language, and with their translations, can be viewed at this link:

<https://www.researchcatalogue.net/view/930674/952133/0/19800>

4.3.2 Three Lap-dog Machines

The result of this process was three *Lap-dog Machines*. The name given to each system refers to a specific technique and is connected to a specific time-space dimension. By time-space dimension I mean the sonic dimension in which the voice is heard. We hear every letter, syllable, and silence in a chronological order in time. However, the voice also normally comes from one person in one place in the space.

³⁴ From the program notes. *Lap-dog Machines: Pre.sa.uro*. Helsinki Music Centre, Black Box, January 25, 2019.

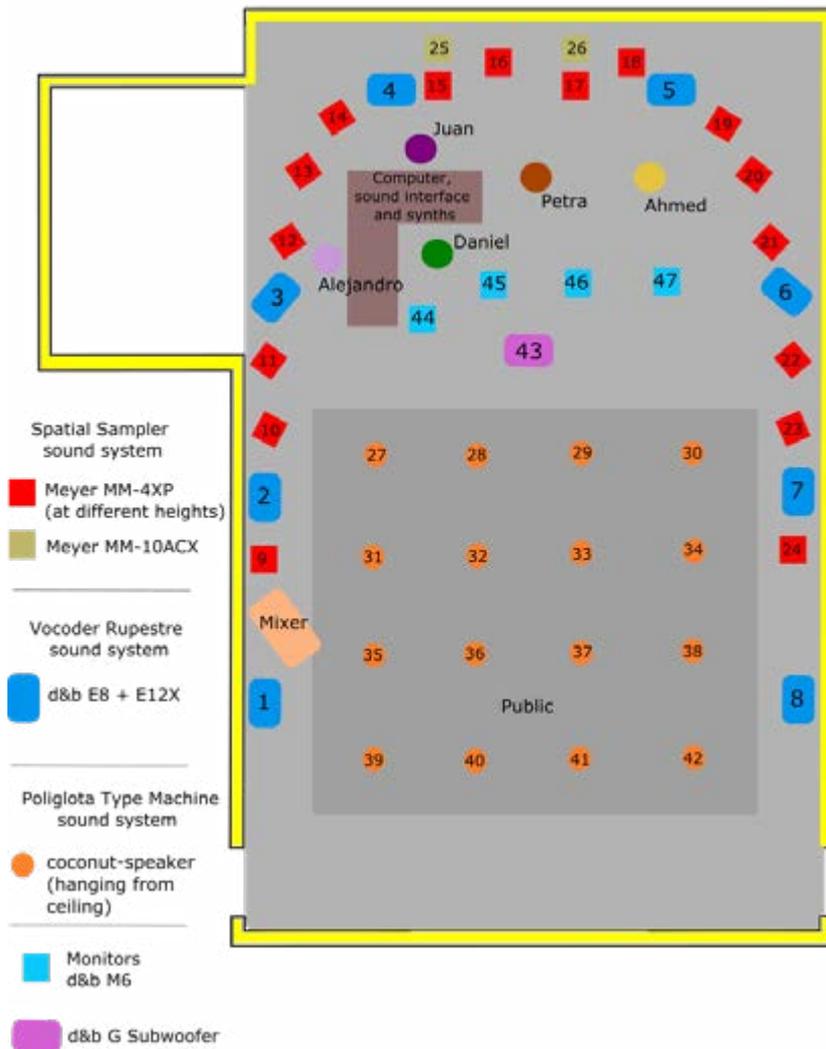


Figure 4: Lap-dog Machines – Installation Plan Black Box

The three machines play with different temporal and spatial composition strategies. The *Spatial Sampler* represents the future time, a machine capable of automatic translation into another language. The *Vocoder Rupestre* corresponds to the past time, where the machine can expand a solo voice into an eight-voice choir. The *Poliglota Type Machine* is situated in the present time and is able to compose/stream live spatial poems in real time by typing on its keys.

Future: Spatial Sampler

Futuro. A language that could be, and the electronic apocalypse.

The *Spatial Sampler* represents the future time, a machine capable of automatic translation into another language. Its main idea is to re-organize spatially and temporally the performer's voice. The Max patch developed specially for this system records the poetic prose read by Ahmed Kakoyi, and then slices it according to a threshold in the amplitude. Using sampling techniques, slices of the poem are re-organized following a graphic user interface that can be modified by hand, with an iPad tablet, or randomly. The slices can be synced to a sequencer or played freely. The poem is spatially re-composed by diffusing every slice into a vertical grid of sixteen speakers located behind the singer and facing the audience.

Past: Vocoder Rupestre

Pasado. Encryption device, deconstructed speech and ancient voices.

The second system is the *Vocoder Rupestre*, a machine that represents the past, and where the intention is to create a choral feeling that emanates from one voice. Several vocoders were tested and investigated until arriving at a collection of six digital commercialized vocoders. Three of these vocoders also function as auto-tuners, and two of them have several cross-modulation effects. All of these vocoders are sequenced and controlled via a sequencer with eight MIDI channels. The poetic collage was read and sung by Petra Poutanen together with the other six ghost voices and was spatialized in an eight-channel system that resembles the disposition of a choir. A custom-made Max patch delayed the signals, either syncing them to the Tempo, or with a chaotic delay time created with a Baker's algorithm (Baker, 2005).

Present: Poliglota Type Machine

Presente. Poetry mixer, multilingualism, and pop culture.

The last system is the *Poliglota Type Machine*, which makes use of pre-recorded audio tracks in order to compose live spatial poems. It was inspired by Malpica's 'combinatorial of text', which consists of tables of words and phrases that can be combined in different order, each time creating a different poem. In this system there is a series of pre-recorded words and phrases in a grid, which can be organized in a temporal-spatial sequence by typing into a tablet. Four sequences can be created and layered, forming a meta-combinatory of poems. The main sound system used in this case was a sixteen-channel loudspeaker system situated above the audience.

4.3.3 Sound composition

Audio-visual documentation of the performance at Black Box can be found in the following RC link:

<https://www.researchcatalogue.net/view/930674/952133/0/1800>

A guided improvisation system was used for the composition of each section, together with a script-score where the voice performer was given indications of which text to use and its mode of performance. The live electronics performance was played with the electroacoustic system and followed the script-score. The modular synthesiser textures and rhythms opened and accompanied the three sections.

Finally, the concert was divided into four sections: an introduction and three main parts. The total duration of the performance was around forty-five-minutes. The introduction was a duo of modular synthesizers. The first part, Future, focused on the *Spatial Sampler*. The second part, Past, had the *Vocoder Rupestre* as its main electroacoustic system. The last part, Present, was for the *Poliglota Type Machine*.

Introduction. (4 min)

Juan Magdaleno and Alejandro Montes de Oca - Modular synths

Section 1. (15 min)

Future: Spatial Sampler.

Ahmed Kakoyi: voice

Juan Magdaleno - Modular synths

Alejandro Montes de Oca - Electronics

Section 2. (15 min)

Past: Vocoder Rupestre.

Petra Poutanen - voice

Juan Magdaleno - Modular synths

Alejandro Montes de Oca - Electronics

Section 3. (12 min)

Present: Poliglota Type Machine.

Daniel Malpica - voice

Juan Magdaleno - Modular synths

Alejandro Montes de Oca - Electronics

4.4 Public Presentation

The project was presented at the Black Box on 25.01.2019. It was unanimously accepted as passed by the Jury, which was formed by Bill Brunson, Caspar Stracke, Juhani Liimatainen, Kalev Tiits, and Otso Lähdeoja (chair).

4.5 Conclusions

Lap-dog machines: Pre.sa.uro was my fourth doctoral project within the research theme of *case-specific electroacoustic systems*. In this iteration of my doctoral research, I conceived three different performative situations – or cases – and put them together in a forty-five-minutes continuous performance. In *Lap-dog machines: Pre.sa.uro*, case-specificity was approached as a creative assemblage of ideas-techniques-aesthetics, where literature, composition, performance, and installation, as well as technological and digital audio development were entangled. Each Lap-dog machine, or case, featured a “soloist” for whom a techno-social network was tailor-made and composed, giving rise to three different electroacoustic systems to electrify and transform voice and text in real time.

The three sonic-literary machines configured for this specific project intended to explore translation processes through technology. Having in mind the general definition of literary as a written text, the origin and basic material of each sonic-literary machine was based upon Daniel Malpica’s poems and his *Mutant Language* project. The translation of the text was considered from different perspectives: the initial translation of the text into different languages, the translation of text to sound in the performance, and finally the sonic translation of the vocal utterances by the three electroacoustic systems. In addition, the contrast between the different languages and performers of the three sections – a Swahili performer with strong emotion, a Finnish performer with scary throat singing, and a Mexican poet with a playfully spoken utterance - were embodied by each case-specific electroacoustic system.

Sound transformation and sound spatialization are other important layers of the project, which were solved uniquely for each performer and sonic-

literary machine. In *Future: Spatial Sampler*, slicing the vocal utterances of the live performer was utilized to disassemble the semantic sense of the text, then each slice was spatialized in a grid of sixteen speakers behind the performer. *Past: Vocoder Rupestre*, used the voice of the live performer to create a virtual choir spatialized in an eight-channel sound system positioned to the sides of the live performer. Finally, *Present: Poliglota Type Machine* uses pre-recorded vocal material, in contrast with the first two sections, and the performance is akin to using a typewriter, where words are combined and spatialized in a sixteen-channel sound system located in a grid formation above the audience. Each case engendered three different spatial sound diffusion solutions and sound transformations, demonstrating one more time the plasticity of the electroacoustic medium and how it can be approached as another creative parameter of the sonic arts field. Furthermore, with the aforementioned three cases of sound spatialization and sound transformation I would like to emphasize the poetic logic used in their respective titles, which helped to establish a feedback process between artistic ideas and the electroacoustic medium.

Finally, with this project I was able to underline the importance of an interdisciplinary approach to the simultaneous process of electroacoustic system composition and sound composition, which not only cross-pollinate each other but also enable an experimental practice within the electroacoustic medium. Following this creative path as a strategy to sonic creation, the agency of the machine-system becomes evident, as well as the fascinating field in which literature, and specifically poetry, engage in direct correspondence with musical creation.



5. Acoustic Paths (2012, version 2019)

18 - Acoustic Paths. Photo by Jakob Johannsen.

19 - Acoustic Paths. Photo by Jakob Johannsen.



The media material of the artistic portfolio published and archived in the Research Catalogue online database can be access by scanning the QR code or by following the link below:

<https://www.researchcatalogue.net/view/930674/952134>

5.1 Introduction

Acoustic Paths is the fifth and last project of my artistic doctoral research. It is a twenty-minutes-long acousmatic sound composition-installation set for two listeners at a time. *Acoustic Paths*, or *Senderos Acústicos* in Spanish, originally started in 2012 when I began to travel and record the soundscapes of different areas of Mexico. The objective was to explore connections between the sound pollution emanating from cities and contemporary society. Since then, *Acoustic Paths* have been presented in different places as a sound installation, live performance, and sound composition. This project has been an ongoing platform for exploring soundscape composition, sound diffusion, and field recording.

This new version of *Acoustic Paths* encapsulates a personal interest regarding the compositional process of forms that are situated between installations and concert situations. It also modulates the role of the audience, letting them decide how to experience the piece; it is possible to move and explore the sound world, or to sit still and listen from a particular perspective. Finally, it experiments with a particular social situation by inviting two persons, who do not necessarily know each other, to experience a work of art together, opening a moment for sharing and communication.

For this Black Box version, a case-specific electroacoustic system was experimented with and designed to provide the best immersive listening experience. It is a combination of three multichannel sound systems, a periphonic or dome type, a planar array, and a third type that delimited the path the audience can follow. A tailor-made multichannel sound composition was crafted to guide the two listeners into an original sonic, spatial, and social dimension. The project demonstrates one possible creative way to combine listening, sound creation, and electroacoustic system design to develop sound art works at the intersection of installation and performance.

5.2 Context

The initial version of *Acoustic Paths* was presented at Tanssilauantai Festival, Petkeljärvi, Ilomantsi, in June 2014. It was set up as a sound installation inside a bunker that could be visited by any person at any time. A specific electroacoustic system was created for that case. It was composed of a Raspberry Pi mini-computer, an eight-channel sound card, a custom-made eight-channel amplifier powered by a 12 volts tractor battery, and eight actuators installed inside the wooden surfaces around the bunker, including the benches. The audience could visit at any time during the weekend it was installed. The feedback from the public was positive, and I consider it a successful work. The atmosphere was dark, and all the technical equipment was hidden, surprising the visitor with a truly 3D immersive sound experience. The bunker's wooden surfaces, set in vibration with the soundscapes of the Mexican jungle, savannah, and different cities, took the spectator away from the Finnish forest of Petkeljärvi for a moment.

Surround sound systems usually focus on the spatialization of sounds in a peripheral area around the listener. Dome-type setups add elevation to the periphery, but speakers are still at similar distances (Gorne, 2015). Certain sounds can give the perception of coming closer or going far away, due to their particular frequency content or some type of sound transformation, e.g., reverberation. Loudspeaker orchestra setups improve the feeling of distance by modulating the spatialization of specific sound material from speakers located far away from the audience to others closer to them. The *Acoustic Paths* case-specific electroacoustic system explored the domain where the perceived distance of a sound source becomes a creative element in the sound composition and the electroacoustic system design. It contributed to the development of the zoom in - zoom out idea, a creative technological setting that enhances the perceptual factor of sound distance, improving the experience of sounds that are placed or are moving in a three-dimensional space, moving far away but also giving the feeling of coming close to the listener.

The case-specific electroacoustic system configured by the three multichannel sound systems combined two sound spatialization methods:

Ambisonics (Gerzon, 1973; Malham and Myatt, 1995) and distance-base amplitude panning (DBAP) techniques (Lossius and Baltazar, 2009). One was used for fixed spatialized sound sources, and the other for creating sound trajectories. The sound material was spatialized with these two methods, recorded, and then rendered into the final twenty-minutes-long electroacoustic composition.

Reducing the number of spectators to two at a time allowed me to play with their listening positions and movement trajectories inside the space. Although the spatial composition was played autonomously, the listeners nevertheless made their own sound mix by wandering through the space where the case-specific electroacoustic was set up. This aspect of the piece connects to the idea of open work (Eco, 1989) and subjective experience (Nagel, 1974; Muscari, 1985), in the way that an aesthetic experience is a product of individual mind and cannot be measured by scientific instruments. Moreover, the situation with the two listeners created a particular shared experience, which is another of this project's contributions.

5.2.1 Acoustic Ecology

“Now we must learn to judge a society more by its sounds, by its art, and by its festivals, than by its statistics. By listening to noise, we can better understand where the folly of men and their calculations is leading us, and what hopes it is still possible to have.” (Attali, 1985, p. 3)

Sound pollution is an intangible product emanating from the contemporary lifestyle. Our capitalist world fills life with sounds produced to influence human behaviour, electrical devices humming and beeping, and machines producing constant background sounds. Our ears and mind try to block them out, in order to distinguish the essential messages. Despite its intangibility, sound pollution's impact on both humans and nature differentiates it from the effects produced by other kinds of pollution. It has a direct repercussion on human senses and our behaviour. We are not usually aware of this, but there are substantial repercussions for our body and mind (Jariwala *et al.*, 2017).

Soundscape studies and acoustic ecology provided an additional and important background for this project. Acoustic ecology is a field of research dedicated to studying the sound-based social interactions of living organisms. The composer and researcher R. Murray Schafer created the term soundscape in the 1970s, to parallel the term landscape (Schafer, 1977). Soundscape refers to an acoustic environment in which listeners are immersed. It includes natural acoustic elements and those caused by human activities in a specific place of the landscape (Wrightson, 2000).

The *Acoustic Paths* Project aims to sensitize the audience to the current situation regarding sound pollution and social decomposition. With it, I tried to address one aspect of contemporary Western society: the use of sound systems in public spaces, which, together with the already overcrowded soundscape of the cities and their traffic, has become a common practice. Moreover, there are more and more aggressive volume levels that we are exposed to in everyday life, and although we have learned to filter them out, they still affect our condition and reflect the societies we live in.

Acoustic Paths is a sound work that wants to make evident sonic manifestations that are directly connected to our contemporary society, like sound pollution, and social decomposition. The soundscapes of nature, soundscapes with human interventions, and abstract or synthetic soundscapes are mixed in a compositional strategy that tries to raise awareness of these experiences.

5.3 Project description

This section reflects upon the Black Box version of *Acoustic Paths*, focusing on how the creative processes of sound composition and electroacoustic system design interweave to create a specific sound work. This version was situated intentionally in the intersection between acousmatic composition and sound installation, opening the idea of the loudspeaker orchestra, an instrument used to perform acousmatic music, to create a case-specific electroacoustic system. The following sections consist of a detailed description of the project and the different areas explored, showcasing the documentation of the creative process and the outcomes.

5.3.1 Initial Ideas

The work on the Black Box version started with considering the previous experience at the Petkeljärvi national park in Ilomantsi. One important aspect was to create again a dark, intimate, and relaxing atmosphere where visitors would feel comfortable enough to open their ears and imagination to the mix of natural and synthetic soundscapes being shared. The second aspect was an immersive experience aiming to sonically transport the listener to other realities. However, on this occasion, a case-specific electroacoustic system was going to be composed to create the impression of paths or trajectories sonically. The aim was that the listener should experience an entire sound organization, carefully composed in its temporal domain and its spatial domain. The idea of an acousmatic composition-installation allowed the use of strategies from acousmatic composition and sound installation practices.

5.3.2 Case-specific electroacoustic system

As mentioned above, three different multichannel systems were investigated and implemented for the *Acoustic Paths* Black Box case-specific electroacoustic system. The first one was a periphonic dome sound system with 14 speakers. I had previously worked with this kind of sound system, either using ambisonic or amplitude panning techniques. My personal listening experience of this type of system focuses on the spatialization of sounds around the listener, creating a feeling of being surrounded by sounds. Although certain sounds can give the impression of coming closer or going further away through their particular frequency content or certain types of sound transformation, such as reverberation or delay, they do not help on a larger spectral scale to convey the feeling of sounds coming close to the listener.

While working on this version of *Acoustic Paths*, an experimentation with a second speaker disposition was carried out in order to improve the sound distance perception. A flat grid multichannel setup was tested on two occasions. First, in the large recording room of the Sibelius Academy, and second in the Black Box of the Helsinki Music Center. After carefully listening to, testing, and comparing different options for the grid, speaker positions,

and spatialization techniques, and discussions directly with Professor Andrew Bentley and my colleague Alejandro Olarte, the final version of the second sound system for the Black Box presentation arrived at its final form. It consisted of 16.2 speakers in a grid disposition, here all the speakers were directed towards the centre, or “sweet spot”.

A third sound system delimited and suggested to the audience the path to follow. It was configured by 16 self-made passive speakers hanging from the ceiling of the hall. They were made for the *Half Full* project (see chapter 4) as a portable multichannel sound system and consisted of coconut shells to which an air-borne transducer element was attached, combined with a long, yellow textile cable. I had previously tested and used this multichannel speaker system by hanging it above the audience. In this case, it helped break up the speaker setup’s symmetrical disposition, making it seem closer to an installation. The speakers were specifically lighted and situated so that the audience could look at them, approach them closely, and listen.

5.3.3 Sound Installation

The methods used for the spatialization of the sound material were developed and tested in combination with the development of the case-specific electroacoustic system. The first method used Max and Reaper in an interconnected way to carefully compose a tridimensional space with the sound material. I used Spat’s Ambisonic techniques in Max (Carpentier, 2018) to spatialize some tracks of the Reaper sequencer in the three sound systems. I also spatialized directly from the Reaper sequencer to the 46 loudspeakers of the three systems. This spatialization was fixed, without trajectories, apart from the ones already in some of the stereo field recordings. I used the multichannel reverb in Spat, which contributed to the feeling of distance and space.

The second method used Max and Reaper as well, but in this case for creating sound trajectories. It combined Spat’s Ambisonic techniques in the periphonic dome speaker setup with a distance-based amplitude panning (DBAP) technique in the planar array speakers’ setup. I also improvised



20 - Acoustic Paths' installation at the Black Box. Photo by Jakob Johannsen.

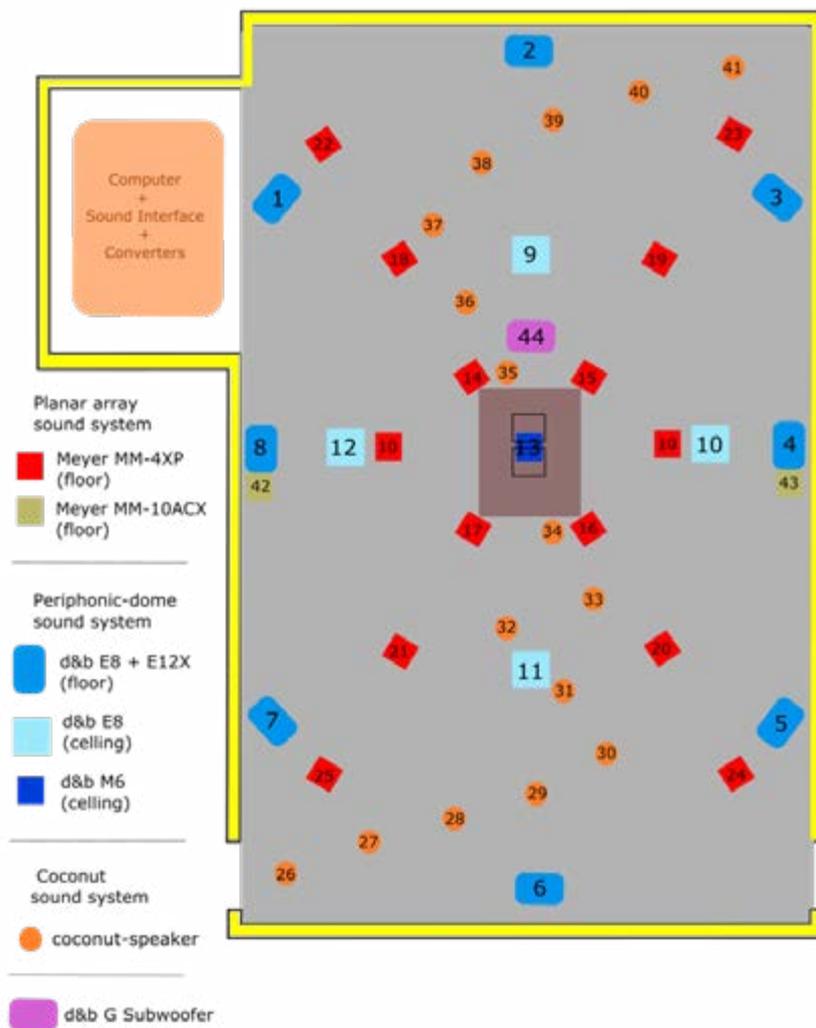


Figure 5: Acoustic Paths – Installation Plan Black Box

in-situ, diffusing the sound material with a Behringer X-Touch Compact³⁵ midi controller. These sound diffusion improvisations were recorded and used for the final composition that was presented.

Zoom in - zoom out

Imagine the sound of a bee, detected by the ears while still far away, slowly approaching until it circles the head and stops ... and then moves again, further away, with the constant beeping sound that is so characteristic and beautiful. Creating this effect in a stereo setting, where the speakers are set up at specific distances, is not so easy, if not impossible. My own experience tells me that for playing with the distance perception of a sound with a loudspeaker, a sound material with specific spectral content needs to be chosen, and its amplitude and reverberation have to be modulated. The speakers-space-listener relation is also significant and works better when the listener is in the sweet spot.³⁶

Like a camera that can adjust its lens so that images seem larger and closer, my idea for zoom in - zoom out aims for technological settings that can create this feeling, regardless of the amplitude and frequency of the sound material, the size of the space, or the position of the listener. The periphonic dome and the planar array multichannel sound systems were combined with the second spatialization method (DBAP) to create this feeling and play with the zoom in - zoom out idea. I basically sync the DBAP and the Spat Ambisonics in Max, crossfading between them according to the sound source's position in the x, y, and z planes. I added a multichannel reverberation from Spat, but this time it dynamically changed according to the position of the sound in the space, using less reverberation when the sounds approached the centre of the hall, or sweet spot.

³⁵ <https://www.behringer.com/product.html?modelCode=P0B3L>

³⁶ The acoustic sweet spot is the optimum location for listening to stereo, surround sound audio. It is usually a position equidistant to all channels used in the sound system.

During the second test at the Black Box, I could experience that the system worked not only in the sweet spot but also in other areas inside the grid. Even at the periphery, I could feel how the sound approached and then went away from me. The zoom in - zoom out idea was working, and it also felt good walking around the space, discovering the different sounds on different loudspeakers. The size and darkness of the black box increased the feeling of distance and space. It was then that the idea of two listeners at a time came. It opened the possibility to play with their trajectory as well, sometimes letting them move freely around the installation space and guiding them to specific places. It also allowed the listeners to create their own sound mixing while walking around the space, breaking the fixed aspect of acousmatic composition.

5.3.4 Sound Composition

A binaural version of Acoustic Paths can be found at the following RC link:

<https://www.researchcatalogue.net/view/930674/952134/0/1600>

When I started working on the spatial sound composition, I had in mind that I wanted to create a sonic space that invited the audience to enter, that made them feel comfortable and safe to open their ears. As I could not install the system permanently due to the significant technical requirements and space needed, I worked first with an eight-channel sound system in the studio. The strategy used was to prepare a multichannel sequence of about twenty-minutes, including eight channels and mono sequences. These pre-composed sequences were mixed and spatialized during the three days I had for that purpose in the Black Box before the opening to the public.

The field-recording material used was from the Acoustics Paths' sound archive. For this occasion, I chose recordings from Nueva Alemania, San Cristobal, and Tapachula in Chiapas, and Valle de Guadalupe, San Quintin, and Mision Santo Domingo in Baja California Norte, in Mexico. Most of the field recordings were from nature soundscapes, and some included vehicles and planes passing by, which connected very well with the idea of

trajectories and sound pollution. In the middle section of the piece, there is a field recording with a human voice, from a coco street-seller in San Quintin, Baja California, Mexico. It belongs to my sound collection of public spaces with loudspeakers, which are often used in Mexico. I chose this recording because of the voice of the man and what it says. It represents very well what I had been looking for in the Acoustic Paths project: sonic manifestations directly connected to our contemporary society, which can serve as a tool of analysis or as a material for creative expression.

The synthetic sound material comes from recordings of modular synthesizers played by Juan de Dios Magdaleno and myself. They were created through a method of guided improvisations inspired by the selected soundscapes. Firstly, I composed a twenty-minutes eight-channel soundscape with the selected field-recording. Then, I collaborated with Juan de Dios Magdaleno to create a sound in the modular synthesizer that could create a synthetic or abstract soundscape counterpoint. Finally, we improvised with the modular synthesizer sound while listening to the pre-composed twenty-minutes eight-channel soundscape. Each of our improvisations was recorded in mono, since the intention was to spatialize them with the DBAP method in the Black Box. We repeated this process several times in order to create different materials from which I could choose the final synthetic or abstract soundscape counterpoint.

Acoustic Paths had three sections and lasted twenty-minutes (3'30"-12'00"-4'30"). In the first section, the two audience members enter the hall from the left entrance. The doors close, and it is possible to move freely inside the space. The configuration of the loudspeakers and the spatial sound composition invite the audience to walk around and explore. The hanging speakers delimited the path that the audience was suggested to follow. Around minute 3'00" the listener was slowly guided, with sounds and lights, to the centre of the hall, where there were two illuminated seats facing back to back and was invited to sit.

The second section was the longest, and it was composed thinking that the listener was going to be in the sweet spot. In this section I used all of the

system's spatial possibilities in full; it includes a climactic moment when an airplane passes from left to right just above the audience.

In the third and final section, the sound and the light guided the audience to stand up and wander around. Towards the end, the intention was to guide the audience to the opposite side of the entrance using light and the sounds from the hanging speakers again. At minute 18'30" the back doors opened, and this marked the conclusion of the work. The final one-and-a-half-minutes were left in silence, to invite the audience to leave the space and close the doors.

5.3.5 Social relationship

The aspect of a social relationship with a co-listener came to the fore when I decided to do the work for two listeners at a time. An online survey was implemented so the public could reserve a slot to visit and experience the work. There were fifty-four slots for each of the two days the work was open to the public. I thought that some listeners might register alone and would enter the Black Box as an unknown situation with an unknown person, producing a mix of intimacy, anonymity, and curiosity. I liked the idea, and I planned the situation in more detail, together with the final disposition of the case-specific electroacoustic system and the spatial composition. I wanted to create a shared listening experience where the participants could also be affected by their co-listener's reactions.

I requested two concert assistants, one who welcomed the listeners and opened the door exactly every twenty-minutes to let the participants go in, and a second that opened the exit back door, one-and-a-half-minutes before the end of each slot, and had to be sure that the two listeners got out of the hall and closed the door before the beginning of the next slot. It was very important for me to not disturb the next two listeners that would follow, and that when the doors were opened in front of them, the possible state of excitement and curiosity was not broken.

5.4 Public Presentation

The project was presented at the Black Box on 28-29.10.2019. It was unanimously accepted as passed by the Jury, which was formed by Caspar Stracke, Juhani Liimatainen, Kalev Tiits, Patrick Kosk, and Otso Lähdeoja (chair).

5.5 Conclusions

Acoustic Paths (2012, version 2019) was the fifth and last project of my artistic doctoral research at the Centre of Music and Technology of the Sibelius Academy, University of the Arts Helsinki. The project presented a twenty-minutes-long acousmatic sound composition-installation set for two listeners at a time.

With this new version of the Acoustic Paths project, I was able to study the compositional process of forms that are situated between installation and concert situations. By dissolving the borders of sound installation and sound composition it was possible to reconfigure the techno-social aspects of the project on two interconnected levels: the artwork per se and the spectator. The artwork reconfiguration was inspired by the conceptual framework of the project. It represents well what I have been looking for in the Acoustic Paths project: sonic manifestations directly connected the sound pollution emanating from cities and our contemporary society, which can serve as a tool of analysis or as a material for creative expression. Moreover, the title of the work, Acoustic Paths, was used as the pivotal idea to develop a multichannel setting to create paths or trajectories of various sonic elements. The spectator reconfiguration happened in two ways. Firstly, the case-specific electroacoustic system allowed me to modulate the role of the audience, letting them decide from which location to experience the piece: listening either from a non-fixed point or, by sitting still, from the sweet spot. Secondly, by inviting two persons at a time, who did not necessarily know each other, I was able to further expand the audience experience into a shared listening situation.

Making the composition-installation for two listeners instead of one made a radical change in how the audience experienced the artwork. It also avoided the typically lonely encounter of VR settings, where a human is confronted with a machine. It was through the creative assemblage of ideas-techniques-aesthetics, experimenting and playing with the electroacoustic medium and a creative approach to signal routing and mapping, that I arrived at the solution of making this installation-composition accessible to two listeners at a time. I did not carry out an evaluation with questionnaire-based interviews for the visitors of this composition-installation. Nevertheless, I can conclude that the possibility of sharing the experience with someone else increased its impact. This insight is based on the visual observation of the audience throughout the twenty-minutes that the piece lasted, as well as the comments by the concert-hall assistants and the members of the jury. Judging from the feedback received, it became clear that being accompanied by another visitor made the audience feel safer and more relaxed when they entered the hall. There was also some excitement when the participants arrived before their time slot, especially for the ones that did not know who the second listener would be. In the end, thanks to this shared situation, the audience could exchange their impressions and discuss what they had just experienced.

The zoom in – zoom out idea, one of the results of this project, is also a good example that showcases how the electroacoustic medium can become a creative assemblage of ideas-techniques-aesthetics rather than merely a technical implementation. The case-specific electroacoustic system for *Acoustic Paths* was developed because, in this specific work, I wanted to play with the feeling of sound distance and trajectories and use it as a parameter of expression. The feedback process between artistic ideas and the electroacoustic medium –listening and relistening to the actual experiments with the systems– apart from triggering technical challenges and creative solutions, also influenced the final artistic outcome.

Finally, in the words of Otso Lähdeoja, chair of the jury members: “The Jury was unanimous in its high appreciation of the work. *Acoustic Paths* constitutes a masterful piece in its aesthetical sensitivity, conceptual originality, musical

quality, and technological expertise. It is an admirable point of arrival of Montes de Oca's doctoral research, showing a full maturation of an artist work with the music technology medium."³⁷

³⁷ Quote from the jury assessment written by the jury's chair
Otso Lähdeoja, 17.12.2019.

6. Final Conclusions and Reflections

The artistic research presented in this thesis began with the intention of increasing the knowledge and understanding of the artistic practice in which the sound composition process occurs in tandem with the electroacoustic system configuration and design process to create a specific sound work. To begin the discussion of the results of this artistic research, I will start with a recapitulation of the main research aspects of my artistic practice, which I have found to be at the core of my study:

- A compositional approach to the electronic, digital, and acoustic domains; that which is considered to be the electroacoustic medium.
- The electroacoustic medium as a system that goes through metamorphoses when exposed to new ideas and practices.
- The case-specific electroacoustic system as the composition and design of the electroacoustic medium that embraces a specific aesthetic and conceptual idea.
- Sound composition and spatialisation used to explore hybrid forms of presenting the work: composition-installation, composition-installation-performance, composition-installation-sculpture, and composition-installation-sculpture-performance.
- A compositional approach to the listener's experience, from the sweet spot, to a non-fixed listening point, to shared listening experiences.
- Two modes of sonic translation, as the interplay between the given and artificially added overtones of the sound source.

The core factors used to examine this process are the artistic outcomes of this doctoral project, in the form of hybrid sound compositions, sound installations, sound sculptures, and sound performances, in addition to their case-specific electroacoustic systems and the documentation of the creative practice that produced them. Moreover, the five sound works that form the artistic portfolio function as research material for this investigation as well as outcomes of the arts-based research processes.

In the light of the research aspects and outcomes of my doctoral project, I must return to the main research questions with the intention of answering them now. *How does the composition and design of a case-specific electroacoustic*

system become an artistic parameter of sound creation? And, How does the composition and design of a case-specific electroacoustic system influence the artistic ideas and process elaborated around a specific sound work?

By considering the electroacoustic medium as a creative assemblage of the ideas-techniques-aesthetics of a sound work (see also section VI on the context and state of the art), rather than a purely technical implementation, a case-specific electroacoustic system becomes an artistic parameter of sound creation. Sound generation, sound transformation, sound diffusion, sound spatialization, sound sculpture, sound installation, sound composition, sound performances, and the listener's experience are some of those ideas-techniques-aesthetics that are configured in a particular way to express the artist's intention, necessity, and choices.

The close relationship between society and technologies can be seen as a techno-social entity where the technical and the social aspects are directly connected and in the process of assimilation and change. **By looking at the electroacoustic medium as a mouldable techno-social network that can take on different shapes and be interconnected in multiple ways, the artist's mind can find solutions for any specific idea, situation, or intention.**

In the specific context of this thesis, the developments of artistic ideas and their associated electroacoustic medium can be observed in relation to society and technology. They evolve within a feedback system of constant change and assimilation that is open to personal views and approaches. **By establishing a feedback process between artistic ideas and the electroacoustic medium, sound composition and electroacoustic system composition, in addition to bringing out particular sonorities and dispositions of materials, also enrich our art practice with another set of creation decisions and approaches.** Whereas the artistic ideas or intentions can be poetic, abstract, narrative, collective, and individual, whether in relation to a particular topic or with the intention of studying something, the electroacoustic medium and its sound composition can highlight secondary ideas that can take on new forms influenced by the previous ones.

Dissolving the borders of sound composition, sound installation, sound sculpture, and sound performance and merging them into one object of study reconfigures their techno-social aspects on two or three interweaving levels: the spectator, the artwork, and in some cases the performer. On the level of the spectator or listener, the reconfiguration affects the normal modus-operandi of approaching, experiencing, and interpreting a work, for example with an interplay between active or passive listening. With regard to the artwork's reconfiguration in hybrid forms that belong to the field of sonic arts, they share their basic materiality of "sound", but not necessarily the techniques or dimensions where their elements principally interact (physical, spatial, temporal, corporeal). Blending the domains necessarily means combining their techniques and dimensionality, for example through an interplay between a commercial studio monitor and a custom-made sculptural loudspeaker. Finally, on the level of the performer, the techno-social aspects that are fundamentally reconfigured reside in the interaction between the performer and the electroacoustic medium. For every case-specific electroacoustic system where a performer is involved, a process of exploration and learning between the performer and the system is needed. The use of a multichannel sound system above the stage in a dance performance can serve as an example of this reconfiguration.

Furthermore, there is a pedagogical aspect that needs to be considered here. Sculptures, installations, compositions, and performances are forms of art with clearly different materials and techniques. Learning to work with those specific materials and techniques requires one to study in specific areas, academies, or departments. Their link to the sonic arts domain in the form of sound sculptures, sound installations, sound compositions, and sound performances is evident. Merging them into one object of study would require knowledge from all those art disciplines. **An interdisciplinary and open practices approach to art education is needed that can provide the knowledge, tools, and critical thinking to reconfigure the techno-social aspects of these different disciplines.**

Looking at the cases presented in this thesis, is possible to find some concrete answers to my research questions. In the *Aquarmonio* project,

the case-specific system created for the sound composition-installation-performance became a creative assemblage of ideas-techniques-aesthetics. The design of each 'cenote' and the 'water flowers' was influenced by the sound material we wanted to work and play with, mainly water and its transfiguration, establishing a feedback process between artistic ideas and the electroacoustic medium. Moreover, the spatial aspect of the project that we were interested to explore - shifting the listening experience from a fixed and non-fixed listening point - influenced the disposition and configuration of the different elements that the case-specific electroacoustic system was composed of. Finally, the composition of the objects and their spatial disposition was also conceived of as a poetical reference to the water matter and Mayan culture.

In the *Half Full* project, the coconut-loudspeaker orchestra became the mouldable techno-social network that took on different shapes to find solutions for every performance. Transforming the idea of a portable sound system into a multichannel coconut-loudspeaker orchestra, the case-specific electroacoustic system enabled me to reflect on my own approach to sound composition for dance performances, and my own artistic practice. During the construction of the custom-made loudspeakers, I had to learn to work with new, unfamiliar ideas and tools, in particular from the sculptural and instrument-making disciplines. Moreover, the coconut-loudspeakers with their yellow cables – apart of been inspired by the choreographic theme “happiness” – represented the creative exploration of sound spatialization in dance performances. In the Black Box presentation, locating the sixteen coconuts-loudspeakers above the stage where the dance performance took place helped to dissolve the borders between sound composition, sound installation, and dance performance. In addition, the spatialized sound composition in the multichannel sound system modified the listening experience of the dancers as well as of the audience.

Superguitar_03 questioned the interpretation of a traditional musical instrument through a reconfiguration and expansion of its ideas-techniques-aesthetics. The four acoustic guitars, together with the rest of the electroacoustic medium that formed the sound composition-installation-

sculpture, are a mouldable techno-social network that embodies an artistic idea. The location of the sixteen structure-born transducers exciting the guitars' bodies with synthesised sounds, apart from producing an interplay between given and artificially added overtones, enriched my artistic practice with the development of the idea of clustered multichannel sound systems. Furthermore, adding the quadraphonic sound system to the sound sculpture allowed me to compose the listeners' experience with a flexible and moveable listening point.

The three case-specific electroacoustic systems developed for the *Lap-dog Machines: Pre.sa.uro* project are examples of a particular way to interconnect, configure, program, and interact with the electronic medium in order to electrify and transform voice and text in real time. The mouldable techno-social network of the electronic medium interconnected and took shape in three different ways to represent each Lap-dog machine's temporality: past, present, and future. Moreover, the sonic-literary machines, with their three different multichannel sound systems and associated sound transformations, helped to dissolve the borders between sound composition, sound installation, sound performance, and literature, forming a hybrid artwork. Blending the techniques and dimensionalities of the four disciplines affected the way the performers interacted with the electroacoustic medium, the way the spectator experienced the work, and the artwork per se.

The main artistic idea behind *Acoustic Paths*, the last project of my doctoral research, was the notion of exploring connections between the sound pollution emanating from cities and contemporary society. It also encapsulates my interest in the compositional processes of forms that are situated between installations and electroacoustic concerts, modulating the role of the listeners, and letting them decide how to experience the piece. The case-specific electroacoustic system was composed, configured, and designed to try to embody these artistic ideas, becoming a creative assemblage of ideas-techniques-aesthetics. The version that was presented at the Black Box is just an iteration of the feedback process between artistic ideas and the electroacoustic medium. The decision to make the sound composition-installation be accessible to only two listeners at a time

was a clear outcome of this creative process, where the elements of the electroacoustic medium are not fixed and do not follow a pre-established form. Rather, they are a mouldable techno-social network through which the artist's mind can find solutions for any specific idea, situation, or intention. I must acknowledge that I am only able to answer these questions from my own perspective and experiences. Nevertheless, it is my sincere hope that this research can contribute to the contemporary practice of composers and sound artists who look to the electroacoustic medium as another parameter of sonic creation.

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This composition-based project of artistic research introduces the term Case-Specific Electroacoustic Systems to describe a set of electric, digital, and acoustic devices that are interconnected in a particular way to embody a specific sound work. The artistic research states that when the sound composition process occurs in tandem with the electroacoustic system configuration and design process, a particular creative practice is engendered. The main research questions are how the development of such a system becomes another parameter of sound creation, and how this influences the artistic ideas and process elaborated around a specific sound work. In the course of the doctoral trajectory five new sound works were created and presented, thus forming the artistic portfolio of this doctoral project. Each work included the composition, design, and creation of a case-specific electroacoustic system.

EST 65

PRINT
ISBN 978-952-329-277-2
ISSN 1237-4229

PDF
ISBN 978-952-329-278-9
ISSN 2489-7981

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