Interdependent Compositions Employed in Sonic Ecosystems: Integrating the Listener in the Evolving Soundscape

Marcelo Ferreira de Sousa

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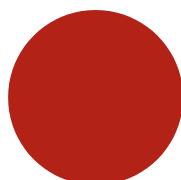
Supervisor: Scott L. Miller (PhD)

Co-supervisor: Eduardo Magalhães (PhD candidate)

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Approved in public defense by the Jury:

President: Gilberto Bernardes (PhD)

External Examiner: Filipe Lopes (PhD)

Supervisor: Scott L. Miller (PhD)

Abstract

This dissertation explores the integration of listeners in the evolving soundscape as compositional agents of the sonic environment, presented as an audio installation.

A method of practice-led research/research-led practice is followed, focusing on the development and understanding of sonic ecosystems and the interdependent relationships between its internal and external agents.

Participants explore generative aural cartographies, transforming iteratively the nature of compositions by expanding into wider motifs or focusing on small and specific elements of the experience.

By navigating across the sonic density of the Historical Centre of Porto, the artwork promotes bonding experiences between the people and their spaces, discussing the identity of the aural landscape and the implications of its rapid transformation.

Keywords: Aural Consciousness, Ecosystems, Interactivity, Soundscape Composition, Transformation

Resumo

A presente dissertação explora a integração de ouvintes na paisagem sonora em transformação enquanto compositores do ambiente sónico, no formato de instalações áudio.

O desenho metodológico seguido é o practice-led research/research-led practice, e foca-se na compreensão e no desenvolvimento de ecossistemas sonoros e das relações interdependentes entre os agentes internos e externos do sistema.

Os participantes exploram cartografias sonoras generativas, transformando iterativamente a natureza composicional das paisagens ao navegarem por motivos abrangentes ou focarem-se em elementos específicos da experiência.

Ao navegar pela densidade sonora do Centro Histórico do Porto, esta proposta artística promove a conexão entre as pessoas e os seus espaços, fomentando a discussão sobre a transformação da identidade do património aural e as suas crescentes implicações.

Palavras-chave: Composição de Paisagens Sonoras, Consciência Aural, Ecossistema, Transformação

"Cities have one crucial resource – their people."

The Creative City – Charles Ladry

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and to everything and everyone that is gone,

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Marcelo Ferreira de Sousa

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List of Abbreviations

DSP   Digital Signal Processing

GPS   Global Positioning System

HCP   Historical Centre of Porto

HOA   Higher Order Ambisonics

IMS   Interactive Music Systems

MIR   Music Information Retrieval

M/K   Microscope/Kaleidoscope

MSP   Max Signal Processing

OSC   Open Sound Control

PC   Personal Computer

PhD   Philosophiae Doctor

WFAE   World Forum for Acoustic Ecology

WSP   World Soundscape Project

1. Introduction

The growing standardization of our sonic landscapes has been extensively researched through the last half of the twentieth century (Schafer, 1993). Sounds transmit a huge amount of acoustic and cultural information, which in turn trigger certain memories and feelings from our surroundings, our cultures, and our communities. A lack of sonic consciousness reveals our disconnection towards our environments (Oliveros, 2005). Active listening must be re-established with our surroundings by developing our aural proficiency and enhancing our roles as cultural beings.

Through the composition of interactive soundscapes and acoustic ecology perspectives, listeners can be re-integrated in their aural dimension, and allow for the preservation of their spaces (Truax, 2008).

The interdependent practice within ecosystemic music systems mimics the molding of sonic spaces by internal and external agents, emphasizing the function of the whole. In a sonic ecosystem, the flow of energy is analogous to the relationships between its agents (Musick, 2016).

1.1 Context and Motivation

The main objective of this investigation is to create meaningful experiences through an interactive audio installation that conveys the kind of change and transformation happening in the soundscape of Porto.

In this investigation, audio spatialization is a recursive compositional resource, encouraged using touch interfaces for the exploration of the sound environment in real time.

Spatial transformations are digitally implemented. Sound fields are rendered by applying spatialization techniques such as High Order Ambisonics aided by node-based sound incidence on a bidimensional space by dynamically altering the sense of proximity to multiple sound sources and transform the sonic dimension.

The investigation seeks to understand how audiences perceive an artwork that depicts a familiar sonic ecosystem while enabling the participants to wander around and shape their own experiences through Porto's soundscape, promoting the use different ways of listening in order to better comprehend the cultural phenomenon of evolving soundscapes.

The generative ecosystemic elements and interdependency between sound sources and participants resonate fluidly the consequences of the audience's actions within the audio environment, complementing each other in establishing the tone of the composition.

With the completion of the development stage of this investigation, data will be made publicly available for academic (and commercial) purposes in an online repository.

1.1.1   Expected Contributions

The main contributions to the field of study strive to involve participants with their sonic environment and as such: 1) excite new ways of listening; 2) encouraging the preservation of memories of sounds of communities, spaces, and cultures, and; 3) nurturing a conscious interaction between citizens and the city's aural panorama through the navigation within its sonic density.

1.2   Problem(s), Research Questions and Hypothesis

Porto's soundscape is now transforming at an unstable pace, with local communities being deported to the outskirts of the city (or farther) as a consequence of the absence of measures to regulate the housing market and protect citizens in the urban and suburban landscape.

A cultural metamorphosis of the city's soundscape is a rising tendency and has been materializing in the last couple of decades. Porto's soundscape is evolving and losing some of its cultural nuances, which are uniquely linked to the communities and the spaces they live in. With fewer physical spaces to inhabit, local accents, dialects, and expressions become less frequent to hear.

New sounds grab ahold of the city, others on the brink of disappearance or shapeshifting. Noise and the sound of non-stop construction work are the only constant spectral beings hovering over the citizens.

There is a need to preserve our aural heritage while nurturing the sounds of tomorrow.

The main research questions are the following:
1. How can we integrate listeners in a transforming environment through an interactive recreation?
2. Can interdependency provide an accurate representation of the repercussion of the participants's actions within the environment?

The primary hypothesis integrates participants in evolving soundscapes as composers of the sonic environment in the shape of audio installations, and as such:

1. Transmits the musicality of spaces.
2. Provides bonding and collaborative experiences between people and the city's aural domain.
3. Explores the emotional triggers within the memory of sounds in order to stimulate self-reflection among citizens and their agency as elements of the ecosystem.

1.3 Research Methodology

This dissertation follows a *practice-led research/research-led practice* methodology. It is inspired by the proceedings of developing media art pieces when seeking to understand ecosystemic music systems. The creative process and investigation's path were molded by the literature, resonating into new questions and hypothesis progressively.

The investigation initiated with a comprehensive state of the art and literature review and is structured in two main topics: 1) a theoretical grounding of literature and a review of the related artistic work - in order to contextualize humankind's relationship with its surroundings - , some compositional approaches, interactive music systems and; 2) an overview of ecosystems, the act of listening, and its importance to the investigation.

The implementation began by gathering and documenting a vast amount of sounds from the soundscape to analyze how sonic agents come together to form and establish relationships. Recorded sounds were documented, considering the identification of each source, then carefully edited and treated acoustically for the highest possible quality of sound.

Afterward, a selection of the most interesting and more representative sounds corresponding to the emblematic places of the Historical Centre of Porto (HCP) was made, as the founding pillars of the ecosystemic elements generating real-time compositions. The interactive ecosystem began by setting up an aural cartography of the HCP by addressing samples into each corresponding zone, such as Fontaínhas, Guindais, Sé, and so on.

Interaction design and user journeys were considered to resemble actual *soundwalks*[1] and accurate physical representation of everyday wanderings, the experience was therefore named *Aural Wandering*.

Lastly, the practical implementation and development of the installation were executed, culminating with qualitatively oriented analysis and practical tests/experiments with participants.

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[1] "A soundwalk is a walk with a focus on listening to the environment." (Schafer, 1993)

The evaluation aimed at understanding the patterns of interaction between the ecosystem and participants, the identification and correlations bounded by sound sources and the exciting of subconscious memories inherent to sonic characteristics.

1.4 Dissertation Overview

The present dissertation is divided into three parts: a thorough literature review and state of the art, followed by a practical implementation of the theoretical and artistic work, and concluded by the evaluation of the feedback, conclusions, and deliberation of future work.

2. Literature Review

2.1 Introduction

In this chapter, a theoretical grounding of the investigation is made in order to understand some historical topics and to comprehend mankind's history with its sonic landscape.

In the latter sub-chapters, some compositional approaches that sprouted from studying sonic ecosystems are noted as well as the attempts to establish an aural reconnection with our surroundings.

2.2 Man and the Sonic Landscape

The sonic environment and its complex array of sounds has experienced a continuous transformation and complexification throughout time.

Humankind has been molding their habitats for millions of years. Humans have specifically tailored each and every aspect of their environments to further suit their needs, and in doing so, contributed to a "shift from the primitive ensemble of nature's humblest tunes towards the aggressive roarings of the city's intimidating engines" (Schafer, 1993).

Noise became the backbone of the aural world and a part of everyday life, reigning sovereign over the sensibility of men (Russolo, 1913). The abundance of acoustic information and loud noises has crippled the modern Man of His aural perception, diminishing his ability to understand the nuances of sounds that surround Him (Schafer, 1993).

The toxic implications of the imperialistic spread of the sounds of machinery, car engines and factories were intensely debated among scholars and emerging ecological movements throughout the mid 1960s and 70s, but in the early twentieth century, artists and thinkers alike had found inspiration from the new musical panorama.

Luigi Russolo (1913) argued in his futurist manifesto, *Art of Noises*, that noise would overtake music and art as the dominant force. For many centuries, the loudest of noises that could interrupt nature's silence were not intense, prolonged or varied. The multiplication of the

machine propelled by the industrial revolution created such a variety of noises that pure sound in its slightness no longer provoked emotion (Russolo, 1986).

Russolo (1986) called for the appropriation of ordinary sounds from everyday life and expressed his regard for the possibility of their orchestration and manipulation, stating "We want to give pitches to these diverse noises, regulating them harmonically and rhythmically" (1986, p.12). Traditional instruments were no longer suited for populations immersed in noise, so he built what he called the Intonarumori: instruments of noise.

Although the *Intonarumori* and his music did not survive the effects of the second world war, Russolo's (1986) ideas spread throughout musicians and composers:

"Wherever we are, what we hear is mostly noise. When we ignore it, it disturbs us. When we listen to it, we find it fascinating." (Cage, 1961).

The invention of the tape recorder bypassed traditional musical notation, instrumentalization and performance when creating a work of music. The ephemerality of the musical performance ceased to be a concern, and a generalized access to audio technologies closed the gap between the understanding and distinction of musical and non-musical sounds.

The tape recorder gave composers the ability to assemble bits and pieces of sounds in the same way that a film editor establishes the montage. Audio recording allowed for the inclusion of sounds from a variety of sources and its manipulation. Pierre Schaeffer (1966) made an extensive use of these techniques when composing several pieces, such as *Cinq études de bruits* (Schaeffer, 1948), which featured five main compositions:

1. *Étude aux chemins de fer*
2. *Étude aux tourniquets*
3. *Étude violette*
4. *Étude noire*
5. *Étude pathétique*

Among sounds from the recording of trains, percussion instruments, clashes from pots, pans and pianos, other sounds were intensively borrowed from field recordings as a compositional resource. He dubbed this collection as *musique concrète*, a genre of electroacoustic music.

The trending plurality of sound sources and digital media tend to create a sense of overwhelming auditory information. Chion (1994) argues that humans have different types of listening related to the required level of awareness, and traditionally, there's a perpetuation of causal listening (1994).

Literature Review

Unlike seeing, our sense of hearing is much more permanent, normally regarded as an involuntary act. As stated by Chion: "causal listening consists of listening to a sound in order to gather information about its cause (or source)" (Chion, 1994, p.25).

This type of listening usually relies on a lax sense of listening, establishing an order of cause and effect and detaching ourselves from the nuances of such sounds, further contributing to the detachment from the nuances of our physical spaces and the soundscapes that surround us (Schafer, 1993). An apathetic relationship towards our soundscapes represents a problem, for they reflect its communities, influencing them and imprinting on them an identity (Gomes et al, 2014).

Truax argues that a hegemony of the most powerful sounds eradicates or masks discrete sounds, contributing to the habit of non-listening (Truax, 2008).

A soundscape is the sonic environment. The term *soundscape* was coined in the 1970's by Raymond Murray Schafer, and describes the aural dimension by adapting the word landscape.

Soundscape studies first started as an attempt to draw attention to the sonic environment experienced in Vancouver and the exponential transformation of urban soundscapes around the globe in the form of the *World Soundscape Project* (WSP).

Schafer (1993) stated that the soundscape of the world was changing and posed two main questions when describing Man's relationship with the soundscape:

- Is the soundscape of the world an indeterminate composition over which we have no control?
- Are we its composers and performers?

The whole course of music history fulfilled the purpose of making people come together in groups. Music is intrinsically connected to our emotions and a harbinger of feelings of grief and joy.

Spiritual communities like neopaganism, neotribalism, and even counter-culture movements make use of music rites, such as drum circles, to create moments of shared experiences where every member contributes their own rhythm to the grander ensemble.

"Typically, people gather (…) in drum "circles" with others from the surrounding community. (…) The main objective is to share rhythm and get in tune with each other and themselves. To form a group consciousness. To entrain and resonate. By entrainment, I mean that a new voice, a collective voice, emerges from the group as they drum together."
(Hart,1991).

The Karelian lament, or *itkuvirsi*, is another ritualistic practice that uses a mix between speech, song and weeping to express affection among the community. It is almost exclusively performed by women at weddings or funerals to convey the spiritual sense of passage and stages

of life and reinforce the connections between the living and/or ones that have passed (Tolbert, 1990).

"Laments were sung to accompany all stages of separation, transition and reincorporation phases of the rite of passage, easing the transition from deceased to ancestor, bride to wife" or to "guide the soul of the dead" to the afterworld. (Tolbert, 1990, p. 81).

A compositional approach for comprehending and devising soundscapes means that humans have the power to understand which kind of sounds they want to preserve, to encourage and to produce in order to preserve their sense of being and to connect to their surroundings, and therefore, their cultures.

Humans are the conductors of the sonic energy that flows in the ecosystem, the vulgarity of their soundscapes, the *antrophony*[2] (Krause, 2008), is a consequence of their apathy and disconnection towards the sonic landscape. Noise is the sound people learned to ignore (Schafer, 1993).

Krause dissects soundscapes and assigns them to three different types, pertraining to their acoustic sources and their roles in shaping our sonic dimension. 1) Human generated sounds - the antrophony, 2) Sounds produced by the natural fauna, such as birds and other biological sources, the biophony, and 3) geophony, or natural sounds from other non-biological sources, such as the "effects of wind, water, weather and geophysical forces." (2008, p.75).

2.2.1 Hi-Fi and Lo-FI Soundscapes

When discussing sonic environments in rural and urban landscapes, Murray Schafer (1993) tends to address them as *Hi-Fi* and *Lo-Fi* soundscapes. In a rural setting, a larger spectrum of sounds can be heard clearly; in the quiet ambiance of the *hi-fi* soundscape, the slightest sounds or disturbances can communicate interesting information and the listener is armed with a farther sense of hearing into the distance. "The *Hi-Fi* soundscape is one in which discrete sounds can be heard clearly (...) (Schafer, 1993, p.43).

Schafer states that the loudest sounds in a rural environment can be attributed to festivities or holy events, generally celebrating the harvesting period of spring or fall or the loud bangs of the church bell (1993).

The industrial revolution introduced high intensity sounds and contributed to the overflow of acoustic information and to the flock of human communities around industrial areas, as

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[2] All sound produced by humans, whether coherent, such as music, theatre, and language, or incoherent and chaotic such as random signals generated primarily by electromechanical means." – www.en.wikipedia.org/wiki/Anthropophony - Accessed on 01.02.19

agricultural workers were sent to the city to seek work in the factories. With the development of the industrial revolution the *Lo-Fi* soundscape was born (Schafer, 1993).

In a *Lo-Fi* system, some sounds are easily masked by high amplitude noises. Discrete sounds can no longer be propagated or flow inside the ecosystem. As stated by Schafer (1993, p.43), "perspective is lost. (...) there is no distance; there is only presence.".

Lo-Fi systems are invasive, even though factories are no longer standard in city centers and are usually dislocated to industrial spaces around sub-urban areas or even sent abroad. Technology succeeded as a force of homogenization, standardisation and uniformity of the soundscape (Schafer, 1993).

From a composer's view, *Hi-Fi* soundscapes are varied and uniquely local whereas *Lo-Fi* soundscapes are uniform and about the same everywhere (Schafer, 1993).

2.2.2 Acoustic Ecology

Ecology concerns itself with understanding relationships between organisms and their environments. David Suzuki (1997, p.198-99) defines ecology as "the beginning of a new way of thinking about the world", adding that ecology studies describe "sets of relationships rather than separated objects."

Acoustic Ecology spun off as its sound related counterpart, appearing within the *World Soundscape Project* as the part of Barry Truax's *Handbook for Acoustic Ecology* (1978), and further transforming into the *World Forum for Acoustic Ecology.*

Soundscapes (or *Soundscape Ecology)* are made of and are part of the compositions between its agents who are its audiences and performers (Schafer, 1993). Acoustic designers should listen, for listening is their most important task when composing. It's through a compositional approach towards our soundscapes that we must know how to create balance between *motifs*, and which elements should we preserve and encourage in the ensemble and which elements should we discourage in order to improve the orchestration of the soundscape (Schafer, 1993).

The fact that physical traversing spaces grows shorter by the day and humans are inserted into a connected *Global Village* (McLuhan, 1964) creates a sense of abstraction and indifference concerning the problems of our small, physical communities (McLuhan, 1967). Schafer (1993) refers that being integrated in a *Lo-Fi* soundscape masked the human voices, creating an amalgam of inhuman sounds.

When analysing the *Hi-Fi* soundscape it is found that the individual agents that populate them have a deep understanding of their contextual meanings. Being immersed in an information rich soundscape encourages that same interpretation by its agents (Truax, 2008).

Spatial hearing and quadraphonic sound systems have made possible the transmutability of sonic environments, enhancing disembodied listening experiences and perceiving cultural information from recreated soundscapes. Soundscapes can be simulated in various acoustic

settings while maintaining various features of its original landscapes, such as moving events who can be replicated in the soundfield (Truax, 2008).

Although this conveys an appreciation of diverse sonic environments in different settings, acoustic and soundscape ecology reiterates that acoustic designers, composers and artists should take into account the history, ethnography and geography of the manipulated sounds (Opie and Brown 2006), becoming representative of and referencing the sonic environment (Westerkamp, 1999).

2.3   Listening to the Aural Space

2.3.1   The Acousmatic Situation

Chion (1983) states that by altering the act of listening we embed it with certain characteristics:

Listeners are unable to visually identify the context of sound sources. By dissociating sight and hearing, we encourage listening to sounds as their beings, the sound object.

By creating a space where sounds are listened to and through an exhaustive repetition of the recorded sound, it allows for the diminishing of curiosity regarding the visual context or source.

The *sound object* (Schaeffer, 1966) is, therefore, the independent aural representation or experience of sounds from their visual context or stimuli, it is the consequence of the acousmatic situation. By listening repeatedly to the same recorded sound fragments, the emphasis is placed on the variations of listening.

Chion (1983) concludes that these variations do not arise from the blurring of perception, but from "specific moments of illumination, directions which (…) reveal a new aspect of the object, towards which our attention is deliberately or unconsciously drawn" (Schaeffer, 1966, p.94).

2.3.2   Schizophonia

The electrical revolution and electroacoustic music created an unique listening experience, schizophonia (Schafer, 1993).

This concept presents a counterpoint to Schaefferian (1966) views on sound reproduction and listening.

Schizophonia describes the split between original sounds and their electroacoustical transmission and reproduction. The twentieth century has given us the ability to dislocate sounds in time as well as space where once all sounds were originals and occurred at one time,

one place only and were consequences of the physical mechanisms that produced them (Schafer, 1993).

The composers of WSP distinguish schizophonia from the acousmatic situation noting listening without care for the contextual and symbolic associations of the original sounds creates a sonic "aberration" (Truax, 2008, p.104).

2.3.3 Chion's Modes of Listening

Pierre Schaeffer (1966, p.24) argues there are two perceptual activities, the *abstract* and *concrete*, which in turn could be an *objective* or *subjective* perception of reality:

1. The *abstract* reality is where "every notion of quality or relationship is considered in a more or less general manner without reference to any of its representations."
2. The *concrete* reality is the complete representation "as it is or could be".

The act of listening could also be divided in four different modes (Schaeffer, 1966), each falling into the aforementioned settings:

1. Listening, the *objective* act of listening to someone or something;

Establishing and identifying the *concrete* connection between the sound and its source.

2. Perceiving, passive listening.

Subjective information where listeners are not trying to understand the source or causality of *concrete* sounds but are merely struck by them.

3. Hearing, showing an intention to listen.

Connecting what we choose to perceive in order to make a *subjective* description, an *abstraction* of the experience.

4. Comprehending, grasping meaning(s) through *abstract* values.

Stripping the object to qualities by which we perceive meaning and representation, treating the sound as a sign through *objective* language(s) or code(s).

Michel Chion (1994), addresses that all of these modes of listening could be condensed into three, addressing them as *Causal, Semantic* and *Reduced* listening.

Causal listening is the most common mode of listening and usually provides supplementary information to visual stimulus. Although causal listening provides for the understanding of sound events or sources, it is easily deceptive, for it builds upon previously acquired knowledge or logic (Chion, 1994).

Semantic listening refers to the comprehension (Schaeffer, 1966) and interpretation of sound patterns or speech by means of spoken languages or codes, such as morse code, associating these patterns with meanings.

Reduced listening is focusing on the traits of the sound without regard for its contextual counterpart, it is the means by which we achieve *acousmatic* listening (Schaeffer, 1966).

Generally, human beings imprint meanings into the experience of listening (Schaeffer, 1966). By concentrating on the reduced listening experience and stripping sounds of their context, listeners convey vague words to describe sounds, such as *warm, cold, full or dull*.

Listeners have particular and shared perceptions when describing the experience of listening, for the act of *reduced* listening requires a certain amount of abstraction and subjectivity but also repetition, fixation and imprinting objective opinions and associations into the *sound object*.

2.3.4 Deep Listening

Deep listening was born from the evolving practice of listening by composer Pauline Oliveros (2005). It is the process of practicing active listening and engagement towards the continuous sounds from the soundscape.

The act of listening is voluntary, and hearing is not the same as listening, for the act of listening requires consciousness, an awareness to the stimuli, the retrieval of information and events. Hearing is the perpetuation of indifferent listening, to turn a "certain range of vibrations into perceptible sounds" (Sterne, 2003, p.96).

The practice of deep listening is commonly associated with meditation, for deep listening seeks for the expansion of our consciousness of sounds, and the connections between sounds and silences and all the perceptible vibrations (Oliveros, 2005).

Sounds carry rich acoustic and cultural information, for certain memories are triggered by sounds and evoke feelings and ideas. A narrow awareness of sounds is the consequence of a disconnection from the environment (Oliveros, 2005). The propagation of noise-polluted, low fidelity soundscapes propagates this detachment (Schafer, 1993), for human beings lose their sense of depth.

2.4 Soundscape Composition

2.4.1 Addressing the Aural Space

For R. Murray Schafer (1993), addressing our aural spaces through compositional approaches requires the understanding of three basic concepts:

- *Keynote* (sounds) is the musical tone, the key of the composition, the tonal root from which elements sprout around it. Keynote sounds shape the "behavior and moods (...) of a given place (...) outlining the character of men living among them." if even the key of the soundscape is listened to unconsciously (Schafer, 1993, p.9).
- *Signals* are foreground sounds, consciously listened sounds that normally represent some kind of warning or alarm. Bells, sirens and train whistles are some examples.
- *Soundmarks* are unique to certains communities and places, for they derive from the word *landmark* and are normally recognized by listeners used to its source.

When analysing the trends that followed soundscape composition over the years, we can delineate some very particular (and clear) stances behind aesthetics and conceptualization.

For researchers behind the WSP, soundscape composition regards itself with the artistic, sonic transmission of meanings about place, time, environment and listening perception (Westerkamp, 1999).

Truax (2008) states that for works to be considered soundscape compositions they need to address the topics aforementioned, for soundscape compositions shouldn't use environmental sound as material for abstract sound explorations only (Westerkamp 1999), adding that:

- Listener's recognisability of the source material should be maintained, despite subsequent transformations it may or may not undergo;

- Listener's knowledge of the environmental and psychological context of the soundscape material are invoked and encouraged to complete the network of meanings ascribed to the music;

- Composers should have a previous understanding of the environmental and psychological context of the soundscape material, allowing for the influencing of the shape of the composition at every level.

Ultimately the composition is inseparable from some or all those aspects of reality, so:

- The artistic work should enhance our understanding of the world and influence our everyday perceptual habits.

Sound spreads around and within the listening body, as well as across and within the body of the sound source. As it takes place, it also takes on the semantic connotations of the place, as an event in and of the environment (Solomos, 2014).

The goal for composers behind the WSP is that "soundscape composition is the reintegration of the listener with the environment in a balanced ecological relationship" (Truax, 2008, p.106).

While *acousmatic music*[3] and soundscape composition seek for the reinforcement of the "primacy of listening", they diverge on the matters regarding context, for electroacoustic music seeks to embrace the path of absolute abstractness, "whereas soundscape composition begins in complete contextual immersion and moves towards the abstracted middle ground" (Truax, 2008, p.107).

Soundscape (composition) studies progressed as electronic and recording devices were refined. Composers dealing with soundscape-based material explored the symbiosis between industrial and natural sounds through an extensive listening of the sounds of the world.

Although a representational perspective is indeed important for the safekeeping of our soundscapes, sound recording can't be simply representational, for recording is merely a creative asset and action (Cox & Warner, 2004 p.82).

Francisco López (1998, p.2) came to reject the strict conditional thinking imposed by *schaferian* "constraints". When conducting recordings for La Selva[4] in the Chilean rainforest, some sound sources remained sparsely hidden, fueling the acousmatic situation and a connection towards listening to abstract(ed) sound(s) captured by the microphones (Cox & Warner, 2004 p.82).

López (1998) is critical of the documentational approach of common nature field recordings and their relationship with the "sonic matter they are supposedly dealing with", for sound matter[5] should regard itself as a transcendental experience, freed from its representational constraints and "other non-sonic elements of the experience" of places (López, 1998, p.2).

In La Selva (López, 1998), sound-producing animal species appear together with other accompanying biotic and non-biotic components of the sound environment, there is no purposeful distinction of foreground/background, but a human centered listening experience to the sound environment as a whole, with regards to the position and properties of the microphones.

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[3] Acousmatic music is a form of electroacoustic music that is specifically composed for presentation using speakers, as opposed to a live performance. – www.en.wikipedia.org/wiki/Acousmatic_music Accessed on 01.02.19

[4] www.franciscolopez.net/rev10.html - Accessed on 01.02.19

[5] "I prefer the term matter to (sound) object. because (...) it better reflects the continuity of the sonic material one finds in the sound environments, (...) affirmed by the non-representational approach to sound recording." (López, 1998, p. 2)

In order to appreciate the richness of sounds from our surroundings, there's a need to endorse and continuously experience profound listening, shifting "the focus of our attention and understanding from representation to being." (López, 1998, p.2).

If technology enables new compositional approaches and music to come into existence, the development of the "texture of sound" (Eno & Korner, 1986) and new mediums of expression, supports the notion that art should be free from shackles that try to bind itself.

2.4.2 Spatialization

2.4.2.1 The Ambisonics Format

The artistic work and growing use of surround sound systems (must) reinforce new ways of listening in order to express the need for the appreciation of the rich sonic nuances of places.

The Ambisonics format codifies a soundfield according to its directional properties and height information, a complete full-sphere representation, enabling for the possibility to recreate and replicate physical properties of soundscapes and the movements of sonic elements within the environment (Ellen, 2001).

The resulting signal is traditionally called *B-format,* considered a three-dimensional extension of the mid/side stereophonic technique.

B-format is composed of four differently labelled channels:[6]

- *W* for sound pressure

The middle signal, in the M/S stereophonic technique.

- *X* for the front-minus back sound pressure.

- *Y* for the left-minus-right

The side signal in M/S.

- *Z* for up-minus-down.

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[6] This specification follows the traditional data exchange format for Ambisonics, the *B-format*. However, the traditional format is obsolete for its inability to adapt toward higher-order ambisonics, since the original *B-format* regarded itself with discretizing a sound field in its first order. In this case, the *Furse-Malham higher-order format* extends and corrects this deficiency. – www.en.wikipedia.org/wiki/Ambisonic_data_exchange_formats - accessed on 12.06.19

In opposition to conventional multi-channel systems, the ambisonics format is not channel/object based, for each and every speaker contains "virtually all the elements of the recording and work together to recreate the acoustic and ambience" of the original recordings or the compositional intentions (Elen, 2001, p.2; Arteaga, 2015).

The fact that ambisonics use "many of the methods of localization employed by the ear/brain combination to localize sound sources" (Elen, 2001, p.1) enables a more transparent, human-like reproduction/listening.

2.4.2.1.1 Higher Order Ambisonics

Ambisonic systems describe the soundfield using spherical harmonics.

The main complications about using traditional Ambisonics approaches are that basic versions can only "(recreate) an accurate soundfield at one central location." For an exact experience, listeners must be at positioned at the *sweet spot*[7], and as listeners move away from that geographical point, the resolution gradually degrades (Bamford and Vanderkooy, 1995).

By incrementing the order of ambisonics (and increasing the number of speakers), the resolution can be continuously enhanced, since the number of spherical harmonics is analogous to the increase of its representing order.

2.5 System Theory and Relationships

2.5.1 Ecosystems

The flow of energies in an ecosystem corresponds to the relationships between its agents (Musick, 2016). Ecology investigations look upon ecosystems as a larger part of a complex system. According to Remmert (1980), research on ecosystems is concerned with the "cycling of matter and the flow of energy" and the dynamics of ecosystemic, or interdependent, relationships.

Recent ecological studies emphasise individual-based models, a parallel to digital media or user-tailored algorithms in digital marketing and other computational systems which embrace this methodology and should be described as reductionist (Sarkar, 2014).

An ecosystem is an autonomous system composed of "nested[8]" autonomous systems: units that move "in their environments according to their inherent laws" (Nees, 2000, p.42),

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[7] "(…) a small usable listening area, or *sweet spot.*" – www.en.wikipedia.org/wiki/Ambisonics - accessed on 12.06.19
[8] www.kyma.symbolicsound.com/ecosystemic-programming-and-composition-part-1-2/ Accessed on 01.02.19

environments based around elements and their relationships, such as organisms, species and their surrounding environment.

Ecosystemic perspectives tend to move away from reductionist approaches, emphasising the structure of the whole as a complex but solid unit. As recognized by López (1998, p.1), "(...) a sound environment is not only the consequence of all its sound-producing components, but also of all its sound-transmitting and sound-modifying elements."

Studying individual elements is still important in order to understand the nature of processes occurring inside the whole. Nonetheless, systems are much more than a sum of individual bits and pieces and are, in fact, a result of the work of each element as well as the unique relationships between these individual elements (Musick, 2016).

When analysing the citizens interdependent networks within the city and among themselves, it becomes important to apply systems theory through *gestalt* principles (Von Bertalanffy 1968). Porto's soundscape is ultimately both part and whole of the complex systems of relationships between its agents. Establishing an order of events between shared realities, human and non-human action and experience creates a circumstance where sound is not an *object* (Schaeffer, 1966) and instead is always an event, the audible manifestation of these interactions (Solomos, 2014).

Systems interact between themselves and influence each other. This kind of relationship is called structural coupling (Miller, 2016). Structural coupling leads to self-organization, even though constituent elements of the autonomous system compete among themselves (Nees, 2000, p.43). This self-organization often results in a balance being found between all of the elements (Miller, 2016).

When analysing ecosystems, their inherent relationships and the harnessing of *sonic energy* [9] towards creative outputs, it becomes important to delineate certain concepts in order to grasp some fundamental system theories. Michael Musick (2016) defines the boundaries of the ecosystem as the first major concern when designing interactive music systems (IMS), for systems are generally surrounded by their natural boundaries, such as rivers, seas or landmass (Odum, 2013).

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[9] "Sonic Energy – The audible sound/music occurring in the installation space. Sonic energy is the sound or music in the space that can be acquired through microphones and converted to a digital representation for analysis by the digital system." (Musick, 2016)
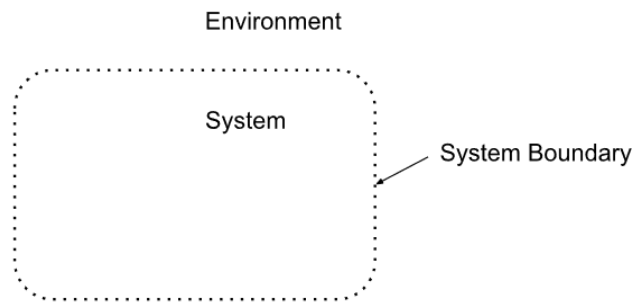
Figure 1: Example of a system within an environment (Musick, 2016, p.21)

There are two contrasting types of systems. Ecosystems are usually designated as *open systems*, for they require the input, output and flow of energy, mass, or information (Musick, 2016) within and outside its system boundaries as opposed to *closed systems* that normally do not require the interpolation of data into and from its surrounding environment.
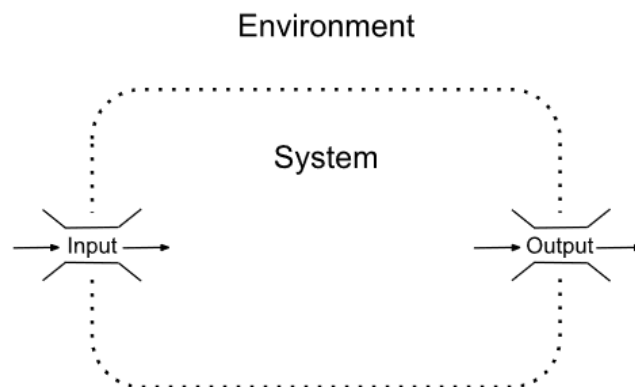
Figure 2: Example of an Open System that gets/gives energy/data from/to its environment (Musick, 2016, p.22)

It is intriguing to analyse systems when applying ecosystemic approaches to IMS. The understanding of the interactions and states between elements in their surroundings, and their goals are clear when abiding by the set of rules imposed by the programmer or the architect of the system, but it is up to participants (or performers) to modify the nature, or ambiance, of interactive systems.

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It is therefore necessary, to "clarify" (Musick, 2016, p. 26) systems in their periodic states[10], for states are different stages in which a system progresses. States can either be values of individual elements (and their variables) or the whole (Ashby, 1991).

Michael Musick (2016) establishes a taxonomy for the most common system states, illustrated in the figure below:
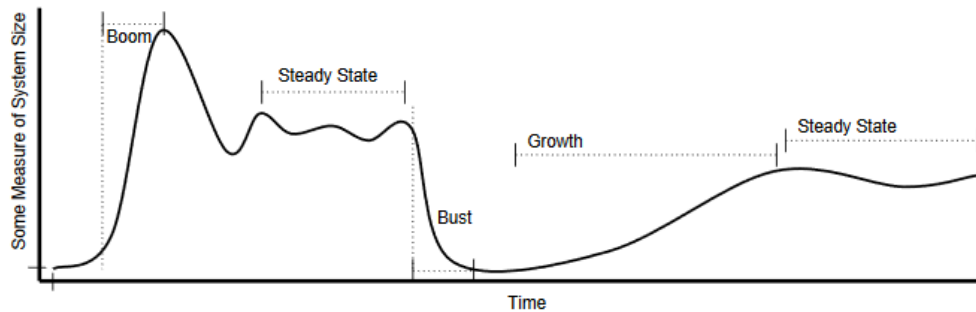
Figura 3:- The various system states (Musick, 2016, p.29)

- The *initial* state of a system is when systems are incapable of producing output or functioning during its initial stage. For example, initial states start with the grounding of rules (if in rule-based systems) of the agents and listing of the set of variables by the performer.
- *Growth & Decay* is when mass, information or any other measurable element, such as the amplitude of audio events, the increase in the number of discrete events and relationships occurring and consequently the number of information occurring in the system (Jørgensen, 2007) tends to grow and decay or fade over the progression of time and the specific nature and type of such growth.
- States of *boom* and *bust* are "reactionary states, typically created from a disturbance, excess, or unbalance".
  o A *boom* can be described as an unsustainable growth of any of the aforementioned information and are recognized by the rapid, exponential growth, followed by a general decay (Odum 2013).
  o *Busts* represent the rapid decay of such growth.
- *Steady* states are generally defined as a "balance" between elements.

When analysing the musical capabilities of systems and the tone of soundscapes, systems should be able to move between "states of stability or stasis and states of volatility as the system

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[10] A state of a system is its condition at a specific time, that is fully identified by values of a suitable set of parameters known as state variables or state parameters. - Adapted from thermodynamic states www.en.wikipedia.org/wiki/Thermodynamic_state - Accessed on 01.02.19

works towards re-establishing equilibrium[11]", for healthy systems should be capable of recovering from unexpected or extreme environmental changes (Musick, 2016).

2.5.2 Interactive Music Systems

Interactive Music Systems (IMS) are dedicated computational tools capable of reacting in real time upon changes in their external conditions, such as the input and control of data (Di Scipio, 2003).

I.e.: Generally speaking, data is set, changed and adjusted throughout the performance (or live presentation) by external or internal agents. By operating the available control devices, the agent has an equal opportunity to contribute information and thereby affect the state of one or more collaborating agents (Musick, 2016).

Human-agents provide sonic energy into the (eco)systems through their interacting sonically or simply listening to the systems, since their physical presence alters the acoustic properties of their surroundings, which therefore shape the musicality of the system (Musick, 2016).

The paradigm of human-computer interaction in arts allows for creators and audiences to reach the same level of contemplation and interactivity, and for growing immersion between all the involved entities, with participants reaching a more active and dominant stance towards the art panorama (Correa, 2017).

2.5.3 Applying an Ecosystemic Approach to Interactive Music Systems

An ecosystemic approach towards an IMS, such as an audio installation, places ecosystemic dynamics at the heart of soundscape composition. Ecosystemic systems are interactive music systems intrinsecaly linked to the physical space where they are set up, designed for a specific place.

These systems make use of microphones throughout their space in order to capture all sounds from its surrounding environment and have speakers return sound to the space (Musick, 2016). Real-time digital signal processing (DSP) interfaces are often used and implemented by composers to mediate interactions between the participants and the interface of IMS which have direct influence on the structure of compositions and outputting sounds from systems (Di Scipio, 2003).

The interactions and relationships of "sound-making agents in the space" and digitally programmed agents in a system are "reliant upon each other and affect the final experienced[12]" performances, for every agent creates sonic energy, transforms it and outputs it back into the ecosystem, in a way, establishing a feedback system (Musick, 2016).

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[11] www.michaelmusick.com/sonic_spaces_project/ - Accessed on 25-01-2019
[12] www.michaelmusick.com/ss5-it2/ - Accessed on 25-01-2019
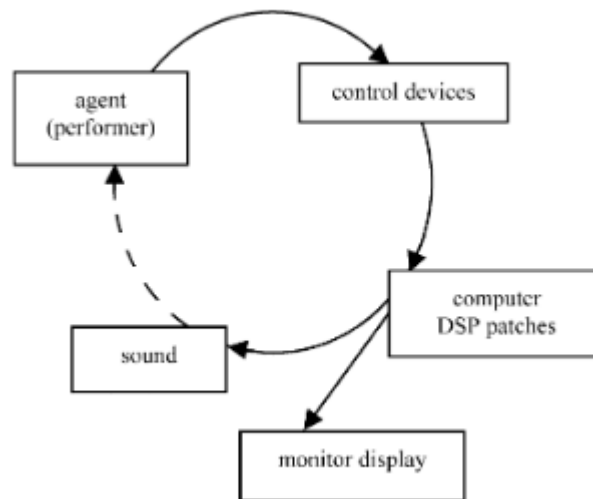
Figura 4: Feedback loop in interactive system design (Di Scipio, 2003, p.270)

Di Scipio (2003) states that IMS instigate the "inter-dependencies among real-time control variables" a shift "from interactive composing to composing inter-actions" (Di Scipio, 2003, p.270).

The inter-relations of ecosystems as models and frameworks for music compositional systems imply an ecological stance where "form is a dynamic process taking place at the micro, meso and macro levels". "It is not defined by the algorithmic parameters of the piece but results from the interaction among its sonic elements" (Keller p.58; Miller, 2016).

Miller (2016) concludes that "form and structure are intimately tied to the ambience of the actual space the music occurs in". [13]
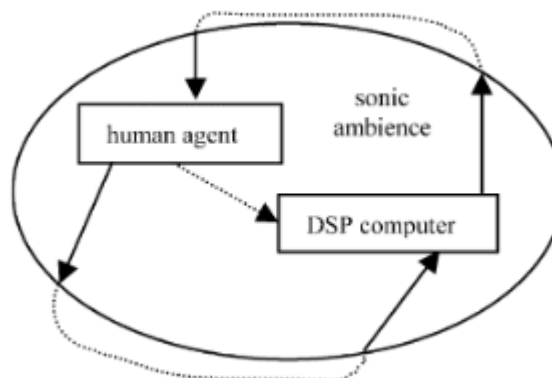
Figure 5: Ecosystemic connection of man/ambience/machine (Di Scipio, 2003, p.272)

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[13] www.kyma.symbolicsound.com/ecosystemic-programming-and-composition-part-1-2 - Accessed on 01.02.19

The aim of ecosystemic systems and compositions isn't to solely simulate "existing environmental phenomena", but to create "small audible ecosystems" that convey certain notions of internal structure and temporal unfolding for the development of the intended relationships between space and audience (Di Scipio, 2003, p.272).

The development of large-scale sound installations is the goal behind the basic notions of the *audible eco-systemic interface project* that represent the idea of "self-feeding loop designs" (Di Scipio, 2003, p.272), represented in the figure below:
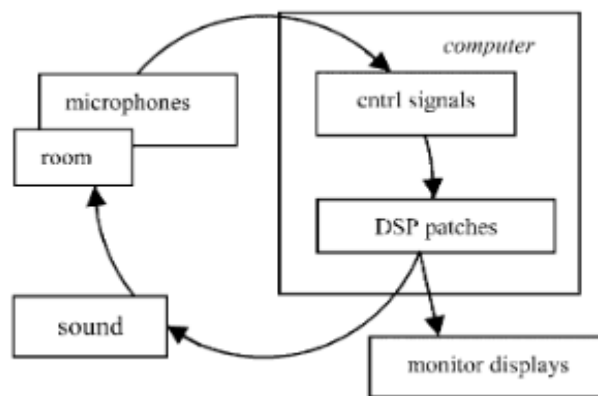
Figura 6: Basic design of an Ecosystemic System (adapted from the Audible Eco-systemic Interface Project, Di Scipio, 2003, p.272)

Di Scipio (2003) establishes a brief description of interactions/iterations occurring in an ecosystemic installation, adapted for the sake of this investigation:

- The computer emits some initial sound output through loudspeakers;
  - This sound is sequentially fed right back to the computer by microphones placed in the room.
- The computer then analyses the input signals from the microphones, extracting sonic information;
  - The extracted data is used to generate low-rate control signals and drive DSP processes.
- Microphone signals are matched against the original signal, and the difference-signal is calculated.
- The difference in numerical values between the original signal and ambient sound signals reflect the added resonances of the room, which in turn is used to adapt a number of signal processing parameters to the room characteristics.

Experiencing this interactive art forms is important for participants as they provide opportunities to "reconsider one's relationship to other systems through experience-based play[14]" and the engagement of the ecosystemic connection (Musick, 2006).

2.6 Related Work

2.6.1 Installations

In this sub-chapter, a review of related artistic work is made, presenting some artworks who make use of, rely or build upon sonic ecosystems and other IMS, digital cartographies and *acousmatic* experiences.

2.6.1.1   POLISphone[15] – Filipe Lopes

POLISphone is an application for music performance and was presented live at Sonópolis 2013 at Casa da Música[16]. The application enables for the creation and performance of *sound maps[17]*, specifically the sound map of Porto, mixing sonorities, sonic events, and field recordings from different parts of the city through the instrumentation of the surrounding sounds.
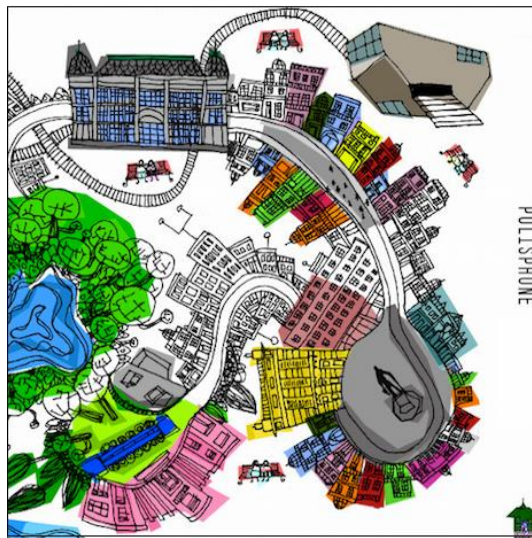
Figure 7: Overview of the POLISphone software

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[14]   www.michaelmusick.com/ss5-it2/ - Accessed on 25-01-2019
[15] www.filipelopes.net/ - Accessed on 01.02.19
[16] www.casadamusica.com - Accessed on 01.02.19
[17] Sound maps are digital geographical maps that put emphasis on the sonic representation of a specific location. -
     www.en.wikipedia.org/wiki/Sound_map - Accessed on 01.02.19

It was part of the educative service of Casa da Música, striving for social inclusion and involving young communities in music making through free software. By using daily sounds as means for creating rich compositions and music perfomances, Lopes intended for participants to become progressively aware and immersed in the importance of sound(s) in our daily lives (Lopes, 2014).

2.6.1.2   La Selva[18] – Francisco López

La Selva is an immersive experience created by the spanish artist and soundscape researcher, Francisco López and presented as a sound installation in 1998.

Listeners are immersed in the sonic environment of a tropical rainforest in Costa Rica and challenged to the exercise of *acousmatic* listening to (and through) the nuances of a day cycle of the forest ecosystem (López, 1997).

López (1997, p.1) intended for the "profound, pure, blind listening of sounds, freed (as much as possible) of procedural, contextual or intentional levels of reference." as a means to reaffirm the idea of concept of sonic objects as their own independent beings, but also as the elevation of their own biological (and physical) ties.

2.6.1.3   Control and Unpredictability (2013)[19] – Gustavo Costa

Control and Unpredictability was presented as a sound installation where the content of soundscapes and their geography and social embeddings, was the primary material for composition.

Compositions focused on promoting *acousmatic* listening, challenging the audience's reactions to sonic events outside of their physical entities and how repeated sounds can multiply in different aural interpretations and various sound artifacts.

Local sounds are transformed through audio processing and custom-built instrumentation, creating a sense of continuous (re-)appropriation and re-thinking of the sonic landscape.

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[18] www.franciscolopez.net/rev10.html - Accessed on 01.02.19
[19] www.gustavocosta.pt/works/cau/ - Accessed on 01.02.19

Figure 8: Control and Unpredictability @ ECOS//ECHOES #3, Lisboa 2013

2.6.1.4 Sonic Space No. 5 (2014)[20] – Michael Musick

Sonic Space No. 5 is part of an ongoing artistic project and investigation - defined as the Sonic Spaces Project (Musick, 2016) - inspired by the perceived relationships and energy transfer principles between the artwork and the audience. It aims at improving the concepts of sonic space ecosystems, open sonic interface, agents, interactive music systems, sonic energy and the role of participants.

Compositions strive to engage participants within their audible ecosystems with the aid of computer programming and site-specific installations that tackle experience-based art and interactivity.

Sonic Space No. 5 is an adapted 10-minute version intended for a fixed duration in concert presentation and performance. The performer introduces sonic energy into the ecosystem by using a pair of tingsha bells in order "to the wake agents in the system up", creating a sort of feedback-based system where agents respond to each other and integrate created sounds into the auditory array.

Figure 9: Sonic Space No. 5 @ International Computer Music Conference, Texas 2015

Audiences affect and transform the final composition through their physical presence and occasional sounds, changing the acoustic characteristics of the space, and therefore, the sonic ecosystem.

2.6.1.5   Scott L. Miller[21]

2.6.1.5.1   Ecosystemic Sound and Light (2015)

Scott L. Miller is a composer and sound artist whose works involves ecosystemic programming, an approach to treating a performance spaces as its own sonic ecosystem(s).

In *Ecosystemic Sound and Light*, sound objects respond in simple or complex ways to the behavior of all sounds in the environment, trying to establish a sense of balance in existence between the agents.

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[21] www.scottlmiller.net - Accessed on 01.02.19

Figure 10: Ecosystemic Sound and Light @ Montalvo Arts Center, Saratoga 2015

The ecosystem listens to the behavior of sound in the space via microphones. Data input decides through a set of rules on how to generate or process the sound in the space and how to introduce them into back the ecosystem with speakers.

Individual elements are in a constant state of awareness towards the existence of other agents, seeking balance, a delicate state of (co-)existence that can be easily manipulated or disturbed by the introduction of new sounds or the transformation of older sonic agents.

2.6.1.5.2   Sonic Augmented Reality – SonAR (2018)

The Sonic Augmented Reality (SonAR) explores the usage of smartphone-based music connected to the environment of its locale for artistic purposes. This connection is inspirational, logistic, and literal. The compositions stem around audio tracks recorded at St. Cloud State University, Minnesota.

Each track revolves around synthesized sound created with the sound design software, Kyma. Compositions are experienced through an application that includes the musical tracks and a map of the campus. Listener's physical position is feedback into the application and the according to synthesized sounds are played back.

SonAR blends the actual, on-site, soundscape with the composed tracks. As such, headphone usage is encouraged to enhance the artistic capabilities of sounds.

As the listener navigates around campus, GPS tracking compares the phone's location toward pre-allocated virtual speaker locations, the original tracks are dynamically adjusted in their amplitude capabilities, considering the proximity of the participants.

2.6.1.5.3   Lições dos Antepassados (2011)[22] – Steve Peters

Lições dos Antepassados (Lessons from the Ancestors) is a journey into the author's portuguese roots and to the roots of remote villages in countryside Portugal.

The installation recreates the mountainous soundscape, its environmental sounds, small chapel ambience, scenery and evokes the names of the region's human ancestors and its flora and fauna, creating a " resonant chamber(s) for the soul of the community."[23]

Figure 11: Lições dos Antepassados @ Capela de Nossa Senhora de Conceição, Nodar 2015

Lessons from the Ancestors was a multi-channel audio installation based in Capela de Nossa Senhora de Conceição at Nodar aimed at preserving impactful memories of sounds and their communities through the "constant meditative flow of the words and the winds".

2.6.2   Soundwalks

A *soundwalk* exposes our senses and our ears to the sounds of our surroundings through a counscious walk or stroll (Schafer 1997). It's a journey whose main goal is to take part in an active listening of the surrounding environment (Drever, 2009).

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[22]   www.spsoundart.com/lies-dos-antepassados/ - Accessed on 01.02.19

[23]   www.thestranger.com/slog/archives/2013/11/01/currently-hanging-days-of-the-dead-lessons-from-the-ancestors   - Accessed on 01.02.19

Soundwalks have been branching into new approaches and variations, among them appeared the concept of audiowalks, distinguished by its reliance on technological interfaces, potentiated by digital mediums (Hollerweger, 2011).

Several sound artists have been making efforts to connect technology-mediated experiences to active listening. The Global Positioning System (GPS) is a lead actor in facilitating the integration of user's data into digital soundwalk practices (Gonçalves, 2016).

The concept of the interactive sound map (*soundmap*) sprouted from the intersection of a variety of artistic fields of study - sculpture, acoustic ecology and sound art - in the late nineties:

> "New mapping technologies like Google Maps[24] and social media websites (…) have significantly impacted how sound maps are developed and understood; so have licensing agreements including Creative Commons "Share Alike", [25]permitting people to freely share media including audio recordings, with right to copy, distribute, transmit and adapt the recordings for non-commercial purposes if they are credited to the author and attributed in the manner the author or license specifies." (Ouzounian, 2014, p.164; Gonçalves, 2014).

The development of aural consciousness for the integration of listeners in their sounding spaces is reinforced in *soundwalk* literature. This dissertation aims to work upon these concepts, as such, scrutiny of relevant projects and artistic works are made in the following sections.

2.6.2.1 Janet Cardiff

Janet Cardiff is a Canadian artist whose main body of work revolves around installations and *soundwalks*. Cardiff explores the capabilities of sound as a medium for unraveling powerfull narratives through sonic voyages. As an artist, Cardiff relies on the synergies between sound, presence and movement as tools for creating diverse and deeply personal experiences, blending unconventional means of storytelling.

2.6.2.2 Ittigen Walk (2002)[26]

Ittigen Walk deals with the profound impact of silence by presenting visitors with the isolated monastic lifestyle of monks at the Kartause Ittingen historical museum.

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[24] www.maps.google.com – accessed on 10.06.19
[25] www.wiki.creativecommons.org/wiki/Share_Alike - accessed on 10.06.19
[26] www.cardiffmiller.com/artworks/walks/ittingen.html - Accessed on 01.02.19

Silence is deafening. By mixing the atmosphere of the museum with a fictional narrative of a broken-hearted lover, the author explores the heaviness of silence and its resonation on the listeners minds.

Figura 12: Ittigen Walk @ Kartause Ittingen Historical Museum, Zürich 2002

2.6.2.3   Jena Walk (Memory Field)[27] (2006)

"A walk is an act of contemplation" (Cardiff, 2006).

Jena Walk is described as a journey on the memory fields, where participants walk through a countryside landscape while unfolding its historical and geographical richness, where 200 years ago Prussian and French forces battled.

Time is an asset, for sound effects from battles scenes immerse the visitors on the intricacies of slipping "from one century to another" (Cardiff, 2006) as they walk and listen to all of the sounds of nature and to the narrative.

2.6.3   Investigation Groups

This sub-chapter presents some organizations and investigation groups with a focus on promoting and augmenting humankind's connection with their aural spaces.

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[27] www.cardiffmiller.com/artworks/walks/jena - Accessed on 01.02.19

2.6.3.1   EcoSono[28] (2012)

EcoSono aims at cultivating close and productive relationships between people and the places they inhabit through experimental innovative sound art and environmental preservation.

The order of operations of the organization is the following:

- An institute for the study of ecoacoustics, environmentalism and music
- Endorsing or sponsoring performances, lectures, and other forms of performative culture-environment engagement
- Publishing artistic multimedia work.

2.6.3.2   Manobras no Porto [29](2011-2012)

Manobras no Porto was a series of events and ideas born from and for the Historical Center of Porto (HCP) throughout 2011 and 2012. The key concept and motivation behind this project placed inhabitants of the HCP and its visitors as social, cultural and creative agents for the regeneration and connection with the city centre.

Manobras manifesto tackled a couple of topics that intended to create harmony between people, their place and time, grounding studies and living on "narrative, anthropological, geographical and emotional[30]" fields for the arousal and nurturing of culture growth, as opposed to strictly economic views.

2.6.3.3   Porto Sonoro[31] (2010-2012)

Porto Sonoro was an investigation group that aimed to record, document, catalogue and recreate the soundscape of the Historical Centre of Porto (HCP) with the coordination of Gustavo Costa (2012)[32].

Data was stored in an online database and serves for the continuous research of HCP, creating a digital sound cartography of Porto with the focus on field recordings that not only document the aural cityscape[33] but focuses on the identity and musicality of sounds and sound events, especially on dialogues and expressions between its citizens and their surroundings.

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[28] www.ecosono.org - Accessed on 01.02.19

[29] http://futureplaces.up.pt/manobras/livro_manobras.pdf - Acessed on 24.07.19

[30] www.futureplaces.up.pt/manobras/livro_manobras.pdf - Accessed on 01.02.19

[31] www. portosonoro.pt - Accessed on 01.02.19

[32] www.portosonoro.pt - Accessed on 01.02.19

[33] In the visual arts a cityscape is an artistic representation, such as a painting, drawing, print or photograph, of the physical aspects of a city or urban area. It is the urban equivalent of a landscape." – www.en.wikipedia.org/wiki/Cityscape - accessed on 06.02.19

2.6.3.4   Phonambient[34] (2014)

Phonambient is an ongoing investigation and artistic work that explores the contemporary sound panorama, born from the ramifications and research conducted by Porto Sonoro. It seeks to record and preserve in a digital database the sound(s)scapes of specific worldwide regions through local research and recording teams.

2.6.3.5   Sonic Explorers[35] (2012)

Sonic Explorers is a global organization focused on engaging and nurturing relations between young people and the natural world through sonic exploration. Creative projects aim at facilitating the access to teachings of acoustic ecology, field recordings, bioacoustics and sound art across the globe to raise awareness on humankind's impact on its geophony.

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[34] www.phonambient.com/ - accessed on 01.02.19
[35] www.sonicexplorers.org/about.html/ - accessed on 06.06.19

3. Implementation

3.1 Porto as Source, Meaning and Message

The primary focus when implementing this dissertation was recognizing events, patterns of interaction, and relationships between the cultural agents of Porto in order to understand the transformations happening in its communities.

The Historical Centre of Porto is a hub to all that is new and all that is old, home to people from varied social backgrounds, as such, it was delineated to be the central figure of this investigation, for each transforming agent converges towards itself. For its historical value, we decided to narrow down the recordings into Sé and Fontainhas, later encompassing the Dom Luis II bridge area.

The bridge has a symbolic value, it connects two distinct but similar cities. Two cities intertwined by their shared cultures and experiences. Akin to the bridge, aural landmarks must connect all the sonic agents at play and allow for each of them to ripple across the plane waves. Soundscapes are shared experiences and collaborative compositions (Schafer, 1997). The interdependency between all the composers at play in creating the musicality of sonic spaces is transparent in their everyday outcome.

The richness of sonic environments is the cultural transmission of meanings about everyday activities.

A total immersion in the aural space was required, and so, a series of successive field recordings were made to harness the surroundings for its dynamic reconstruction.

The practical component of this investigation revolves around the exploration of the sonic density of the HCP for the reintegration of listeners in the evolving soundscapes.

The development of an audio installation prototype suggests the approximation between individuals and their recreated sounding landscapes as a place of meditation through interaction.

3.2 Recording the Historical City Centre

3.2.1 Field Recordings

In order to proceed with the field recordings, I adapted the practice-led research/research-led practice methodology into the wandering approach. This exploratory method allowed me to clearly delineate a practice in its progressive stages.

In order to grasp the soundscape and its cultural transformation and evolving nature, I first needed to comprehend it. I applied a cyclic approach of exploring, listening, documenting, and recording that led me to acknowledge the most sonically interesting areas, among the choosen zones, and plan the recordings.
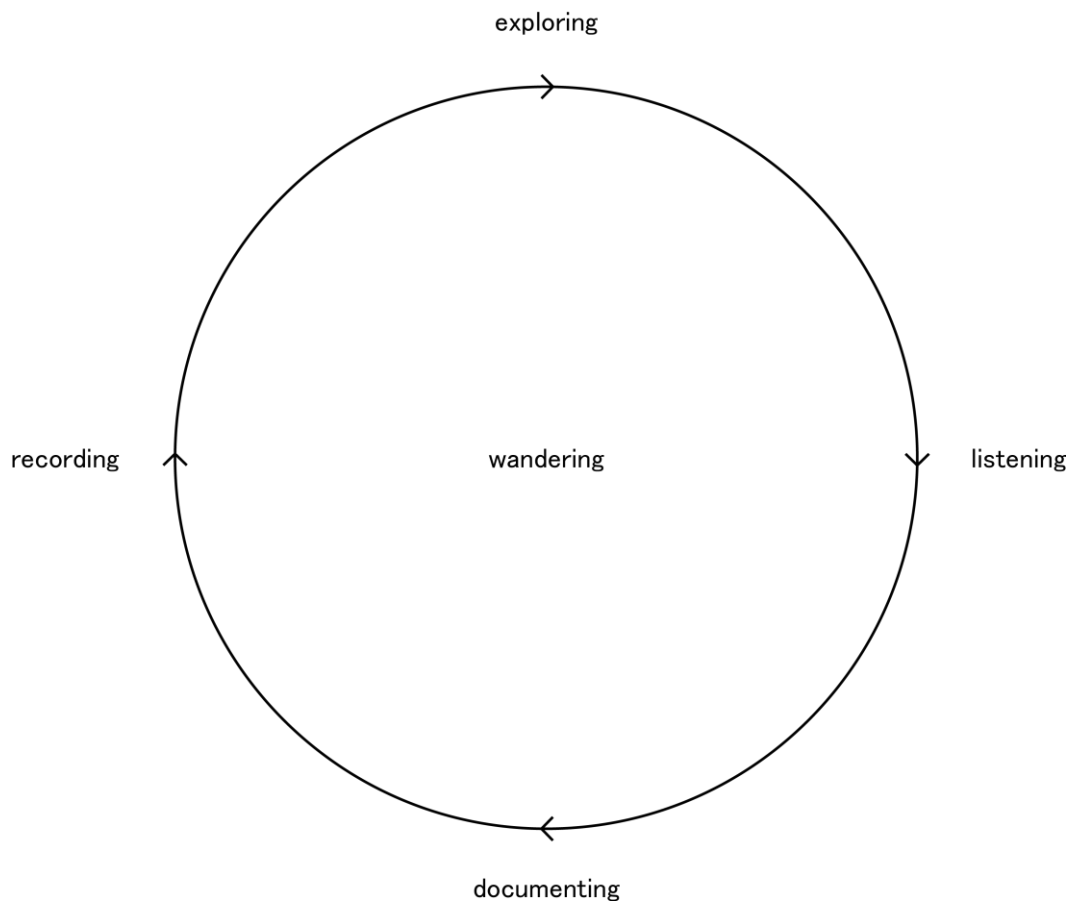
Figure 13: The Wandering Approach

The following material was used for the field recordings:

- Zoom H5

- Oktava MK 012-01 MSP2 Pair

- AMBEO VR Mic

- Sound Device MixPre-6

- Rycote's Cyclone Windshield + Tripod

- Sennheiser HD6 Headphones

Different methods and techniques were used in the different stages of the recordings. Initially, stereo approaches were predominant with a focus on the usage of the AB and XY stereophonic techniques for the capture of panoramic sonic movements in the field.
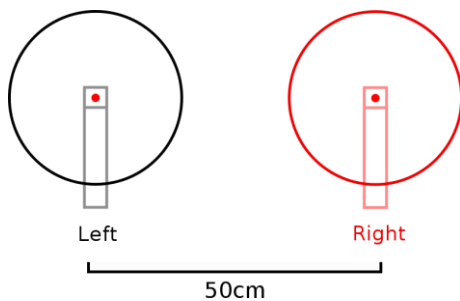
Figure 14: The AB stereophonic technique
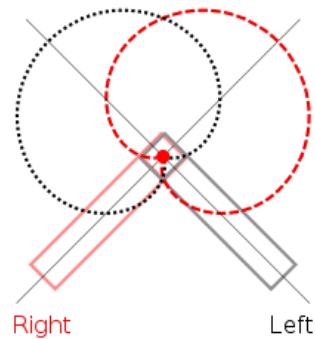
Figure 15: The XY stereophonic technique

As the recordings proceeded, there was a need for a more accurate depiction of spaces and a broader depth of field.
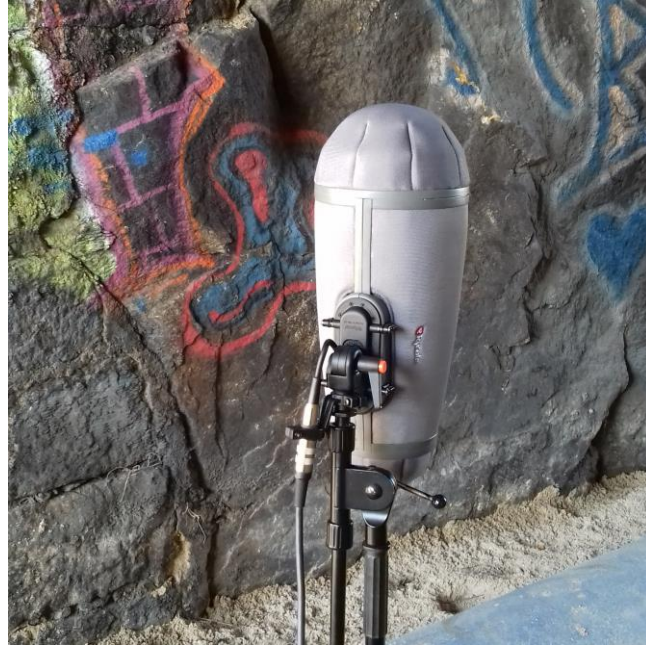
Figure 16: Ambisonics Kit

Ambisonics recordings in A Format[36] were implemented to gather a raw representation of sounds in their horizontal and vertical planes. Decoding from A to B format replicated the full 360º sphere sonic perception and simulated the ubiquitous presence of sounds.

3.2.1.1   Sé and Guindais

Sé, and the Stairways of Guindais in particular, always fascinated me as the nerve center of popular activity. It's a concentrated zone bursting with life, shrinking year after year due to the speculative real-estate forces that keep on stripping families from their living places.

Local costums keep resisting this trend, however, as the communities still come together and celebrate life, gathering for the local festivities.

It was joyful to keep revisiting the Stairways of Guindais as the recording sessions progressed. It was usual to find people on the autumn part of their lives discussing the latest family gossip by Guindalense, the old local café, the center point for younger people, tourists and old locals alike.

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[36] A Format is the raw format of the recording using four individual cardioid capsules in the ambisonics microphone, it is specific to the microphone model. The B format is a standardized format derived from the A format, where the first channel carries the the amplitude information of the sound signal, while the other channels determine the directionality through phase relationships between each other. – Adapted from https://postperspective.com/vr-audio-differences-format-b-format/ - accessed in 27.06.19

The fact that Guindais are hidden inside the big urban center just adds to the experience. This small part of land preserves relationships that are slowly fading away in Porto.

Figure 17: Batalha, Sé.

The sonic dimension is dense, highly populated by several elements; interesting to dissect.

Among the previously stated families that always made their life on those steps and the regular flocks of tourists, the stairways unravel its nature precisely how it is: a patrimony of the old and new living side by side.

3.2.1.2   Dom Luis I Bridge

The bridge is famous among tourists strolling along the bridge's walkway, seeking the vast views across Porto's skyline.

Dom Luis I bridge were mostly recorded during nighttime, hoping to uncover another type of ambiance that contrasted with the noisy, crowded one amid daytime. During nightfall, sounds had a clear purpose, the recordings could distinctly perceive sounds in their time, space and movement.

A great number of panoramic sounds were recorded. Among them, the sounds of people wandering about, a blend of locals and tourists from a variety of backgrounds. Generally, these tourists were of Brazilian, French or German origin, in contrast to the Asian atmosphere that was heard throughout daytime.

Figure 18: Dom Luis I Bridge seen from Passeio das Fontaínhas

As the field recordings took place at the beginning of spring and lasting until the middle of March, there was some interesting weather, setting the tone for a chillier ambiance.

A lot of interesting effects were captured from the bridge's steel structure, such as sneakers squealing in the pavement of the bridge, the metro roaring from left to right and the generally grim mood from a cold, windy place.

The bird population was notably active during nighttime. The greater part of the recordings had the call of seagulls demarcating their presence quite loudly throughout sessions.

3.2.1.3   Fontaínhas

In contrast with other zones at Sé, Fontaínhas was a sparsely populated zone, mostly because of its greater size. Its soundscape, although, was similar in places to the sounds of the Stairways of Guindais.

Recordings sessions were mostly with the Ambisonics Recording Kit in order to experience the location and its larger encompassing field.

Some observations were made regarding the predominance of high-intensity sounds: Airplanes and helicopters regularly inhabited the skies; the local school occasionally buzzed its bell along with the yealling of school kids; the old train went along its tracks and the horns of passing by cars never grew tired.

Construction work was also noted around these parts, as local rehabilitation efforts tended the houses along the slope underneath Passeio das Fontaínhas.

Figure 19: Neighborhood in Fontaínhas

The resonance of people who live there was often masked by their distance from the recording setup, however, when they got close enough and even interacted with me, I was able to capture some interesting conversations.

I noticed that Fontaínhas was a place the young, younger and elderly meet and come together. I was able to record a fierce football match and a heated conversation between a grandmother and her granddaughter.

I spent a lot of my time there trying to catch people in the old community laundry tanks but failed miserably.

There was an incessant calmness in the torrid afternoons spent visiting the abandoned train tracks. The further I got across Fontaínhas, I felt that sounds could reverberate athwart the space and into my eardrums.

There were also sounds exceptionally well contained in their physical surroundings, generally discrete sounds that forced me to move incessantly across the field looking for them.

Figure 20: Abandoned Train Tracks at Encosta das Fontaínhas

Sounds from nature were discernible among the abandoned green spaces along the hillsides, carrying a sense of the serenity I was searching for after long weeks of field recording noisy environments.

3.2.2 Sound Cataloging

Sound cataloging began by dividing and documenting sounds according to their acoustic sources, assigning them into the corresponding soundscape:

- Biophony: the biological sounds of Porto, the natural fauna that still lingers in the city centre.

Krause (2008) notices the aural interdependence of vocal organisms in certain biomes, suggesting the possibility that creatures that inhabit the biophony "may be vocalizing some unexplainable relationship to one another" (Marten, 1977), resembling the goal of this investigation. This approach attempts to implement and resemble this interdependency towards the sounds of the anthrophony, and the inter-reliability between human relationships that depend on each other.

Most of the biological sounds of Porto were those of birds and their tunes. A huge predominance of house birds contrasted the usual domination of open-air spaces by seagulls, who loudly pronounced their activities.

Implementation

Other biophonic scenary were of those of dogs, especially while boisterously barking.

- Geophony: natural sounds from non-biological sources – wind, water, weather and geophysical forces.

Since the HCP is geographically close to Douro river, some sources were arranged en route to their geophonic causality. The wind was chosen as a linear conductant between ambiances; Watery sounds demarcated the proximity toward chillier environments.

- Anthrophony: human-generated sounds.

Human-produced sounds usually reflected those of conversations and everyday activities, documented accordingly. Most of the produced human samples were those of elderly people, casually bickering about life; local tourism mixed with foreign tourism; young people in groups; a great number of laughings, screams, and whistles.

Mechanical sounds were assimilated into their causality, movement, and geographical source. Sounds from construction work were sampled and documented according to the perceived activities, such as heavy materials being lifted or falling, beeps from heavy machinery and other local reconstruction work sounds.

Most of my fascination with field recordings occurred when discovering new possibilities of sounds while listening to them on a frequent basis. I worried, at times, about how I was progressively invading people's privacy by recording their daily lives and the conversations they had with each other. What eased my mind along the way was the enchanting nature of experiencing all these sounds over and over again. Even during the frustrating task of editing sample after sample.

Recording all these surroundings made me realize that all sounds had a unique essence, a life of their own. Sounds had a purpose, even the most randomly produced ones, and every sound spoke of its story.

I realized that not only was I building narratives, but that I was creating a middle ground for people to express their own; their struggles, their disappointments, their joys, and interests.

Field recordings are (and were) but a medium, an initial step, towards integrating people with their surroundings, and in producing and disseminating (their) culture.

A selection of the richer sonorities was made, considering the maximum representability and musicality of the recorded sounds of the HCP. In summary, 250 samples were selected, edited and treated digitally for maximum sound clarity.

- 157 samples came from Sé/Guindais area;

- 61 samples from Fontaínhas;

- 15 samples from Dom Luis I Bridge;

- 12 samples from Jardim do Morro in Gaia;

- The remaining 5 samples from the area around Sé church.
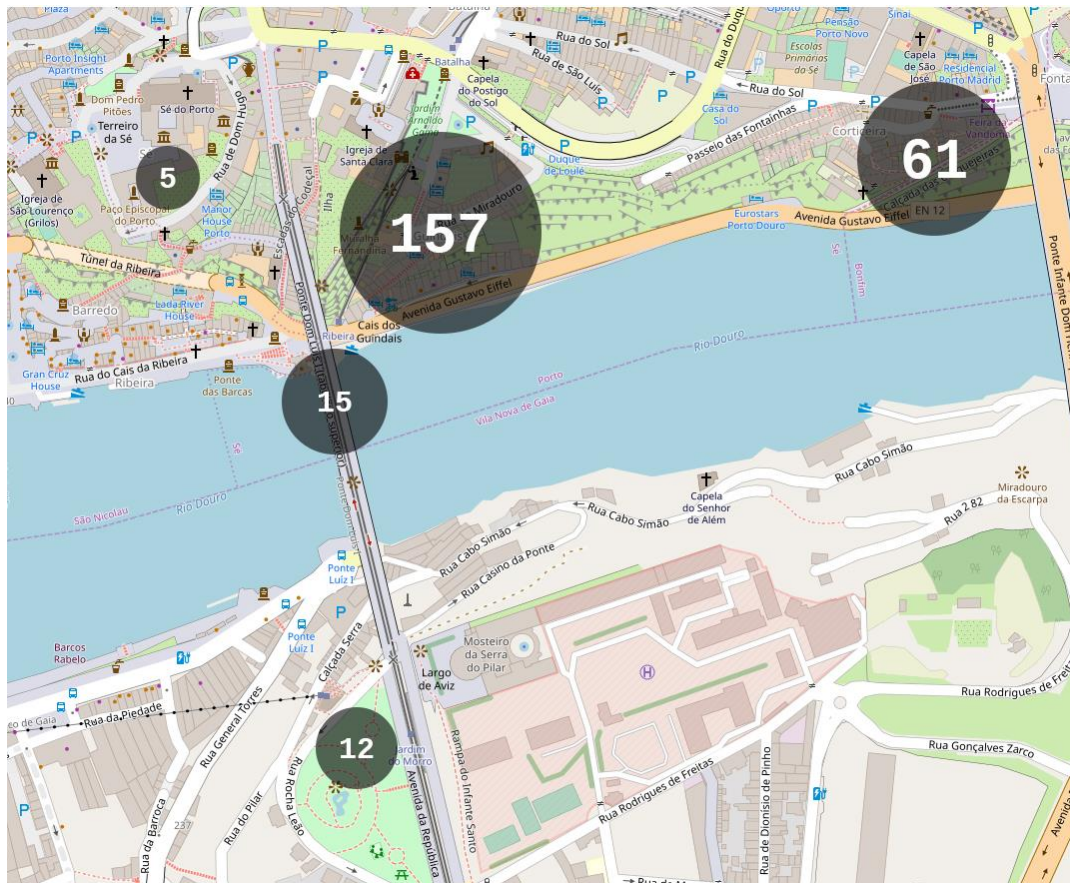
Figure 21: No. of Samples Gathered and their Geographical Sources[37]

Several sound design techniques were used when treating acoustically or piecing together the chosen samples of The *Aural Cartography*, among them:

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[37] www.openstreetmap.org/#map=17/41.13989/-8.60622 – accessed on 10.06.19

- **Editing**

  o For linear and non-linear narratives.

- **Filters**

  o Dynamic low-pass or high-pass filters.

- **Transitions**

  o Audio Fades and Crossfades.

- **Track Envolopes/Automations**

  o Panning, Volume, Width and EQ.

- **Mixing**

  o Compression, Delays and Reverb.

- **Mastering**

  o Equalization, Leveling.

3.3 Designing Interaction

In this sub-chapter, the development of the practical experience/experiments is described, delineating the practice-led approaches that were tested along the way, through programming an interactive music system that recreated the soundscape of Porto and the ecosystemic relationship between participants/computer/surroundings.

3.3.1 Learning Through Experience

All the pragmatic development of the sonic ecosystem was entirely conceptualized, planned and programmed in Max, using several DSP processing, synthesis, transformations, and other algorithmic approaches.

Max (or Max/MSP) is a visual programming language for music and multimedia created by Miller S. Puckette[38], currently developed by Cycling '74[39]. It's been the industry standard for the last couple of decades and is used by composers, performers, software designers, researchers, and artists and media artists alike to create recordings, performances, and installations (Sheffield, 2015).

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[38] www.msp.ucsd.edu/ - accessed on 10.06.19
[39] www.cycling74.com/ - accessed on 10.06.19

The practical approach was initially divided into three big processes, corresponding to the independent Max patches:
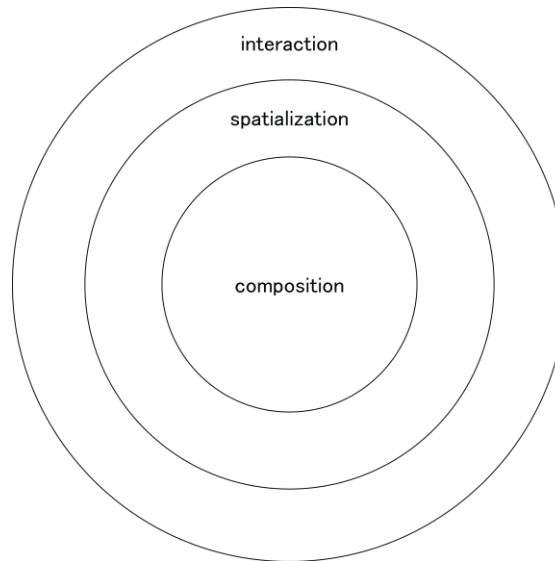
Figure 22: A circular diagram showcasing the stream of processes, the transformations, and their interdependence between one another.

- The Composition Patch
  - Manages everything related to creating the sonic ecosystem (sound related algorithms).
- The Spatialization Patch
  - For rendering and transforming sound fields
- The Interaction Patch
  - Handles all communication between users and the system.

All these patches were condensed into one general patch in the later stage of the investigation, named *The Aural Wanderer.*

3.3.1.1 Higher Order Ambisonics

The first practical approach explored the use of the Higher Order Ambisonics[40] externals in Max/MSP, in order synthesize, transform and render the designed sound fields.

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[40] www.hoalibrary.mshparisnord.fr/en - accessed on 12.06.19

HOA decomposes the sound field in the polarities of different microphones, called spherical harmonics. Although somewhat complex at times to understand, these externals allowed me to implement interesting transformation processes in the soundfields, by concentrating or dispersing sonic energy dynamically through soundfield synthesis (Sèdes, 2014).
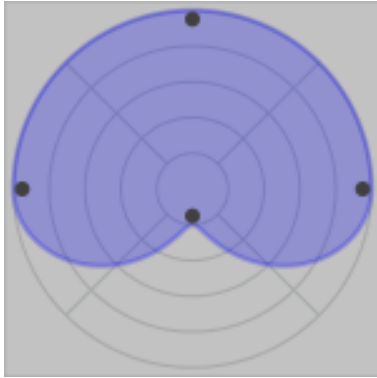
Figure 23: Recreation of a Cardiod Microphone Polarity
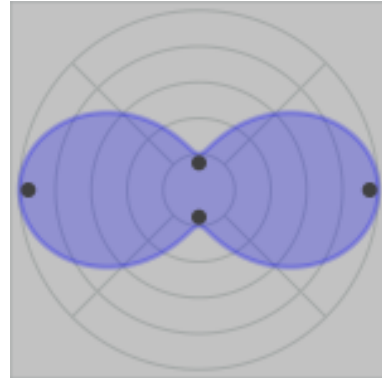
Figure 24: Recreation of a Figure-of-eight Microphone Polarity
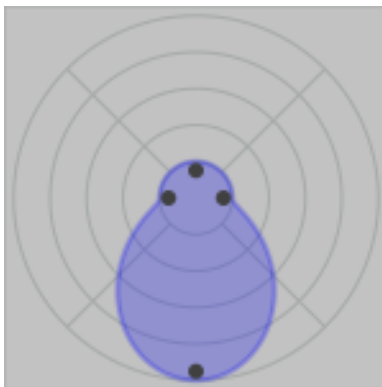
Figure 25: Recreation of a Shotgun Microphone Polarity
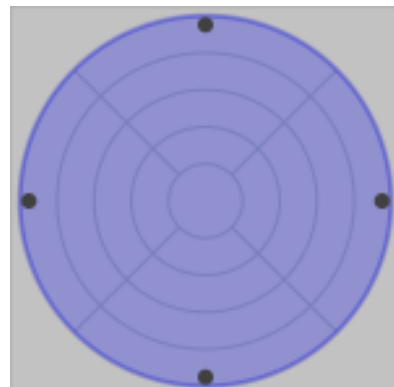
Figure 26: Recreation of an Omnidirectional Microphone Polarity

Other ambisonics-related transformations are possible, like DSP. Transformations and soundfield synthesis are generally aided by graphical interfaces. In the figures above, I

performed a series of perspective distortions and spatial filtering techniques, by simulating the polarity of commonly used microphones.

Figure 27: *hoa.2d.projector~* discretizes the ambisonic soundfield into the plane waves domain.

Figure 28: *hoa.2d.recomposer~* recomposes a plane wave decomposition into circular harmonics.

These multichannel processings are implemented in the outcoming soundfields, establishing *virtual microphones*[41], by creating areas of retraction/expansion – using the *hoa.gain~* [42] object – for concentrating sonic energy in different ways.

In order to apply the aforementioned transformations, the encoded signal must first be discretized into the plane waves domain and then recomposed into circular harmonics, in order to successfully apply the processing transformation and render the soundfield.

The conceptualized techniques aimed to resemble the spans, planes of attention or the capability of perceived focus by applying sound capture approaches. A clear example of this concept is that of a boom operator or sound recorder choosing which kind of microphone to use, and how he uses them for recording whatever task or setting he is presented.

The application of *virtual microphones* proved difficult to pursue and employ in the plane of user interaction. The graphical interface was difficult to work with, to adapt to the dynamic interpretation of expansion/retraction and connect with external touch interfaces via OSC.

Other practical approaches needed to be pursued from here after.

3.3.1.2   Devising the Microscope/Kaleidoscope Approach

The last couple of rounds of field (re)recording(s) brought a breath of fresh air and cleared some of my doubts concerning the practical development of the generative ecosystem.

I started narrowing down the approach into something me and my co-supervisor referred to as the Microscope/Kaleidoscope interaction. Instead of having the rendered sonic output be processed on a spatial level to replicate the perceived sense of proximity or distance, these processes began on the compositional level, iterating cyclically during the lifespan of the ecosystem.

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[41] "The B-format components can be combined to derive *virtual microphones* with any first-order polar pattern (omnidirectional, cardioid, hypercardioid, figure-of-eight or anything in between) pointing in any direction." – www.en.wikipedia.org/wiki/Ambisonics - accessed on 12.06.19

[42] "Hoa.gain ~ is a multichannel gain manager." – HoaLibrary Overview – accessed on 12.06.19

The M/K interaction allows participants to dissect pieces of the ecosystem, exploring the sonic density on a smaller – microscopic - level or on a wider, crowded plane; the kaleidoscope counterpart.

Participants could then transform the ecosystem by choosing what and when to hear and reinforce the chosen ambiances by lingering in certain spaces or aspects. This type of experience mirrored a *soundwalk* application.

3.3.1.3 The Nodes Object

The nodes objects in Max interpolates data graphically on a bidimensional plane, creating regions populated by nodes that have their own spheres of incidence/influence, calculating the distance between each of the node points.
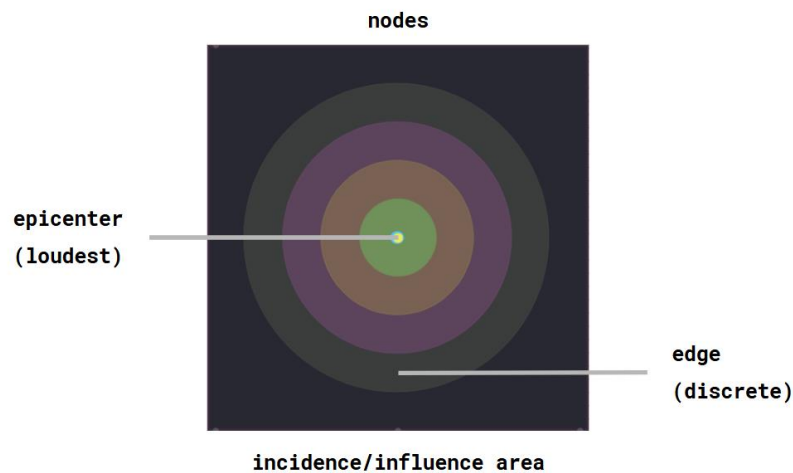
Figure 29: An overview of the nodes object and amplitude modulation

A knob is responsible for controlling the playback volume of each node. It performs this task by combining the interpolated weight of each node into a list and feeding it into a slider that sends a float value of 0. to 1. The value changes according to the distance from the epicenter of the node.

Multiplying both signals creates the perception of distance through amplitude modulation.

In order to create a dynamic interpretation of wandering about the bidimensional plane, I decided to feed the X and Y axis values of the Knob - named *Wanderer* - via an external OSC-based interface called OSC controller[43].

The chosen application uses the OSC protocol for communicating with Max and has a 2d slider mode set-up with the same values of the cartesian plane at the nodes object. Moving the white square below performs amplitude modulation of the sonic field.

Users can navigate across the sonic density of the plane, experiencing the soundscape in its recreated depth of field.
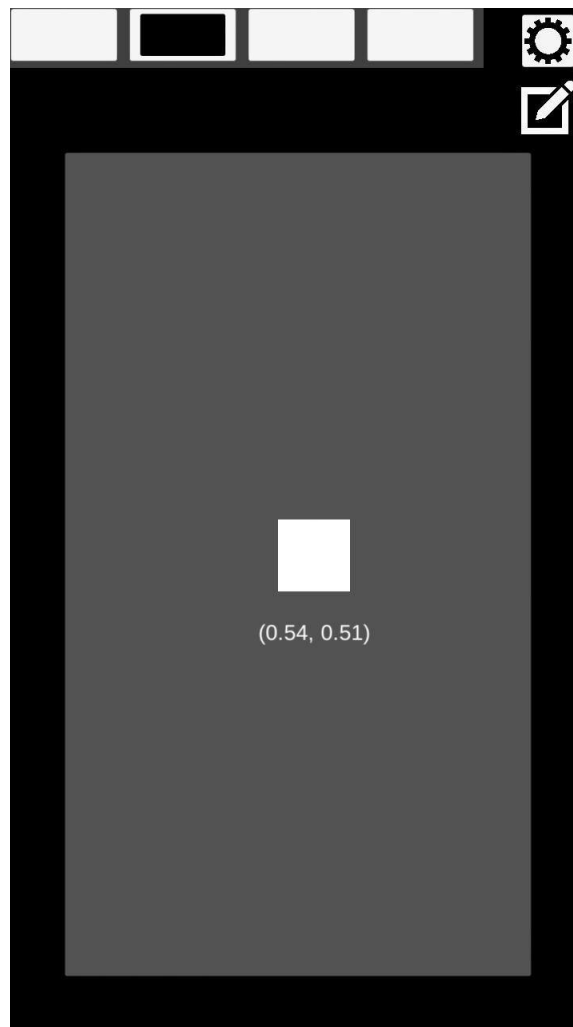
Figure 30: A screenshot of the Interface's GUI and the *Wanderer*

By arranging these nodes on a two-dimensional plane and creating controlled amplitude modulation through a knob that runs through the space, I was able to create a kind of *soundmap*.

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[43] www.play.google.com/store/apps/details?id=com.ffsmultimedia.osccontroller&hl=en_US – accessed on 12.06.19

This approach proved fruitful has it matched the concept of M/K interaction and arranged agents across their zones of influence in their ecosystems.

3.3.2 The Aural Cartography

3.3.2.1 Establishing the Atmosphere

The interactive ecosystem began by establishing a cartography of soundscapes of the HCP. The previously recorded zones of Fontaínhas, Guindais and Dom Luis I Bridge were assigned zones on a bidimensional plane.
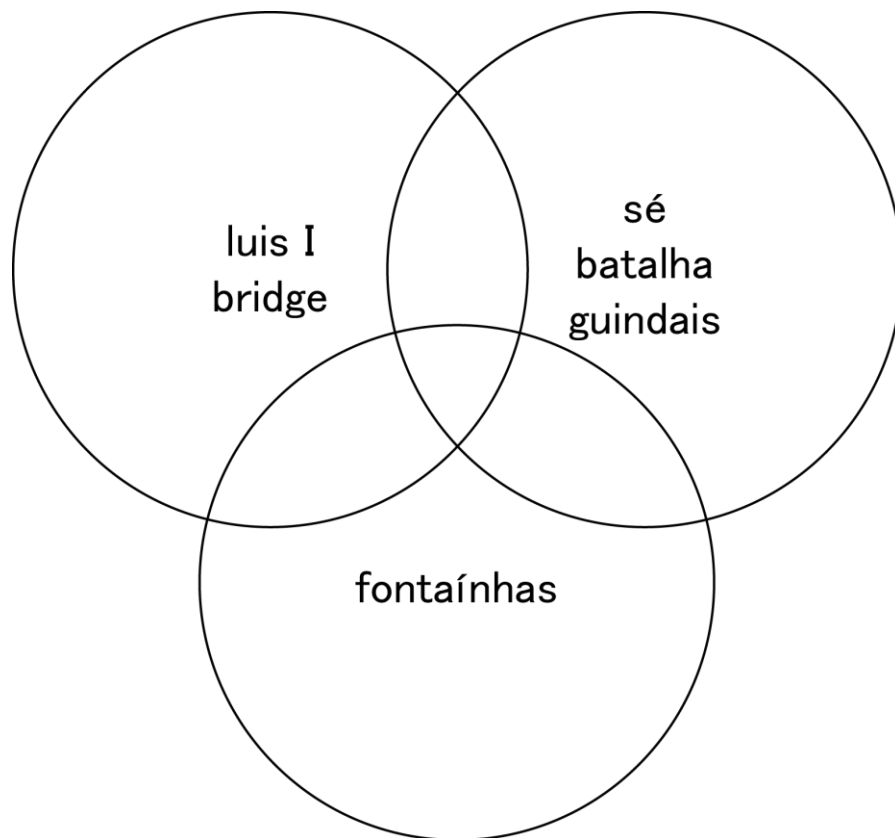
Figure 31: Dividing the two-dimensional plane into the three zones (Dom Luis II Bridge at top-left sphere; Guindais at the top-right sphere; Fontaínhas bottom sphere).

I divised these zones according to their physical counterparts. Guindais is an aforeknown hot-spot of cultural activity, packed with all the people that climb up and down those steps. The Bridge is right beside Guindais, so it was assigned to the top-left area of influence.

Fontaínhas is a huge place, it encompases a great number of areas that I spent recording. The most emblemantic ones being the pathways of Fontaínhas, the abandoned train tracks and all its neighborhoods.

It seemed appropriate to map all the bottom part with the recreated soundscape of this area.

The next big step was filling this map with sound elements and making them come together to create the soundscapes.

As such, there was a need to consider three big factors:

- Selection of sounds for each environment:

Sounds need to be representative of their surroundings.

- Building the setting:

Using foreground sounds.

- Provide pivotal agents/compositions:

Soundmarks: the harbingers of cultural information.

The dichotomy between the compositional tone of these elements revolves around the nature of the implemented techniques - cyclic, intermittent/sporadic, generative, algorithmic, linear or non-linear – and matched the boundaries of each zone or the repercussive nature of elements across space.

3.3.2.1.1 The Sounds of Guindais

The local population was chosen for the pivotal element of the stairways of Guindais, for their distinct cultural characteristics. These sounds characterized the area of Sé, imprinting it with their accents and their livelihood, these were the predominant *soundmarks* that stood out during the recording sessions.

Efforts were made to conceive different kinds of atmosphere, resembling the different kinds of elements experienced throughout the day.

Most of the recreated relationships were those of people, three different groups:
- Locals:

The composed samples generally revolved around elderly women and their conversations.
- Tourists:

Most of them were foreign and from a variety of backgrounds.

- *Café* Background

People enjoying their leisure time, coffee machine noises and other related activities.

Keynote sounds were difficult to compose, as traffic has become the keynote sound in urban areas (Schafer, 1993), making it difficult to replicate some of the experienced high-fidelity sounds. Most of them were birds, bees, dogs and cats, the most predominant fauna in the middle of March.

Sound Signals - foreground sounds - depend on the use of loops, since the most common examples of *signals* are alarms, which heavily rely on repetition. Algorithmic probabilities were introduced through Max/MSP programming in order to reduce or leave toward chance the playback time of each *signal.*

Figure 32: Satelite Image of Gustavo Eiffel Avenue, the southern part of the starways of Guindais.[44]

I tried to create counterpoints between the supersatured and concentrated aural landscape of Guindais with the discrete nature of Fontaínhas when the user crosses from one zone into another, for the sake of letting the experience breath and enable a richer experience.

Guindais are filled with invasive, high-intensity samples who threaten to standardize Hi-Fi elements of its and the surroundings zones, creating a mushy, ubiquitous Lo-Fi soundscape.

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[44] www.zoom.earth/#41.141177,-8.608424,19z,sat – accessed on 11.06.19

3.3.2.1.2 The Sounds of Dom Luis I Bridge

Figure 33: The Bridge at Dusk

The melodies of the Dom Luis I Bridge were those of inherent movement.

I focused on replicating the panning sounds felt across this part of the map, with sounds moving from side to side in the sound field, just as people and vehicles move from one margin to the other.

Most nodes are nocturnal elements, with a great predominance of seagull sounds, the metro, tourists, and locals crossing the pathway of the bridge.

The intention was to convey a darker, chillier soundscape, the sonic events are very soft in nature, harmonically pleasant sounds, with very small chances of playing back during the experience.
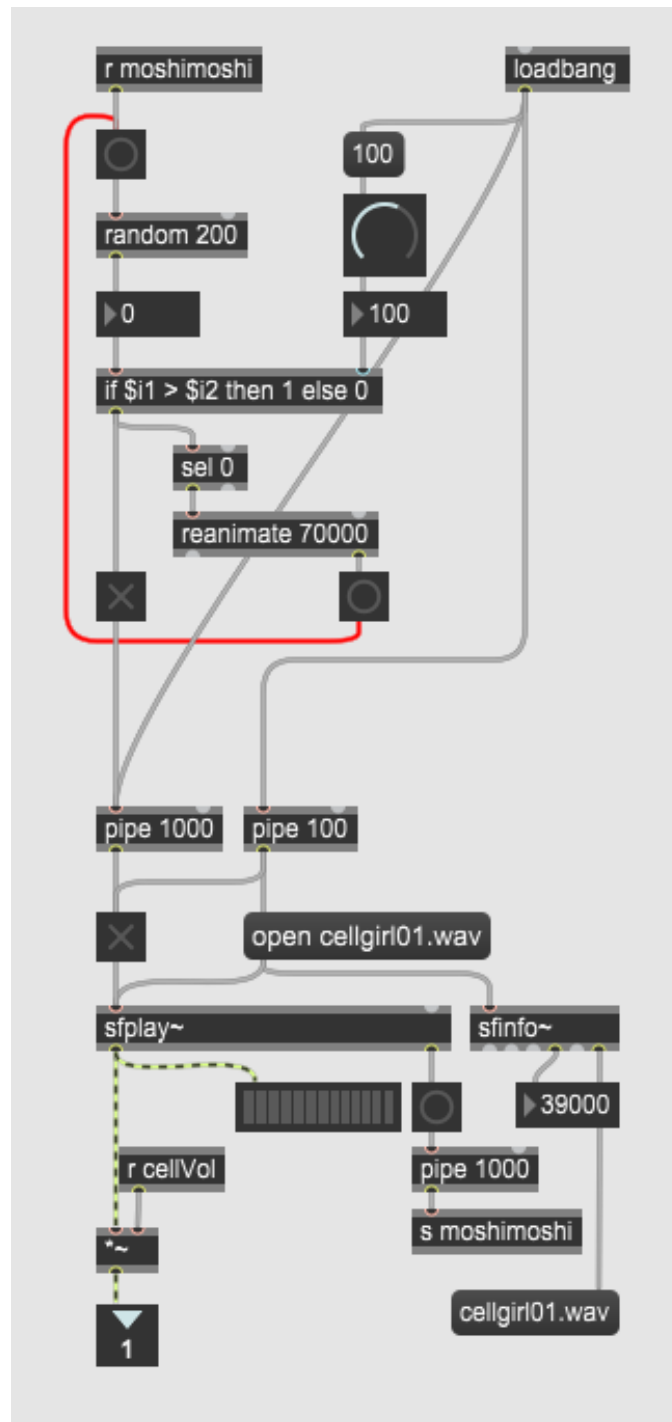
Figure 34: The Cellphone Girl – An Example of a Rare and Discrete Sonic Event

3.3.2.1.3 The Sounds of Fontaínhas

Fontaínhas is a huge portion of the aural cartography, composed of three basic resonances:
- The traffic.
- The abandoned hillside.
- The construction works.

The nodes stretch crosswise larger scales, as sounds reverberate on a wider extent across the landscape.

The soundscape of Fontainhas is very quiet and calm, most sounds can be perceived from different coordinates in the map since the depth of sound is broader here.

There are hints of human presence across this part of the soundscape but most of the sounds are easily missed or masked.
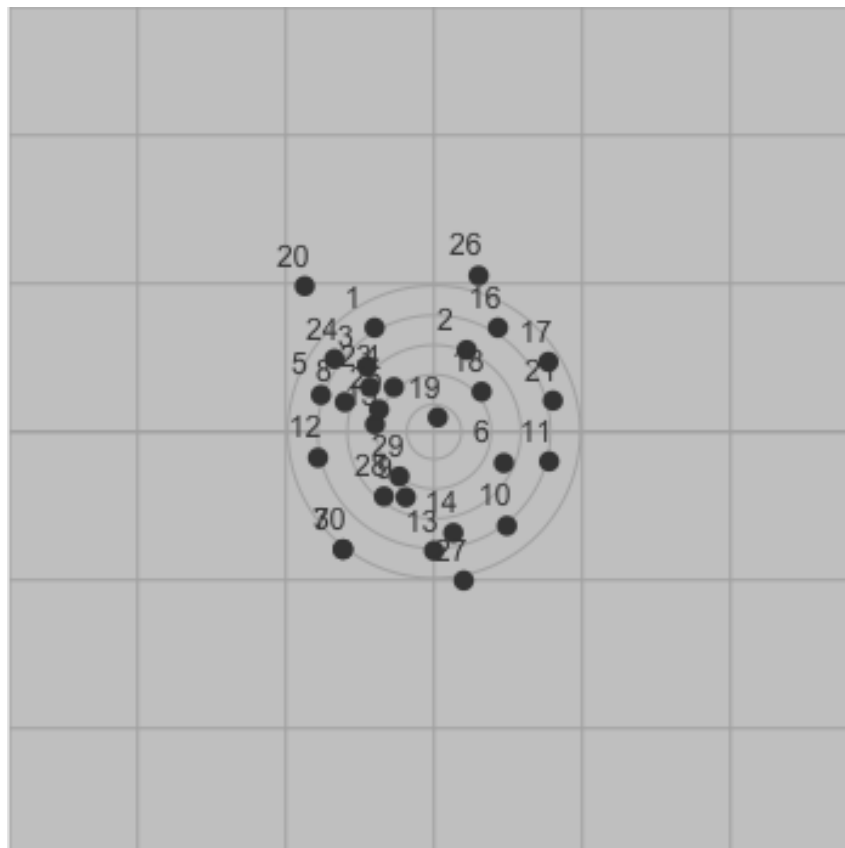
Figure 35: The spatialized sources of *The Aural Cartography*.

To simulate causality to the generative agency of the system, and to link sounds to their real-life counterparts, listeners are sequentially fed with information regarding the spatial identification of sources, hoping to stimulate the gathering of the memory of sounds, their zones, and to identify the type of spaces and its elements during the experience.

The natural sounds of the deserted hillside:

Smaller species of birds, the echoes of the wind across the old train tunnel and the abandoned water fountains.

The traffic: Two different moods were created for replicating the perceived stages of the soundscape of cars, whether peaceful or congested.

In the peaceful interpretation, cars pass from one side to the other calmly. There may be the occasional warning sound of horns, but the general sonic landscape remains serene.

In the congested mode, the incessant noise of horns is more expressive, as drivers frequently express their displeasure.
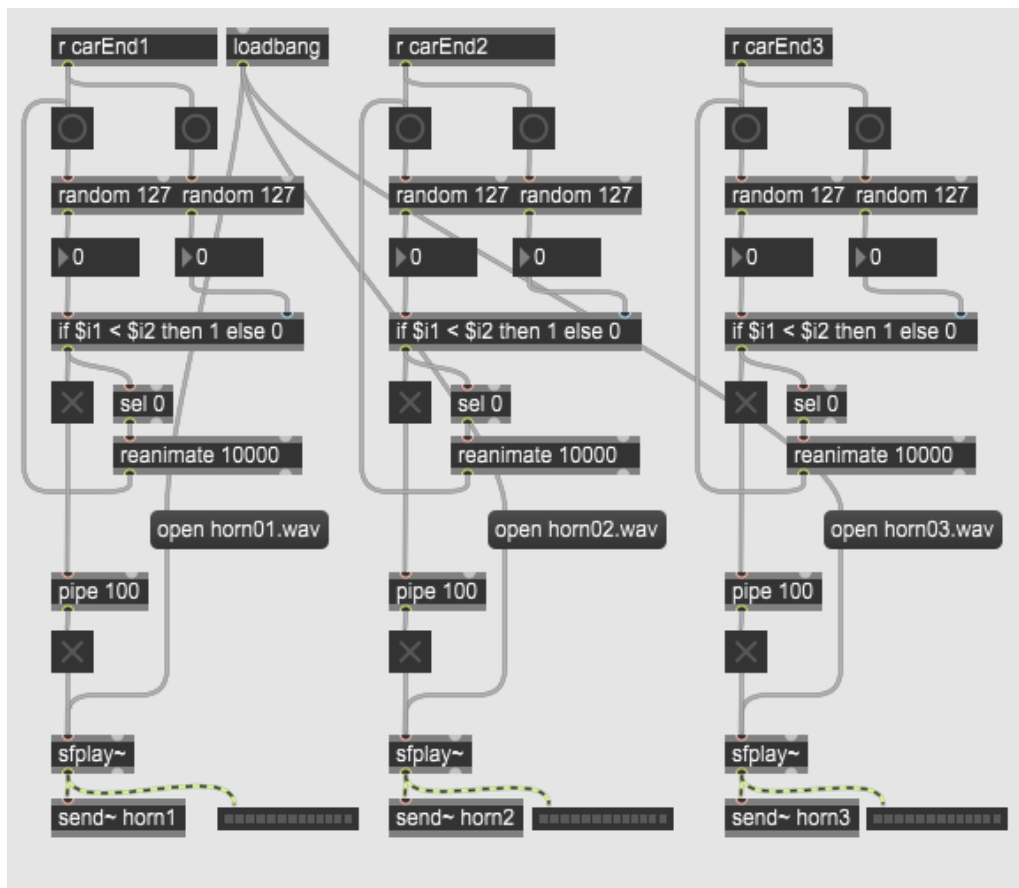
Figure 36: The Horn Pollution Element
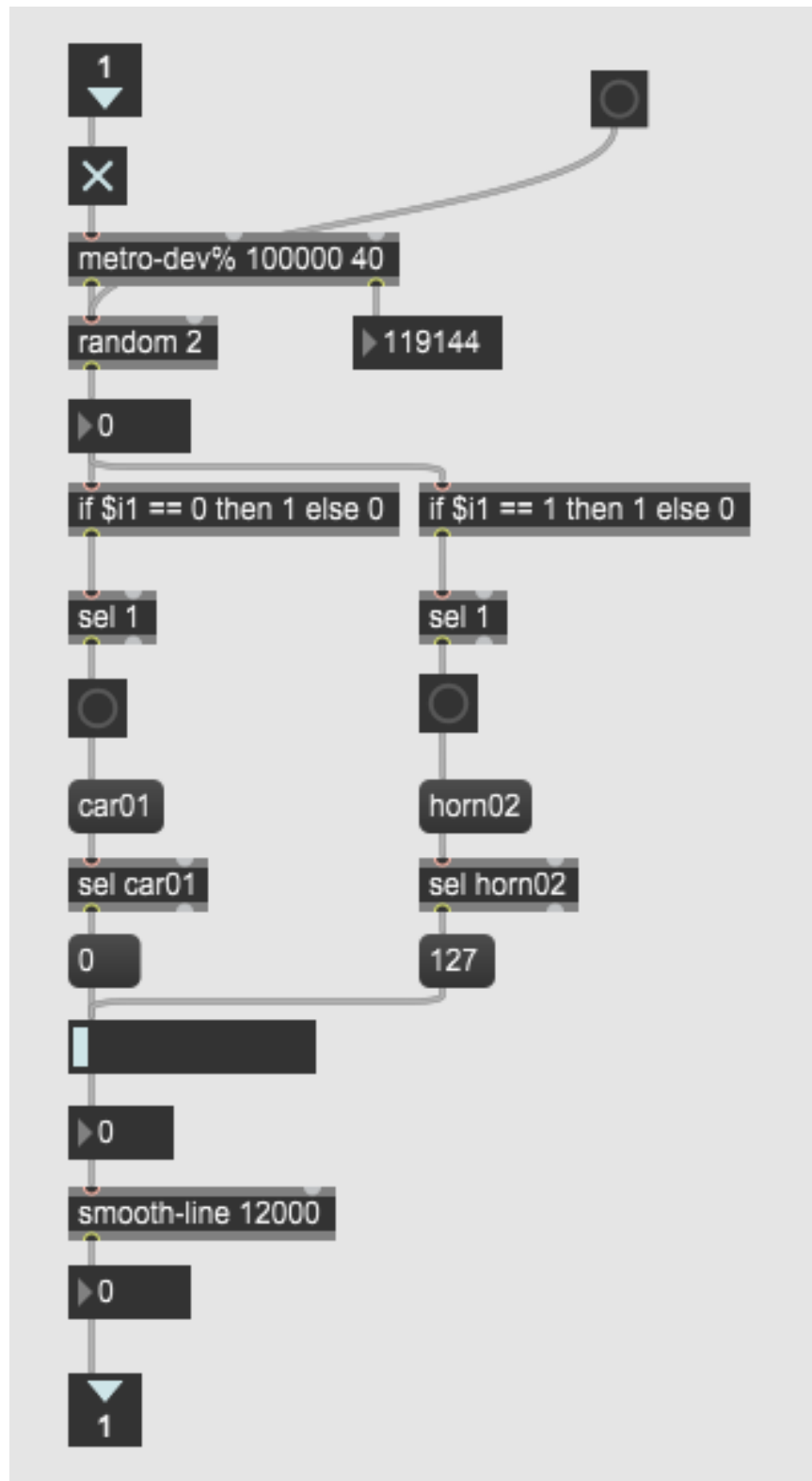
Figure 37: The Two Moods of Traffic (Peaceful and Congested)

The construction work: It was necessary to adapt the construction sounds to heard across Fontaínhas to the dimension of its nature.

Most of the construction sounds come from small contractors, who usually tend the facades of newly rebuilt houses.

The sound collection of manufacturing work is of little intensity but with expressive attack envelopes - pardon my antithesis - since they are the sounds of tiles being placed on their roofs or men smoothing walls with mortar.

3.3.2.1.4 An Overview

The aural cartography of Porto took shape with 30 different nodes, numbering 43 different samples, spatialized according to their physical characteristics and movements.

Each zone contains their own internal and external agents. Nodes are individual or groups of samples. Each of these nodes was allocated to their recreated spaces of origin, to recreate the ambiance of each space.
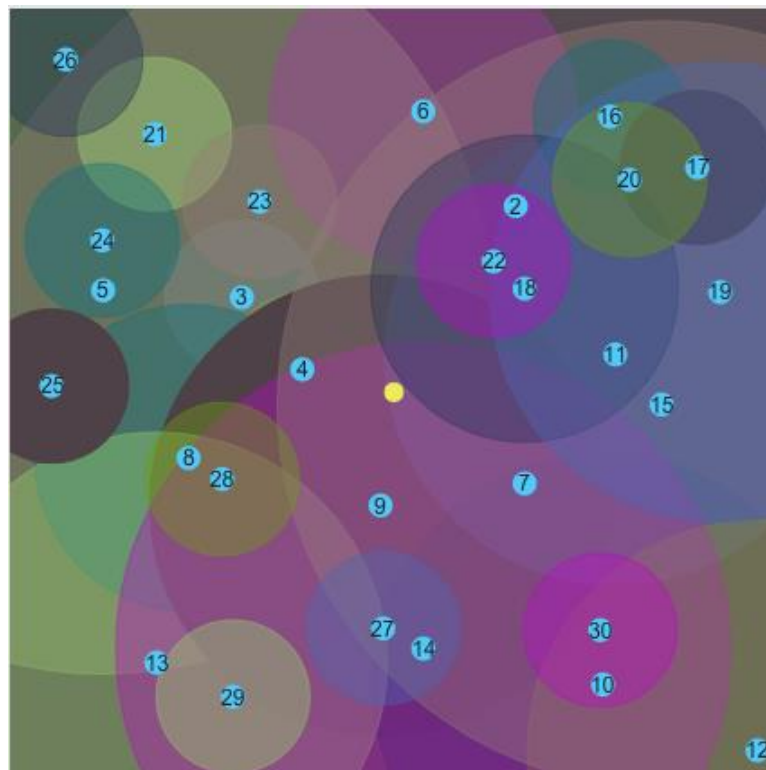
Figure 38: The Aural Cartography of the Historical Centre of Porto

There was a heavy reliance on the use of sound loops to establish the atmosphere of the soundscapes. In order to keep them fluid and interesting over time, it was required to add some chance into the mix.

An interesting sound design approach was tested, which played back random portions of the samples sporadically, creating exciting conversational outcomes and intricate dialogues that could be representative of being immersed into dialogues found on-site[45]. Since the probabilistic chance of playing back each sample created a non-linear continuum, this approach sufficed and the previous one was scrapped.

Although complex at times to implement, the use of such probabilistic systems added a new layer of fun to an already dynamic listening/composing experience. Probabilistic rules mostly reflected the imposed threshold or increased/reduced chances to play certain elements of the recreated soundscapes.
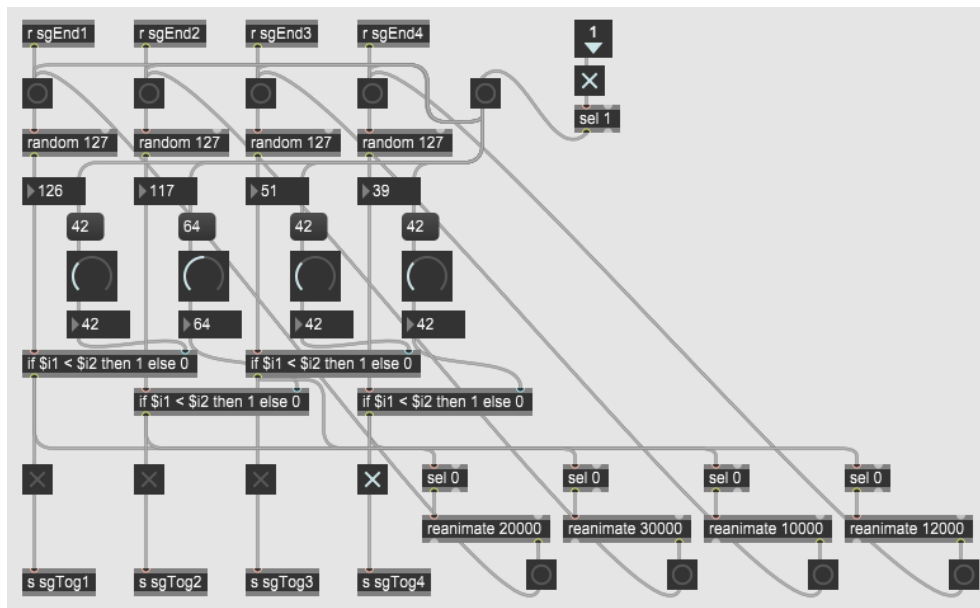
Figure 39: Example of a probabilistic system used for dynamically playing Seagull samples.

Human-generated harmonies were organized at a compositional level, considering the type of relationships being found during the recordings and posterior sampling sessions. Traditional sonorities were mixed in linear and non-linear samples, and left chance to decide the amount of playback time.

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[45] This was later removed during the practical experiments but will be re-implemented in the public presentation of the audio installation.

Some of the anthrophonic ambiances were vital to creating background pieces, such as recreating soundscapes from local cafés and the table football matches between the younger generations or the crowded trains and metro stations across Porto.

Background sounds were mostly simulated with sound looping techniques, replicating the unconsciously heard sounds of everyday life, such as crowds, footsteps across pavements and other sounds with inherent movement, like vehicles or even the distant chirping of birds.

Loops are a simple technique, usually used in linear settings to create a sense of repetition and the absence of the element of surprise; they help set the mood for some of the ambiances.

Small loops usually enable for a fuller experience of the *sound object* in its setting, however, the use of longer loops masks the life cycle of each track, as the listener might not notice the transitions of each sample.

Interaction design and realistic user journeys were considered to create accurate depictions of everyday wanderings, to imprint authenticity.
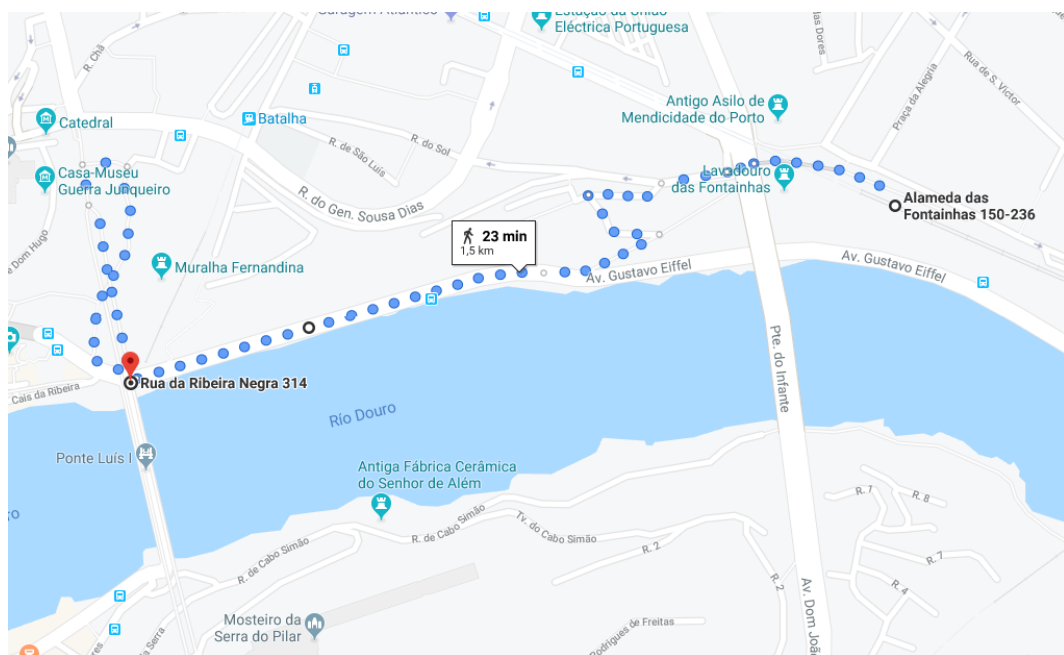
Figure 40: A physical walk example from Fontaínhas, passing by Guindais, to Dom Luis I Bridge[46]

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[46]www.google.com/maps/dir/41.1424662,-8.6001619/41.1408099,-8.6096461/@41.1417445,-8.6072378,16.73z/data=!4m9!4m8!1m5!3m4!1m2!1d-8.6074303!2d41.1413237!3s0xd2464e7aff9a671:0xe87727e81e6863fe!1m0!3e2 – Google Maps - accessed on 12.06.19

Figure 41: A physical walk example from Guindais to the Bridge[47]

The resulting sounds were pieced together to create diverse compositions and immersive experiences of the sonic atmosphere by recreating bits and parts of the experienced soundscapes of Porto in acoustic spaces.

Reverberating sounds like the metro, the trains or planes could be perceived across the general plane since some mechanized vehicles have intensive repercussions across the sound landscape, influencing zones that are usually outside of their physical reach.

The sound of wind was synthesized to be the binding, linear, element, transversally heard across the map to build up the atmosphere of exploration, the sense of walking through the sounds of Porto.

In *Listening to the Aural Space* and *Soundscape Composition*, some perspectives on ways and modes of listening were made. As the most important dynamic at play in reconnecting people to their aural spaces, these theoretical notions sparked certain questions on how to integrate listeners in evolving soundscapes.

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[47]www.openstreetmap.org/directions?engine=fossgis_osrm_foot&route=41.14195%2C-8.61004%3B41.14167%2C-8.60871 – OpenStreetMaps - accessed on 12.06.19

Implementation

While somewhat paradoxical and contrasting, stemming from abstractionist – Schaefferian – to referential – Schaferian – ways of listening, these approaches could both elevate art and the human experience, enlarging our sonic boundaries.

It was decided that the method of listening should be inherent to the nature of sounds and their correlation to the participant.

Different kinds of sounds kindle certain emotions in our plane of thought. Some sounds are very quiet in their nature and potentiate nostalgic feelings and introspection. This led me to apply some of the teachings of *Deep Listening* and emulating safe spaces with calmer nuances (Oliveros, 2005).

Through constant repetition of mechanical sounds, *reduced listening* can be achieved. Sounds start to attain disembodied form and gain characteristics, such as *cold, bassy, ripping,* and *stretching*.

The dialogues among tourists and locals were the best auditory cues for mapping the cultural background of each zone. Although these areas are very dense, by being attentive to each word and the expressive way they're uttered, the experience becomes highly rewarding by uncovering each gossip, tale, and the very accent of people.

Having a complex atmosphere of sounds and experimenting with different compositional techniques creates a sense of adaptative listening. Participants can (un)consciously adapt their approach and their hearing during the interaction through the sense of embodiment and immersion during the experience.

4. The Aural Wanderer[48]

"The city is a communications device. It speaks to us through every fibre of its being. The lived urban experience comes from a circular sensory cycle. The Sensory Landscape of Cities sees the city as a 360-degree, enveloping, immersive experience, which has emotional and psychological impacts. It argues that we sense, feel and understand it through increasingly narrow funnels of perception. Living in an impoverished perceptual mindscape makes us operate with a shallow register of experience and understanding about what is important for our cities to survive well. A greater understanding of the importance of environmental psychology is crucial. This focuses on the interplay between people and their surroundings and the degree to which it creates stress or feels restorative" (Landry, 2012).

The Aural Wanderer encompasses three digital signal processes:
Composition, Spatialization and Interaction.
The premise:
Participants explore a generative ecosystem, transforming iteratively the nature of compositions by expanding into wider motifs or focusing on small and specific elements of the experience.
The goals:
To transmit the musicality of spaces, provide bonding and collaborative experiences between participants and the city's aural domain, and explore the emotional triggers within the memory of sounds.

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[48] www.github.com/marcelodesousa/theauralwanderer - accessed on 14.06.19
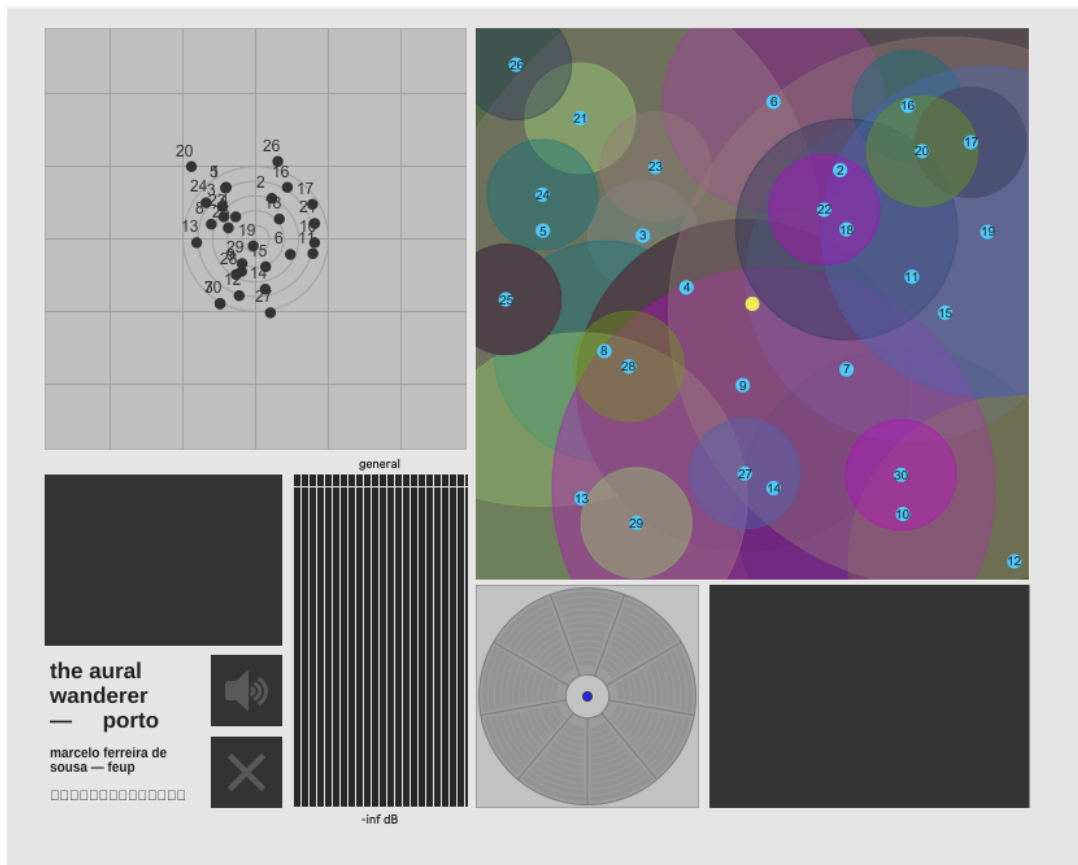
Figure 42: The Aural Wanderer – GUI of the Application

4.1 Practical Experiments

This chapter presents the practical evaluation of the approach, consisting of five-minute experimentations between participants and the system, taking place at the university campus of FEUP[49].

It started by setting up the prototype of the audio installation and testing it with a qualitative-oriented analysis/feedback with a varied group of participants (11, in total).

Data evaluation aimed mostly at understanding, studying the patterns of interaction between composers and the ecosystem, and identifying elements (sound sources) of the composed soundscapes and their correlation toward the memories of sounds.

Setup:

The room was dark. Hints of sunlight delineated the silhouette of the arranged materials and furniture.

Participants sat upon a movable chair and were given the touch interface.

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[49]www.fe.up.pt – accessed on 14.06.19

The Aural Wanderer
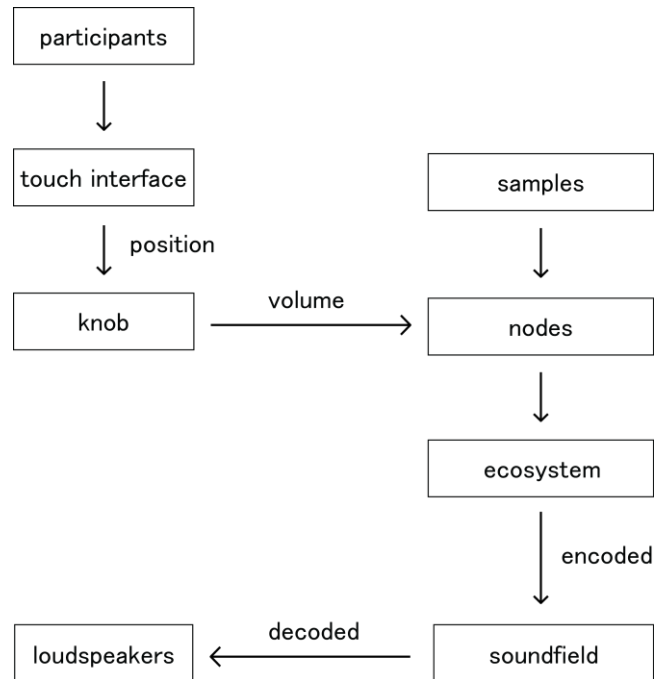
Figure 43: The Aural Wanderer – System Architecture

A blindfolded kind of interaction was implemented, presenting the interface as is, giving a brief explanation on how to interact with the general experience. The practical experiment had the duration of five minutes. Nothing more regarding the experiment was explained.

Technical rider:
- A circular arrangement of 9 horizontal speakers (2nd Order Ambisonics);
- 1 chair;
- 1 mobile touch interface running OSC controller;
- PC running the ecosystem (Monitor turned off).

Academic background of the participants:
- Digital Media;
- Electronic Music and Sound Production;
- Electrotechnical Engineering;
- Image and Sound;
- Information Science;
- International Communication and Media;
- Multimedia;
- Music Technology and Production;
- Veterinary Medicine.
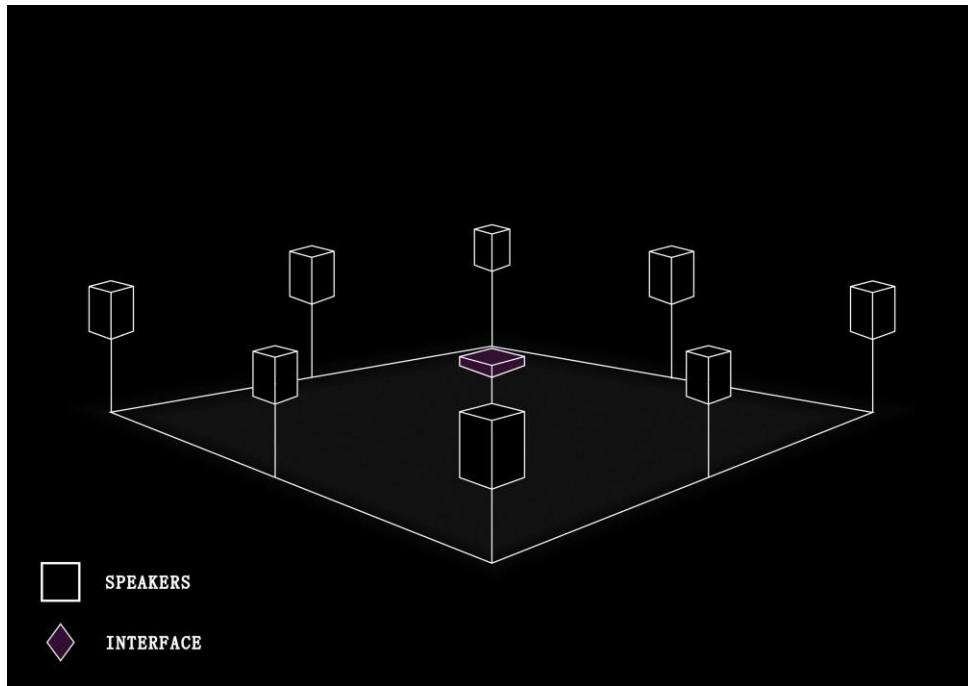
Figure 44: The Sketch for the Practical Experiments

When the practical interaction was over, a brief conversation followed it. I thanked them for participating in the experiments and asked them the following question:

"What did you feel about the experience? Do you have any comments or observations?"

Generally, that sufficed to spark an interesting conversation about the perceived aspects of the experiment, the system, and the interaction.

In order to indirectly guide the conversational outcome and keep it straight to the point, I had prepared some other sub-questions about the general flow of the experiments:

1. What did you think about the overall experience?
2. Did you find the experience stimulating? Did you want you to keep on navigating?
3. Was the relationship you just established with the experience clear along the way?
4. Do you have anything to comment about the sonic elements? The spaces, people, anything in particular that you enjoyed?
5. What do you think you just did by controlling that device?
6. Was the interaction fluid/rigid?
7. What drove you to interact/guided you during the experience?
8. Did the movement of sonic sources impact you positively during the experience?

When a considerable amount of information regarding the qualitative evaluation of the experience was gathered, I thanked them once again and ended the experiments.

Figure 45: The Dark Setting of the Experiments (A Brighter Recreation for Documentation Purposes).

4.1.1 Day no.1

The first iteration of the practical experiments took place on the 29th of May with 6 people attending.

The first person to interact with the ecosystem was incisive regarding the general nature of the interaction when asked for some commentary.

"Interviewer: What did you feel about the experience? Do you have any comments, observations?

P.01: It looked like I was walking through Porto. There were noises or sounds of the beach, from Matosinhos… The sound of the subway made me laugh... The noise of the construction works also, unfortunately.

It seemed like I was in Porto. And with all the speakers around here… they helped to build the ambiance.

Interviewer: What did you think about the overall experience? Did you find it stimulating?

P.01: Yes (…) it looked like a kind of map where you chose where you wanted to be.

At first, I started throwing/moving this [*white square*] around, but I realised that each different place had a different noise and I was guided by the speakers... And I understood what the various places were and their sounds.

I realised that in the middle there was almost no noises. It wasn't exactly sound, it was a total absence of noise (...)

I don't know if that's your goal, but at least I realized that it would be a map where you chose the places where you wanted to walk.

But maybe it was even evolution... Because at first it was those noises with all those characteristics of the places and in the end there was already an absence of those characteristics."

The second participant praised the experience and the overall outcome. Mentioning that the application performed well.

The second participant was well versed in the paradigm of sound programming and sound design, noticing early on that the general soundscape wasn't linear or even stationary. The participant also mentioned that he wished to have heard a lot more of voice sounds, specifying some voice he had heard, noticing that it was a foreign voice.

The participant said that at first, he wanted to listen to a bit of everything, trying to identify what sounds played at which parts and to analise and match the outcoming sounds, comparing them to the previous time he was at that specific coordinate.

He said that he perceived a sense of movement and proximity/distance to the sound elements, especially when being stationary and listening carefully.

The next participant was familiar on the general terms and goals of my investigation. He noted on how his experience was modulated by searching for the quieter elements of the cartography, remarking that the zone with a high concentration of people was noisy, unpleasant and intense.

This third participant regarded the value of the plurarity of spaces and their different resolutions of sound. The participant recognized some of these sounds, especially those of Fontaínhas – which he tended to listen to – and how there were auditory cues about human presence. Some discrete sounds about people working, and how things about their time and a lot more space and how it allowed him to breathe, to think inside that place. He praised the "freshness" and "openness" of this surroundings.

He was surprised by the perceived generative aspect of the ecosystem and how things could pop into the auditory array:

"**P.03:** (…) Another cute thing was a moment when I was standing still for a while in a specific place and recognizing that nothing was happening… Meanwhile I went somewhere else… Then when I went back there, I noticed that something was happening! There were people talking in that space…. And that was a surprise!

So I think that five minutes for this is a very little amount of time, it doesn't give me the right amount of time to be surprised… I would play with this for at least another five minutes to see if there were other things that could happen.

(…)"

He also commented about how the relationship of his actual size and his representative size on the map isn't an ideal relationship, sonically speaking. His representative steps across the *soundmap* are very big ones. He mentions that this *(interface)* works very well in terms of being presented and wandering about different spaces. It moves past the technology because we can realize about where things are specifically.

The third participant also regarded other development iterations and on the transformation of the recreated zones during the development phase, recalling about how there used to be a zone that was filled with loud seagulls, and that now that zone is a complete silence. The participant wondered about the physical space and if it was desolated or stripped of life. He made this remark because "I had this memory from before.".

The fourth and fifth participants had a background in Musical Technology and Production and were the most dissonant voices of the overall experiments.

They said that they enjoyed the experience but that they couldn't grasp the type of interaction between the interface and the correlation towards the general experience.

They both remarked about how it was unclear to them what they are performing by moving around with the interface in terms of spatialization, that they couldn't focus on the essence of sound. The interface was intrusive and had a huge weight regarding their immersion on the outcoming sounds.

Both participants thought that this interaction regarded itself with the sonic perception of focus, aided by the sound field rendering, but considered that there wasn't parallelism between the point that they defined in the interface and what was happening around them *(speakers/space)*. Some zones in the interface didn't seem to focus on anything and that this particularity wasn't helping them to turn off from the technology and into the experience *per se*.

When asked about the sonic aspect of the experience and their elements, the fourth participant commented on how he loved voices he had heard. He said he was from Porto and could transpose himself into the spaces where that sounds were happening.

He recognized most of the elements - helicopters, metro, the tourists - and could pinpoint them in a physical place like Ribeira do Porto - the riverside -, even if he was not actually there in person.

He recognized that this investigation had something to do with recreating sounds from Porto and that it was a very powerful experience to be listening to the local accents mixed with other kinds of elements that are typical around these parts.

Another contrasting view was that participant number five was always looking for the loudest, most intense elements.

The fifth participant was interested in getting an explanation regarding the general aim of the project, and when familiarized with the concept of the aural cartography of the HCP and its recreation on a bidimensional plane said that it would have conditioned the experience to have known beforehand. He suggested that I could make some improvements to the exploration capabilities by dropping the number of variables necessary for interacting with the ecosystem.

He said the he could have lost way more time understanding the sonic richness of sounds, the timbral characteristics, their duration, etc, by having a more transparent kind of interaction.

He recalled on how it was a good stroll across the sounds of Porto even if he did not know at times what he was doing.

The last participant of the day - sixth - also had a background in Music Production.

The participant started the interview by explaining what he thought he was doing.

Commenting on how he started by exploring the sound field, understanding where the high-intensity sounds were, exploring the interface and its capabilities and trying to perform a composition of his own.

He also said that he was carefully listening and trying to perceive the sound characteristics, to understand if it was a softer, sharper or stronger sound and contrasting them with others.

He remarked on how there were some interesting sonic outcomes.

He said that he could immerse himself in the space, that the interface was not intrusive to the overall experience, and that in his head he only thought about how he was designing the space.

He said that he was allocating certain sounds to certain zones, especially the sound of the trains or metro, that he could pinpoint them onto the interface. He created a mental picture of each zone.

He added some interesting remarks regarding the choosen interface, commenting that If I had used hand tracking interfaces like *Leap Motion*[50], that we wouldn't enjoy it as much as he had enjoyed the interface. He explained that the visual stimulus of dragging the white knob was

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[50] www.leapmotion.com – accessed on 14.06.19

transparent about what he was and could perform, guiding himself with what he would progressively hear.

4.1.2 Day no.2

The second iteration of the practical experiments took place on the 30th of May with 3 people attending.

The seventh participant initiated this round of experiments by vocalizing his desire to deconstruct each and every one of the recreated ecosystems down to its sonic characteristics, by creating iteratively smaller and smaller ecosystems of sounds.

He enjoyed the experience but recalled how it would be interesting to have the freedom to explore each sample and not the whole composition.

He was also one of two people who had insight into the developed software, although to a smaller degree than the third participant.

He recalled on the clarity of sound, by observing the discrete nature of some of the samples, saying that some sounds were distant, almost off the grid.

I asked him if the interface was fluid in terms of the perceived control and he replied quite cheerfully that he was expecting to have a sort of drag-only kind of control with it, and like tapping around the interface. I liked how he was unfolding bits of the soundscape and joked around about how he'd like to have 30 speakers, giving him a full 360º representation of sound.

He recalled on how the seagulls reminded him of his ex-girlfriend, or the metro passing by Gaia.

He mocked that it was only natural of him to attribute specific memories to this sounds as he's a guy from Porto.

The next participant – eighth – started by saying that he was on "free-ride" since he was not explained the do's and don'ts about what we could accomplish by toying around with the interface.

He said that it was interesting to be left out in the open about the goal of his interaction since he was understanding "on the fly" what sounds were appearing in the sound field and composing a soundscape and some kind of movement.

He commented on how cool it was that this experience reminded him of some other artistic work by Luc Ferrari, an electroacoustic musician.

The eighth participating had a background in Music and was currently pursuing his PhD. in Digital Media. I was happy with the correlation between my work and the work of a renowned artist.

He said that his guiding actions during the interaction were by understanding how sonic elements behaved and that he actually closed his eyes so he could perceive it clearly.

He made some notations regarding the sense of journey, and after I told him what the experience was about, he assumed that these zones corresponded to the streets of Porto.

He felt that he was wandering about some street, passing by stuff, hearing them and how we experience a lot of situations in our everyday lives. He said that the background sound of the winds maintains that connection to the physical world.

He said that once he disconnected from the visual dimension that he was much more immersed in the experience, inside a *soundwalk*, walking along the street and passing by a lot of stuff.

The ninth participant had a background in Veterinarian Medicine and was also pursuing a PhD in Digital Media.

The participant was also captivated by the experience, finding it interesting about how the elements were spatially dispositioned in the acoustic space.

She was also focused on the high-intensity zone of sounds but greatly enjoyed the duality of spaces and their quieter, calmer ones.

She remarked on the different kinds of people that he was encountering, with some speaking Portuguese, others and English and several other languages.

She questioned me about where I had been recording and if there was a logical route to the experience. I replied that since it was me who recorded and spatially disposed these elements and assigned them zones of influence, that it was only natural to recognize logical paths between one another. My own field recordings revolved around going from one place to the other.

She made a very interesting remark about a specific set of sounds, the *café* ambiance, saying that she could specifically assign the birds sound to a local *café* with a little bird inside its cage and a very Portuguese owner that greeted people as they walk in or by his place.

She enjoyed the narrative capability of uncovering each of these stories, these narratives. It captivated him to keep searching for more tales, more stuff. She navigated across the sonic density by wanting to discover new sounds.

4.1.3 Day no.3

The third and final iteration of the practical experiments took place on the 31st of May with 2 people attending.

Figure 46: People Experimenting and the Surrounding Ambisonics Setup.

The tenth participant didn't have a background in this area of study.

The participant started by explaining that she was trying to understand what happened if she moved the knob and how it translated in terms of sounds. Then she tried to figure out what kind of sounds they were, noticing how on the right side of the interface there were a lot of metro-related sounds, people talking, the alerting beep of the metro, the doors closing, and opening and the panning effect of the metro passing by.

The left part of the interface reminded her of a chillier ambiance, like the beach where she usually hears birds, seagulls, and a lot fewer cars.

She said she tried to carefully understand and to listen attentively to the sound characteristics: if it kept going, if it repeated itself, how it was triggered and if there were different or repeating sounds and if they never ceased playing.

She felt that she was in there, inside the experience, that it was his movements that were happening, and it was about what she wanted to listen at that specific point.

She was delighted on how there were realistic sounds and not computer-generated ones *(synthesized)*, especially because the sounds she had heard were connected to the real world and that it was smooth to go to different places and hear a couple of different stuff. This digital interpretation was connected to real life, and that impacted her positively.

She guided her interaction by slowly listening to the sounds. That she could understand and know a lot more about them if she stayed on that point longer and was picturing a mental plan of every sound she encountered.

The participant described quite accurately the sequence of sounds regarding the life cycle of the metro:

"**P.10**: (…) the metro was more… Okay, it's going to start, it's going to open the doors, people are going to walk, then it has the *beep*.

So that was more, what was going to happen? So yeah…

Interviewer: A richer experience?

P10: Yeah, a more interesting experience and yeah, in that case I really saw or heard the movement of the metro arriving or leaving. And also, the doors, but that was just in my mind. (…)"

She ended the interview by saying that she was curious as to what this practical experimentation would transform into, if with was being shown publicly and for which kinds of people. She commented on the name (*Aural Wandering)* and was thinking about it, wondering about how it could be used for different kinds of people with different kinds of needs, especially for visually impaired people.

She said that this had an interesting narrative capability.

The final participant – eleventh – had a background in Electrotechnical Engineering and in Music.

He started by discussing the characteristics of the interface and what he could accomplish by interacting with it and then moving onto the aural capability of the experiment.

He noted about how there was a quadrant in the upper-right part that was more intense that then other quadrants, and how that zone had interesting dialogues.

He did not immediately realize that he could drag the knob in order to slowly navigate across the bidimensional plane and was amused by the different kinds of approaches he could have with the interface and the overall experience.

Having no previously remarks about the context of my experience and experiments, he claimed on how this experience had a strong capability to recreate and represent soundscapes.

He then started comparing his own life experiences and the memories he has of the sounds he was encountering by interacting, noting on how he could assign real specific spaces to this experience, like the metro stations and the beachside, something close to the sea.

I asked him if he thought that the experience was unraveling in a fluid away during the course of his interaction, to which he added a very interesting commentary.

He said that he encountered a sound of a male subject and that he wanted to force it to play it again, in a sort of way that resembled a *granular synthesis*, but that the system didn't allow him that, that the fluidity of the process imposed itself onto his whims.

Even if he was trying to break the system or the experience, the system didn't flinch, that it made him feel, and sense/perceive the experience as a *soundwalk*.

I asked him if that sort of linearity was what guided him along the experience, to which he replied affirmatively, adding that he almost entered physically into the sonic landscape, that he didn't only see the process as a linear one, but multiple linearities.

He explained that the process was linear in a way that it is continuous, but that his role as a performer allowed him to navigate across several continuums… It didn't allow him to create one of his own, but to experience a great variety of continuums. He felt that he couldn't violate the intrinsic human nature of the paths, he compared the process to that of a person who knows where she or he's going.

The participant also added once again that he couldn't force the system to bend to his expectation, that much like real life, something happens only once and that one cannot return or go back in time to experience it once again, one has only the memory of it.

He directed the conversation towards the linearity that he kept on recalling, to which he mentioned that it was interesting to have control over the experience, but not a ubiquitous or unrealistic control over what he was doing or earing. A humane interaction.

The interview ended with another interesting remark from his part.

"**P.11:** Senti-me o compositor do meu fado… do meu destino."

"I felt that I was the composer of my fate."

5. Conclusions and Future Work

In this dissertation, the practical hypothesis of involving participants in an exploration of a dynamic ecosystem was made, by empowering people with the capability to compose and to ultimately transform the nature of compositions by choosing what to hear.

The premise was that of wandering about an aural cartography of the sounds of the Historical Centre of Porto, in order to transmit the energy and liveliness of those spaces and providing bonding interaction by exploring emotional triggers within the memory of sounds.

Even though participants initiated their interactions without knowing the parameters or the kind of interaction that they were establishing with the ecosystem, they gradually realized the overall aim of the experiment.

Most of them praised the experience, and its narrative capabilities, noting how they'd want to keep on interacting for longer than the stipulated five minutes.

During the course of the experiment, they understood that different places or coordinates fed back different kinds of sounds and started grasping their own boundaries and how perception was modulated by expectation.

Some interesting feedback was gathered, as people were generally excited about the outcome of the experience and about interacting with a dynamic soundscape and learning about the origin of their sounds and their own integral part at composing the overall experience.

Participants frequently answered my research questions and the overall aim of my hypothesis. Especially regarding the memory of the sounds of spaces and its people, and the general concerns about the transformation of places and the vitality of preserving some elements and having different kinds of soundscapes.

Not only were participants perceiving cultural information, but they were also apart of making it.

I presented this dissertation in "Congresso Internacional Paisagens Sonoras: Património, História, Territórios Artísticos e Arqueologia Sonora[51]". The conference was a place of reflection on the meaning of the interaction betweens human beings, nature and music. A space to discuss the creation of cultural and historical soundscapes and their aesthetic and heritage values in civilizations.

At the end of my presentation, I was asked why I was not acknowledging myself as a musician, a sonic agent. I replied that I regarded myself mainly as an arranger of the aural landscape by harnessing the environment and creating a disembodied space where these elements could express themselves freely across recreated sounding spaces.

This question made me realize that I couldn't formally abstract myself from the burden of being a musician or composer of some sorts. I was also not able to disassociate from my relationship with all those sound sources in all the different stages during the development of the experience. I was imprinting bits and pieces of my thoughts, feelings, and choices on the participants by establishing the limits of what they could and could not hear.

The stage where I made use of the HOA package for developing a practical approach was a bittersweet part of this dissertation. It allowed me to outline an interesting interaction, that I subsequently named M/K, but it delayed my progress on refining this solution. Since I was relying on a third-party package, I could not piece together the kind of interaction I was imagining and developing with the software.

However, the use of HOA as a sound spatialization format/tool proved to be vital to the experiment. Listeners could engage in an interesting way with soundscape and play around with the dynamics of the spatialized sound agents.

In the end, what I learned from relying on the HOA package gifted me with a good understanding of how to create an interesting and rewarding experience.

In a conceptual way, the main goals behind developing an ecosystemic music system never strayed too much from the main topics, motivations, and aspirations: re-integrating listeners in their evolving spaces.

The self-imposed methodology of pratice-led research/research-led practice greatly impacted the outcome of the investigation in a structural way, transforming the sense of perceived interaction amid person-computer.

The use of other kinds of technologies was considered, e.g.: hand tracking interfaces, but deemed obtrusive when trying to conceive a sensible interaction, I worried that the experience might suffer under the constraints of relying on an ambiguous interaction or technology.

It was decided to use touch interfaces for their reliability, familiarity, and their fluidity for dealing with the self-imposed variables of interaction.

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[51] http://paisagensonoras.pt/ - Accessed on 20.06.19

My own experiences while wandering through the HCP, recording its aural life, shaped the outcomes of the implementation phase into a quasi-realistic exploration of the city's own pathways.

In other words, the same relationships between the participants and the experience were akin to a physical hike across the city ways. Hence the name: *The Aural Wanderer*, a navigation across a dynamic *soundmap*.

5.1 Future Work

In the future, new layers of interaction, regarding sonic input and motion control, can be added to boost the dynamics of the piece.

The application of Music Information Retrieval (MIR) techniques is being considered to analyze the predominant resonances and incoming attack envelopes from participants and the surroundings spaces in order to create and establish ambiances and triggering sonic events, enriching the liveliness of the ecosystem and building a vibrant atmosphere with an expanded level of interaction between participants and the ecosystemic music system.

Strategically placed mounted interfaces might also emulate a sense of discovery, but a distance between the artwork from the touch interfaces is intended, to fully implement the paradigm of *soundwalk*, by having people move inside the sound field and explore *The Aural Cartography* as if they were physically wandering from place to place, using motion capture approaches. Moving away from intrusive technology and into a fuller representation of the aural dimension.

I am also preparing and applying to publicly present the installation in new spaces, especially media arts and electronic music festivals.

In order to do that, I want to recreate even more scenarios and adapt the generative soundscape to the sounds of local communities where the artwork is reproduced.

Other approaches are also being considered, like the conceptualization and implementation of the investigation work into an online *audiowalk* mobile application using GPS coordinates and headphones, enabling users to experience a mix of sounds between my general soundscape and the recreated ecosystem, in the same line of work as the Sonic Augmented Reality (Miller, 2018).

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Appendix

7. Appendix

7.1 Interviews

In this chapter, I present the integral transcription of the interviews, generally conducted in Portuguese after each of the experiments terminated.

7.1.1   P.01

Interviewer: What did you feel about the experience? Do you have any comments, observations?

P.01: Parecia que estava a passear pelo Porto. Haviam barulhos/sons da praia, de matosinhos, barulho do metro que até me parti a rir… O barulho das obras também, infelizmente. Parecia que estava no Porto. E com todas as colunas aqui à volta ajudaram a construir o ambiente.

I: O que achaste da experiência? Achaste-a estimulante?

P.01: Sim porque, pelo que percebi e ao início não sabia o que ia fazer nem o que ia sair daqui quando comecei a interagir com a interface. Porém, parecia uma espécie de mapa onde escolhias onde querias estar.

Ao início comecei a atirar/movimentar isto de um lado para o outro, mas fui-me apercebendo que cada sítio diferente tinha um barulho diferente e fui-me orientando pelas colunas… E perceber quais eram os vários sítios e os seus sons.

Apercebi-me que a meio existia uma quase ausência de barulhos. Não era efetivamente som, era uma ausência total de barulhos… Como o barulho do avião, helicóptero e de pessoal a

andar e a falar e essas coisas. Mas lá está, não sei se é esse o teu objetivo, mas pelo menos eu percebi que seria um mapa onde escolhias os sítios onde querias andar.

Mas se calhar até era a evolução... Porque ao início eram aqueles barulhos com todas aquelas características dos locais e no final já havia uma ausência dessas mesmas características.

I: Que tipo de elementos sonoros conseguiste identificar? Os mais claros de identificar e os mais difíceis?

P.01: O que me lembro melhor era o metro, as gaivotas… E as obras e carros a passar. Lembro-me de algumas coisas que me pareciam a Sé.

I: Achaste fluída a maneira como foste interagindo?

P.01 A mudança dos sons?

I: Sim, sim, e a própria interação que foste entendendo e do que realmente se tratava.

P.01: Claro… Ao início claramente não percebi, mas ao estar a brincar com isto, percebi que ele respondia com sons diferentes em cada uma das zonas em que estava. A própria interface mostra-me as coordenadas de cada sítio e dão a entender isso mesmo. O sítio é diferente, então o som é diferente.

Era bastante fluída a transição entre sons e dão para entender… Não havia qualquer quebra ao passar de um lado para o outro. Tudo se mesclava. Pareciam que estava a andar.

I: Disseste que foste brincando e percebendo que estavas a mudar de lados e de sítios, então foste guiando a tua interação…. Aliás, foste-te apercebendo que estavas a guiar a tua interação através de experimentar e ver o feedback sonoro.

P.01: Claro, para ir percebendo o que estava a fazer, visto que inicialmente não me disseste concretamente o que era preciso fazer, só como mexia com a interface. Foi pegar, mexer e ver o que é que dava.

I: Sentiste algum tipo de diferenças entre presença e distância sonora?

P.01: Sim, especialmente no fim. Até comecei a pensar nisso, visto que para qualquer sítio que eu parecia ir tinha sempre os helicópteros em todo o lado.

I: Tipo omnipresentes?

P.01: Tipo Deus? (risos)

I: (Riso)

I: Tens mais alguma observação? Específica ou mais geral?

P.01: Curti bastante, não tenho assim nenhuma observação mais específica… Mas curti mesmo o facto de teres várias colunas… ganhou bastante, é mesmo fixe… Claro que mesmo com uma ou duas ia perceber, ia mudar, etc, mas tendo assim tens toda uma presença à toda a tua volta.

Correu bastante bem! Gostei muito e parabéns!

I: Obrigado! E mais uma vez obrigado, agradeço por teres participado no estudo!

7.1.2   P.02

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.02: Achou que tudo correu bem, gostei, esta app funcionou bem, não falhou nada.

A nível de som achei que um som em específico… Mas isto é generativo, certo?

I: Sim, sim.

P.02: Ah, é que houve um som em específico que foi mais abrupto a nível de transição… Mas foi apenas um som, em todos os outros notei que havia um bom crossfade entre cada um deles, estava tudo fixe, percebia-se tudo bem. No geral acho que foi bom.

I: A nível geral da experiência…. Achas que foi clara? Achas que a interação entre ti e a experiência foi clara e foste percebendo o que foste fazer ao longo do tempo?

P.02: Sim, sim, sim. Só houve um ponto quando a paisagem acalmou que fiquei um pouco perdido… Mas lá está, pensei no facto de poder ser generativo e podia ser por causa disso. Não saiam quase sons durante um tempo e andei a procurar, mas logo após isso entrou um comboio numa coluna em específico…

I: Achaste estimulante a nível sonoro?

P.02: Sim, senhor!

I: A nível de elementos sonoros…. Conseguiste estabelecer alguma relação a nível de memória... identificar algum tipo de sítios?

P.02: Sim sim. Acho que faltavam um pouquinho mais de vozes, talvez… E havia uma voz que não consegui reconhecer… Não sei, pareciam romenos… ou…. Eram portugueses?

I: Não.

P.02: Ah ok! É que não estava a conseguir saber que língua era, sei que não era português e fiquei um pouco confuso nesse momento. Mas sim, em específico, em específico é assim, ouço um comboio a vir e não sei se é de S. Bento ou de Campanhã, mas claro, vêm-me logo memórias à cabeça.

I: Talvez seja redundante visto que falaste da boa cadência/transição dos sons tirando aquele som que falaste.

P.02: Sim, lá está, esse abrupto pode ter sido precisamente pelo momento em que eu passei lá, o pico do som está a ocorrer ao mesmo tempo… Por ser generativo… Se calhar se tivesse chegado àquela parte e apanhado a cauda do som não acontecia isso.

I: De que maneira é que te foste guiando à medida que foste interagindo? Se foi através de sons específicos…?

P.02: Primeiro quis ouvir um pouco de tudo e depois tentei identificar sítios e tentar ver se correspondia ao que tinha ouvido anteriormente no mesmo local.

I: Foste tentando corresponder e identificar sítios a certos locais.

P.02: Sim, houve uma altura que até está à procura de duas vozes…. Tinhas aqui sítios com vozes em sítios diferentes, certo? Ou a própria voz muda de sítio? Não me pareciam os mesmo diálogos ou línguas em alturas.

I: Como é generativo e espacializado em diferentes sítios, a um dado tempo mudam de sítio… Algumas delas são estacionárias, no entanto.

Completando o que disseste…. Achas que o movimento das fontes sonoras potenciou a tua interação a nível de procura?

P.02: Sim!

I: Conseguiste percepcionar algum tipo de proximidade, distância entre as fontes sonoras? Não tanto enquanto ias interagindo, mas à nível de onde as fontes se encontravam, onde estavam espacializadas no momento.

P.02: Sim sim. Achei fixe. Achei que estava tudo bem interligado tirando aquele som específico e mesmo o posicionamento no campo e a qualidade sonora estava boa.

I: Tens mais alguma observação?

P.02: Talvez o estímulo auditório um pouco mais alto… Mas isso sou eu… (risos).

I: É um ponto válido. Sentiste pouca clareza sonora devido a isso?

P.02: Está tudo claro. Lá por estar baixo não significa que não estava claro. Mas senti... precisava de um pouco mais.

Não é da tua coisa em si. Mas mesmo do volume geral do sistema de reprodução. Não tem nada a ver com os sons associados ao teu trabalho.

I: Ok, é uma ótima observação, bastante específica (riso).

P.02: Acho que é isso.

I: Muito obrigado mais uma vez por teres aceitado participar e dou então por terminado o estudo.

7.1.3 P.03

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.03: É pena já ter acabado. (risos)

I: Tinha a duração de cinco minutos (risos)

P.03: Tenho mesmo observações, mas ainda estou a processar.

Em termos de interface, ainda bem que esta cadeira roda porque é mesmo difícil sentir que te estás a aproximar do lado esquerdo e a coisa está a vir do lado direito… Então queres virar-te para o sítio de onde as coisas vêm e do lado que estás a ver. É fixe poder rodar (a cadeira) e acho que isto faz mesmo parte!

I: Sim sim.

P.03: Há aqui uma zona em que… O quadrado (interface) é um pouco grande e a interface (ecrã) é um pouco pequena então é um pouco difícil passar suavemente desta zona silenciosa

para outra zona intermédia no mapa. É um pouco difícil fazer uma passagem ténue de uma forma silenciosa para a forma que está a fazer mais barulho.

Há aqui uma zona onde há uma concentração muito chata (riso) de pessoas e não dá muita vontade de ter... Há muito barulho... E há aqui momentos que são mesmo muito interessantes. Isto é mesmo valioso… Um pouco por causa do que eu já sei previamente do teu trabalho.

I: Claro.

P.03: E há aqui uma zona em que tu ouves o espaço, sabes que existem pessoas, tens até aqui um *pau, pau, pau, paus* mas tens muito mais definição, não está tudo ao monte… As coisas têm muito mais tempo e muito espaço e consegues respirar, e consegues pensar e consegues mesmo… especialmente tu e eu que estudamos ali no meio…. Quase que consegues saber onde e que tipo de espaços tu conseguias encontrar, que estivemos neste ambiente que é relativamente fresco, mas aberto… E tu ouves as pessoas a viverem ainda, mas se saíres para a rua ao lado estás mesmo no meio da cidade… Mas ali não estás. Estes espaços são mesmo preciosos.

É giro usar a interface de uma maneira que não deve ser suposto utilizar (riso). Que é de forma assim repentina… outra coisa gira foi um momento em que eu estive durante algum tempo e onde não estava a acontecer nada e, entretanto, fui para outro sítio qualquer… depois voltei para lá e reparei que estava a acontecer alguma coisa…. Estava gente a falar naquele espaço. E isso foi uma surpresa! Por isso acho que cinco minutos para isto é muito pouco e não me dá tempo para ter surpresa… ficava a brincar com isto mais cinco minutos no mínimo para perceber se haviam outras coisas. No fundo a relação entre o tamanho do que eu sou neste mapa e as possibilidades a nível de som que existem neste mapa não é uma relação ideal porque sinto que dou passos muito grandes de um sítio para outro. Mas acho que funciona muito bem em termos de espaços, não só por estar espacializado porque ultrapassa bastante a tecnologia, porque consegues perceber onde é que as coisas estão e acho que isso é especial.

Acho que é isto. Daqui a pouco lembro-me de mais alguma coisa.

Lembro-me de estares a testar isto anteriormente e haver uma zona neste silêncio onde haviam imensas gaivotas… E aqui estava super silencioso. E eu imaginei o mesmo espaço onde elas estavam vazias. Porque tinha esta memória de antes.

Para mim esta outra zona é mais perto da praia, mas está frio… Não sei… Se calhar é porque não tem as gaivotas agora.

No sentido de uma mensagem das coisas se estarem a transformarem, isto dá-me vontade de querer espaços mais ténues…. Menos intensas como noutras zonas… Mais zonas intermédias…

I: Sentiste intrusivas... outras partes?

P.03: Não eu, mas que isto é muito intenso. Mesmo barulhento. Não há outro adjetivo. É mesmo barulhenta. Estão a acontecer muitas coisas que eu não quero ouvir. Enquanto que noutras zonas, como a zona onde se ouvia alguém a martelar aconteciam coisas que eu queria ouvir.

Acho que essa vontade pode…. Acho que é provável que lá fora me lembre que há coisas que eu não quero ouvir por causa disto… Tipo dois ou três dias. Ou então não, tipo 5 anos por causa da tua coisa, quando estiver no meio do Porto e sentir mesmo muito barulho. (risos).

Acho que é isso, gostei muito e obrigado pelo teu trabalho.

I: Obrigado eu por teres participado.

P.03: Não sei se é vantajoso teres as coordenadas aqui, mas, no entanto, permite-me repetir certas coisas com clareza, no entanto. Outra pessoa é capaz de achar bastante mais vantajoso. Mas gostei muito da experiência! Obrigado!

P.03: Obrigado eu mais uma vez. Dou então por terminado o experimento.

7.1.4 P.04

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.04: Pá, essencialmente isto está a funcionar bem, mas não é intuitiva a relação como mexes na interface. Estava à espera que isto representasse o formato circular que está à tua volta e fosses centrado o teu foco de atenção no ponto em que tu estás.

Mas da maneira como está a acontecer, não é circular, não me está a focar a atenção no ponto que eu quero e sim noutro lado que até pode ser atrás de mim… E isso torna um pouco mais complexa a experiência, porque tenho que perceber qual é a relação da interface com o que estou a ouvir e não só apenas a ouvir. Focada nisso.

Sinto que há um foco, mas como não consigo perceber de que forma é a que interface me está a dar esse foco, não me consigo focar essencialmente no som, mas sim tbm na interface. A interface tem um grande peso na experiência de maneira a eu perceber o que ela está de facto a fazer.

Não há um paralelismo do ponto que defines na interface e o ponto do que está a acontecer à tua volta (colunas, espaço). Até porque de um dos lados da interface parecia que nunca focava em nada, o que pode ser interessante, mas se calhar devia ser um ponto neutro no centro. Ou seja, não me estou a focar em nada... e não quando tento focar em algo em específico.

A interface se calhar ganhava em ser circular para ser representativa do espaço em que tu estás e o ponto central seres tu sem estares a ouvir e que vais apenas explorado e focando nesse círculo e nos pontos que estás à tua frente.

Dava a sensação que estávamos num espaço imaginário. Como se estivesses numa rua e estás a brincar com os pontos em que te podes explorar, atento ao que está a acontecer em X e Y e existirem pontos neutros em que estás desligado sem ouvir nada. A interface não ajuda muito neste ponto, não me desliguei tanto.

I: Não achaste então clara a relação entre ti e a experiência?

P.04: Não achei porque o mediador (interface) não é representativo do espaço que estou fisicamente e estava à espera que fosse. Ou seja, o movimento que faço aqui, ou o foco que acentuei aqui devia ser imediato. Passa um pouco por um processo aleatório de exploração e não me senti a controlar o meu próprio processo de escuta, ou foco de escuta.

Não há paralelismo entre o ponto que defino e o ponto que estou a ouvir, não me pareceu coordenado.

Ou seja, achei que o quadrado era representativo de mim, ou do meu foco, ou seja, quando estou no centro devia ser o foco em mim mesmo e nao ouvia nada e quando foco em algum ponto fora do centro, estava à espera que focasse em alguma coisa, nesse lado.

I: A nível sonoro. Que tipo de elementos é que achaste mais estimulantes?

P.04: Ai adorei a cena das vozes. Como sou do porto revejo-me bastante e consigo transpor-me para os sítios onde eles estão a acontecer. Também tens o metro e a parte dos helicópteros que me leva para a pista de helicópteros que existe na ribeira, ou assim… Um sítio de turismo ou assim, a pista de helicópteros.

Consigo reconhecer as coisas apesar de não estar a visualizar onde elas estão a acontecer no ponto exato mas consigo transpor-me para o espaço. Consigo perceber que é alguma coisa relacionado com o Porto porque sou de cá e dá para perceber isso.

Gosto muito das vozes, é muito poderoso ouvir o pessoal a falar, o sotaque e tudo muito a ser misturado com montes de elementos que são típicos de cá… Está fixe!

I: Pensas então que a experiência estava relacionada com a tua capacidade de foco sonoro?

P04: Sim, pensei que este ponto (quadrado, interface) funcionasse enquanto motor disso e no elemento que se encontra num dado ponto. No entanto isso não aconteceu na maior parte das vezes.

I: Existiu então um conflito entre o que querias ouvir num certo ponto e a sua disposição no espaço?

P04: Sim, exatamente.

Pensei que este ponto algo semelhante ou igual a isso e tornava a experiência mais imersiva, porque a experiência beneficiaria da maior intuição da interface.

I: Tiveste que recorrer ao estímulo visual para ouvir o que tinhas que fazer, certo?

P04: Sim, porque assim estaria a ouvir o movimento que estaria a fazer.

I: Então achaste que não foi fluída a sensação de controlo entre o espaço?

P04. Não, fluído foi. O controlo existe, e falando de termos técnicos e de programação está a acontecer bem, dos faders e etc, e deixa de tocar, por aí. Os cortes podiam não ser tão brutos, mas isso é opcional e uma opção tua.

É apenas uma questão de o controlo/interação corresponder de maneiras mais fidigna à minha expectativa de percepção.

O que pode ser interessante, mas dá uma ideia de instabilidade, de não dominar a experiência em si.

I: Estás dependente da pré-determinação no espaço dos elementos, então.

P04: Exato.

I: Percebeste através da representação do som no espaço a distância/proximidade entre o caminho que estavas a fazer…

P04: Não tanto quanto gostaria porque estive muito tempo a tentar entender qual era a relação do que eu fazia na interface e o que estava a ouvir. Em termos de espacialização, não tive muito tempo para perceber essa parte, ou seja, o que acontecia no espaço de forma intuitiva.

Se os elementos fossem mais difusos resolviam também alguns dos problemas a nível de espacialização.

I: Beneficiária então de mais tempo a experiência?

P04: Sim, claro, 10 minutos no mínimo.

7.1.5 P.05

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.05: Não sei bem o que dizer.

Acho que não cheguei bem a perceber o que se estava a passar… tenho algumas suspeitas, mas não consegui arranjar uma relação direta entre o retângulo da interface e o que está à minha volta (colunas). Percebi, no entanto, que há setores que estão sempre no mesmo sítio, no entanto. Não percebi muito bem a lógica de routing das coisas, o que é interessante, mas me deixou um pouco à toa.

I: Não achaste claro a parte da disposição das fontes sonoras no espaço. A nível da interação entre interface e a experiência.

P.05: Sim. A interface não foi análoga ao espaço, percebes. O fazer um movimento para certo sítio não corresponde às samples desse sítio tocarem. Ao início até pensei que o lado esquerdo não estava a tocar, mas notei que tinham sons, porém muito mais baixos.

A certo ponto, e visto que não estava bem a perceber de onde as coisas vinham e como estava sempre a alternar entre samples, apercebi-me que estava a perder coisas do lado oposto para onde estava virado, tipo um blindspot.

I: Conseguiste estabelecer um paralelismo entre os elementos que apareciam no campo sonoro e a tua própria memória de sons e de espaços?

P.05: Há coisas que eu identifico claramente através da memória, mas não me remeteram para alguma memória em específico, mas mais a um nível geral visto que são sons claramente reconhecíveis.

I: Que espécie de controlo é que sentiste ter sobre a experiência?

P.05: Não é direto o controlo, passei bastante tempo à procura de estabelecer uma relação entre a interface o sistema montado. Fazia movimentos pequenos e às vezes as mudanças

(volume) dos sons era muito grande. Os sons mais altos são muito objetivos a nível de direção… A posição em que estou criou um pouco ilusão de fases, posição dos sons no espaço não foi clara.

I. Que tipo de ações guiaram a tua interação com a experiência?

P.05: Sempre dentro dos sons mais altos, a procurar os sons mais intensos.

I.O movimento das fontes sonoras potenciou a tua interação? Ou seja, conseguiste sentir a percepção de proximidade/distância entre os elementos no campo sonoro?

P.05: Sim, claro, sem dúvida. Claramente proximidade, andava à procura dos mais claros e dos mais próximos

Sobre o que te falei, sobre os problemas de fase dos sons, usaste diferentes tipos de técnicas de gravações, certo?

I: Sim sim, tenho algumas samples que gravei em stereo e outras em multicanal, com o soundfield.

P.05: Estou curioso para saber claramente o que tens a dizer sobre a experiência em si e do seu propósito.

I: Quanto à experiência, espero que tenhas gostado apesar dos pontos que referiste. O propósito é semelhante ao que falaste, ou seja, remete para a exploração de uma cartografia sonora num plano bidimensional.

P.05: Ah, ok. Se tivesse conhecimento prévio teria claramente condicionado a experiência, porém acho que podes talhar ainda mais a questão de exploração. Acho também que haviam muitas variáveis que me distraiam a nível de interação, fiz gestos estranhos para perceber como tudo funciona e por brincadeira quando podia ter perdido tempo a entender realmente a riqueza sonoras, as características timbres, etc etc e a duração dos sons.

Foi uma boa volta pelo porto apesar de não saber que realmente estava a percorrer espaços físicos inicialmente, recriados no campo espacial…

I: Obrigado mais uma vez por participares no estudo, dou então por terminada a experiência.

7.1.6 P.06

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.06: Passava aqui mais tempo muito sinceramente....

Comecei numa de explorar o campo, perceber onde há sons com mais intensidade, explorar a interface com os sons e tentar fazer uma composição só minha.

Passar num som não só para ouvir, mas perceber se é mais grave, carregado aquele som, aproveitar isso para contrastar com os outros e ter umas sonoridades interessantes. E dá mesmo

por acaso… A interface é um quadrado cinzento, mas na minha cabeça já estava tão a olhar para aqui que na minha cabeça já estava tão a desenhar o espaço, onde devia ir e queria fazer! Engraçado! Passava mais tempo aqui, por isso mesmo... foi uma boa experiência.

I: Gostei bastante do que disseste porque vai de encontro ao que estou a tentar estudar.

P06: Boa…

I: Sentiste então que a relação entre si, a interface e a experiência foi clara ou ficando mais clara ao longo do tempo?

P06: Senti que havia regiões com maior densidade sonora, depois haviam momentos que não tinha tanto e foi um pouco instintivo querer brincar com um pouco com isto, ver o que se pode fazer diferente, brincar com isto. A interface ajuda sendo plana e de toque.

I: A nível de estímulos, foste-te guiando pelo facto de conseguires reconhecer as fontes sonoras, não pela natureza de quem são estas pessoas ou assim, mas conseguir reconhecer…

P06: Sim, saber que nesta parte ter aqui uma pessoa, não sei se é esta a pergunta, mas…

I: Foste reconhecendo o tipo de sons e onde se concentravam.

P06: Sim, exatamente, por exemplo, o tipo de sons como comboio ou metro, sei que era nesta zona e quando lá queria ir, ou seja, eu estando ao querer compor alguma coisa, por exemplo, quero um som mais assim... Sei que está ali um comboio… há pessoas que lá estão que se calhar não estão lá sempre… Fui-me apercebendo dos sítios e do que estava em cada sítio. Uma espécie de um mapa. Na minha cabeça já estava a pensar: esta zona é disto, esta é disto.

Foi interessante experimentar saltos, assim a nível de exploração.

I: Então não só estavas a compor o que estavas a ouvir, à medida que foste interagindo, mas também a jogar com o que ouvias e o que já estavas à espera de ouvir.

P06: Sim, exatamente isso, claro que ao início foi um pouco mais de exploração, tipo ver o que soa aqui e ali, mas claro que depois uma pessoa joga com o que conhece e o sistema.

Também houve um momento em que estava a testar as capacidades da interface, testar com 3 dedos, saltos para ver o que acontecia… claro que tudo numa relação de som/comportamento.

I: Através do comportamento da interface, não é?

P06: Sim sim, sim, ou seja, tirar o partido máximo da relação do gesto aqui com o campo sonoro que está implícito no quadrado/campo da interface.

I: A fluidez da interface potenciou então a tua interação?

P06: Eu gostei… claro que me estou a desligar-me que isto tem um ícone, uma roldana. Por exemplo, comparando com o leap motion… Não ia gostar tanto. Aqui posso pousar o dedo, consigo e sei que estou a deslizar porque posso ver um quadrado e e guiar-me pelo que ouço… pelo que consigo ouvir. E até o comportamento que estou a ter e a relacionar-me com o som.

Por acaso e muito sinceramente não estava à espera que me prendesse tanto, o ambiente, o setting (colunas) contribuiu a imersão. Especialmente porque estou sozinho a interagir com isto.

I: O movimento das fontes sonoras potenciou a interação? Ou potenciando?

P06: Nem por isso, confesso que desenhei o meu modelo mesmo a partir de algo gráfico, por exemplo, sei que tenho aqui sons deste tipo, e até que fontes ia ter, mas essa proximidade foi necessária e válida no início, enquanto não percebia a própria interface e o sistema. Depois fui brincando e percebendo que resultados podia ter com o movimento através da interface.

P06: Por acaso mesmo assim sinceramente, gostei mesmo muito sinceramente e fiquei surpreendido comigo mesmo. Consegui meter-me aqui dentro, capta bem e chamou-me à atenção para explorar mais.

A interface é mesmo boa escolha e ser num tablet também faz todo o sentido. Estou a desligar-me do design de interface, a interface enquanto ligação com outra coisa.

I: O facto de ser uma tablet e não outra coisa…

P06: Podia ser qualquer coisa, mas tu tocas, sendo algo físico e que tocas dá logo a sensação de estar a controlar coisas e saber onde estão as coisas e guiá-las para certo caminho.

O toque funciona muito bem neste caso e o gesto (hand tracking), fico a pensar que se calhar não resultaria.

I: Gostei bastante do que foste dizendo e dos pontos que foste tocando, da interface à tua própria interação… tens mais alguma observação a fazer?

P06: Gostei… e ficava cá mais tempo, mas claro que o estudo tem que terminar.

I: Muito obrigado novamente!

7.1.7 P.07

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.07: Incrível pá, pena já ter acabado. Tenho umas perguntas.

Imagina, gostava de ter mais display gráfico do que estava a fazer. As várias zonas… Eu comecei a ir aprendendo o que é que elas e eu fazíamos por causa das propriedades sónicas. Tipo o objeto node (no Max/MSP), tipo por áreas.

Era fixe teres liberdade para cada gravação e não só liberdade numa composição de 5 minutos com bastantes gravações.

I: Focar em cada uma das gravações? Em uma específica?

P07: Separar… é um pouco arruinar o conceito de ecossistema, e criar vários ecossistemas… Mas era uma opinião fixe.

I: Focar num ecossistema mais fechado então?

P07: Sim, que era o que me apetecia fazer. Eu curtia isso. Fui aprendendo o que fazia cada coisa, e que tipo de interação… Para aqui faz isto, para ali faz aquilo, por aí.

I: A nível de experiência gostaste? Foi estimulante?

P07: Sim sim, achei que foi altamente. Mas tens algumas gravações que estão um pouco off the grid…

I: Muito discretas?

P07: É, é. Mas se calhar nem é culpa tua nem da técnica de gravação, mas do que está a acontecer à tua volta. Como a gaja que está a mandar vir e assim.

I: Era fluído a nível de interface?

P07: Era! E essa é outra, e fiz tipo tapping e ele muda dinamicamente e não só com o deslizar.

I: Foste-te movimentando no campo um pouco através da exploração então?

P07: Sim, estás quase a compor em tempo real, é tipo isso. Estás mesmo quase a compor em tempo real. Unfolding bocados da paisagem. Essa é a cena fixe para mim.

Era incrível ter mesmo 30 canais…

I: De que maneira? 30 colunas?

P07: Sim, claro! Visto que tens prai 30 canais, tens que ter 30 no espaço também. Respeitava mais o que fizeste a nível de software.

I: Conseguiste sentir algum movimento inerente às fontes sonoras?

P07: Sim, claramente.

I: Contribuiu para que fosses explorando?

P07: Contribui mais as propriedades do som, mas gostei, sem dúvida.

I: Tens algo mais que gostarias de dizer? Nota? sugestão?

P07: Já falei da interface, canais… é isso… Também gostava de saber qual é a técnica da interface e assim, qual foram os sítios do Porto que gravaste…

I: Mas achaste interessante… pensaste nisso?

P07: Claro, o sítio das gaivotas lembrou-me logo a minha ex-namorada… Ou o metro de Gaia… estás a mostrar a um gajo do Porto, o Porto… Por isso é normal ter memórias.

I: A recriação potenciou essa parte sensorial de memórias?

P07: Sim, sem dúvida. Claramente.

I: Pronto, então da minha parte está terminada a experiência, obrigado por teres participado.

7.1.8 P.08

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.08: Na realidade não percebi muito bem o que era pedido fazer, neste caso. Tive com este controlador quase em free ride. NEsse sentido é engraçado porque realmente permite on the fly os sons que vão acontecer e compor uma paisagem e algum tipo de movimentação. Se calhar, e não sabendo propriamente o objetivo do teu trabalho, e que se calhar também é mesmo o objetivo do teu trabalho... pareceu-me uma situação interessante!

Entretanto fui-me reorganizando mediante a frente do sistema e andei à procura dela e achei piada quando estavam os sons ao contrário. Visto que tens esta componente visual (interface), um link com o que está a acontecer.

Sim, achei interessante a questão da montagem da paisagem, faz lembrar a Audio in the Docks do Luc Ferrari, esse tipo de trabalho… Isso é fixe.

I: Foste-te guiando um pouco ao ir percebendo onde estavam as coisas e como se comportavam?

P.08: Sim, como elas se comportavam com o que está a acontecer, até houve uma altura em que estive mais com os olhos fechados e deixar isto rolar… Sem ter feedback visual… Que é normalmente o problema dos touches (interfaces), o pessoal quer sempre por a rodinha a mexer.

Mas também é muito interessante, especialmente criar este percurso… E depois como não é um percurso linear com paisagens que quebram de umas para as outras fazem-me lembrar muito o trabalho do Luc Ferrari.

De uma forma geral é isto.

I: Obrigado, foi bastante incisiva a resposta.

P08: Já agora e concretamente isto é?

I: Assim mais concretamente isto é uma reconstrução de paisagens sonoras da cidade do Porto, de sítios do Porto… E criei uma espécie de cartografia aural, temos certas zonas e o utilizador…

P08: E o utilizador vai essas zonas como se isto fossem as ruas… Eu sinto um pouco isto como ruas em que vamos andando, tal como quando vamos na rua, passando por várias coisas e vamos ouvindo… várias situações… engraçado com aquele som de fundo que mantém uma ligação. Isso é fixe porque me deu mesmo ainda mais uma ligação de soundwalk. Até quando estava com os olhos fechados estava mesmo numa de soundwalk, como se fosse mesmo a caminhar pela rua e vais passando por várias situações.

I: Isso é mesmo o que tentei recriar, por isso é ótimo que tenha lembrado isso.

P08: Sim, isso deu, isso deu. As cenas de soundwalk e assim. Depois a montagem lembrei-me do Luc Ferrari e as cenas dele. E ele até tem trabalhos aqui no Porto, acho que era ele.

Especialmente quando nos desligamos da parte visual… ficas mais imerso na cena e vais a andar e assim…

Em geral é isso.

I: Obrigado mais uma vez por participares no estudo e ainda bem que gostaste.

7.1.9   P.09

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.09: Muito fixe! Achei super fixe puder voltar a sons que estava a curtir e conseguir encontrá-los outra vez no espaço.

E também achei interessante que às vezes não era automático a disposição dos elementos no espaço, ser surpreendida pela disposição no espaço mediante a na interface. Foi fixe.

Não senti muito vindo de trás… estava a vir de trás?

I: Sim, supostamente sim, mas…

P09: Não senti tanto, mas se calhar também não explorei bem porque estava a tentar ir a todos os cantos, todos os lados e voltar para trás.

Se bem que a coluna da esquerda parece…

I: Tem predominância.

P09: Tem não tem? Pois, eu acabei por vir quase sempre ir buscar a este lado.

E depois também achei super fixe tanto a parte mais intensa quando ia para o lado esquerda, mas a parte do cantinho super calma… Também gostei muito.

Claro que ficas um pouco constrangido com o tamanho da interface, mas não acho que… Até estava a fechar os olhos para ficar assim mais…

I: Achas que ganhava não ser assim tão intrusiva, tão luminosa ou?

P09: Não me incomodou a luminosidade, é mais tu saberes onde acaba… E vou até li e aqui e vais procurando a luminosidade.

Mas também podia dar quando se gira, mexe, roda a interface… fazer qualquer coisa (riso)

Se mexesses a virtude da frente e de trás… (riso)

I: Tipo um barco (riso)

P09: Tipo um barco (riso).

Mas está muito fixe e também tinhas várias pessoas a falar em português e inglês e tinhas várias...

Onde é que captaste?

I: Captei maioritariamente na zona do centro histórico.

P09: Mas tinha algum percurso lógico ou?

I: Sim, mais ou menos. Estavas sempre condicionada da minha parte porque fui eu que os dispus no espaço. Mas tinha a zona dos Guindais, o percurso entre as Fontainhas e Guindais… Por aí. Percursos do centro histórico.

P09: Muito fixe… Portanto, do elétrico, do rio… Há do elétrico?

I: Sim sim, do elétrico, comboios de são bento e do metro também.

P09: Mas sim, o diálogo é muito português. Tem também um pássaro qualquer, não é? (riso)

I: Sim, sim, sim.

P09: Imaginei logo um café com um pássaro numa gaiola ali à porta do café.

I: Por acaso é exatamente… (riso)

P09: Pronto (riso) Imaginei logo que fossem logo aqueles (café) que dizem olá logo na entrada... aos clientes (riso). Mas está fixe!

I: Espero mesmo que tenhas gostado.

P09: Sim, sim, sim.

I: Então achaste estimulante o facto de os encontrares…

P09: Sim, descoberta, sim. Captivava tu ires procurar mais coisas e mais histórias em cada ponto. Estava ali a ver… E depois voltava ok, está já ouvi e tentava ir buscar coisas diferentes… várias as gaivotas… fui lá dar várias vezes… (riso)

Não sei… Tu que já ouviste montes de vezes, houveram sons que não explorei?

I: Sim sim.

P09: Houve…

I: Mas é normal, a experiência é curta também.

P09: Não consegues ouvir tudo, não é?

I: Não não, também reduzi o tempo da experiência para 5 minutos por medo de a tornar aborrecida. Claro que tem bastantes samples e possibilidades de interação, mas há sempre o medo de esgotar as capacidades de surpresa na descoberta.

Mas como é generativo, existem coisas que tocam uma vez, mais ou não.

P09: Quando é que mostras novamente?

I: Espero que seja em breve, estou a tratar disso. A testar e a refinar o sistema.

P09: Ainda bem, gostei bastante, parabéns.

I: Obrigado mais uma vez por participares na experiência.

7.1.10 P.10

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.10: I was trying to understand that… if I move this sounds happens and goes like this...

After a while I tried to figure out what kind of sounds, they were...on the right part the metro, waiting for the metro, people talking the beep, the doors and passing by.

On the left i noticed a bit more... I saw the outside of the city, beach... I heard the birds, seagulls… A bit chiller, less cars and other stuff.

I noticed as well that i tried to, apart from what was there, like, stay on one point… To listen more, if it keeps on going, if it repeats itself, how it was triggered... if it repeated, if it was different or if there were repeating sounds… How it was triggered… If it stayed all the time playing...

That was what I felt, I felt that i was in there, that I was more in there in one point. It was about what I wanna listen too, really being in there… It was really your own movements.

I: What did you think about the experience (overall), did you enjoy it?

P10: Yes, I did, I think it is interesting especially in the beginning because you gave me the interface and I didn't know what it did. I thought I was about to play a game but something with sound. But it's cool because they aren't computer sounds… Especially because sounds are connected with the real world. It's smooth to go to different places and ear different stuff, the digital life is connected to the real life, I could imagine where I was.

I was actually imagining I was at Polo Universitário when I listened to the metro. I thought about that because it's usually a dark place and its dark here. You can only see the people and the metro there.

I: So, as long as you were interacting, were you understanding what happened, what it (experience) did, what it led you into doing? Did it stimulate you to keep on navigating or to listen more carefully and understand what was happening?

P10: Yes, it did. I could learn more if I listened to it slowly. Anyway, I could've known more if I was listening longer… To know exactly… On the right side was a bit of the metro, that it was a long space with the metro sounds. If I wanted to know more, I could've stay a bit longer on eery points to get like, you own floor plan of each sounds… And which sounds was were. And yes, then... Especially after the beginning... after switching everywhere to see what it did, to listen more in depth about what's happening on each point.

I: Did you notice any kind of movement inside this space?

P10: I noticed, yes. Especially with the cars passing by and the metro. The thing is that I didn't have it a lot, not super much, because I also changed it quite in the middle of the movement… So, it broke it.

Maybe in the cars I just stopped early because it was like… hey… It's a car, I know this sound and I don't want to listen to a car. And the metro was more… Okay, it's going to start, it's going to open the doors, people are going to walk, then it has the *pi-pi-pi* . So that was more, what was going to happen? So yeah…

I: A richer experience?

P10: Yeah, a more interesting experience and yeah, in that case I really saw or heard the movement of the metro arriving or leaving. And also, the doors, but that was just in my mind.

I: That was a nice observation… Because the metro really has its own life… Its own ecosystem.

P10: Own life.

Yes, and the car… I don't know… On the upper left part there was a… It had the sound of a car, and I think once or twice I stayed to listen if the sound stayed there or passed by a lot of times… But after one time or so it passed by, but I found it less interesting than the metro and the people talking… So sometimes I broke the movement.

I: I really liked all the points where you are mentioning. You talked about the experience, the sounds, you own experience with the… experience. Do you want to add up anything?

P10: I'm very… more interested in what you will... to know how, if it will be… how will it be developed if possible… and when… And for which kind of people… To actually see what it will be used for… Because I see the name Aural Wandering and was thinking about it.

I was thinking about this for people who cannot see… Blind people. Just for anyone who wants it. Like, you can close your eyes and use it, without the interface. It can be used for cool things… stories… That kind of things combined with the movements. It is really interesting.

I: Thank you so much for participating in the experimenting, hope you enjoyed it thoroughly.

7.1.11 P.11

Interviewer: Thank you so much for being a part of the experiment.

What did you feel about the experience? Do you have any comments, observations?

P.11: Assim do ponto de vista mais pragmático da ferramenta é inevitável olhar para as coordenadas e o facto de ser um retângulo e não um quadrado foi logo à primeira coisa que me saltou à vista e então tive isso em mente durante algum tempo. Depois na resposta mais auditiva, na minha sensibilidade notei uma zona que tinha claramente uma maior intensidade de som… Aquele diálogo concretamente que acontecia aqui no no quadrante superior direito. Em regra geral, senti que do lado direito havia maior intensidade sonora do que no outro lado. E senti também que no início... andei a clicar e a navegar e não a deixar espaço e mover diretamente o quadrado… Ou seja, estava mais aqui a deixar e a percorrer. Descobri que dava para navegar lentamente.

De resto acho que tem aqui uma capacidade muito forte de representar as paisagens sonoras. Não sei qual é especificamente o contexto disto, visto que não falamos anteriormente, mas o contexto disto… As gaivotas, o metro ou o comboio dá me uma sensação, e também por estar condicionado ao sítio onde vivo e também à experiência de vida que tenho, algo como uma paragem em matosinhos ou próximo do mar. Deste género. Assim as primeiras coisas seriam essas.

Os primeiros comentários seriam esses… Assim na escuridão.

Outra coisa sobre os testes e visto que já estive neste mesmo sítio, desta mesma forma, e não tens culpa, mas os últimos tempos passei mesmo muito tempo aqui e então tentei perceber como é que o som se movia aqui no espaço. A minha primeira tentativa foi mesmo tentar perceber se e como é o que som se traduz na movimentação pelo set espacializado.

Mais uma vez, não tens culpa, mas sou eu que não deixo inconscientemente de tecer paralelismos entre a tua cena e outras.

I: Achas que foi fluída a maneira como foste interagindo?

P11: Perfeitamente. Ou seja, a certa altura estava até enervado…

I: Melindrado (riso)

P11: Sim (riso), não sei se deu para reparar de fora, mas havia aqui um sample de um sujeito masculino a falar e eu tentei voltar a reproduzi-lo sempre, tal como uma síntese granular, a ativar frequentemente..., mas opá… Não… As fluidezes do processo todo impõem-se sobre isso… Mesmo que eu enquanto utilizador esteja a tentar forçar isto a não ser tanto um soundwalk, não, isto força-te a sentir isso.

Eu queria distorcer um pouco a paisagem sonora e quebrar isto um bocado. Somos humanos e curiosos e gostamos de encontrar os bugs no jogo (riso). E foi o que tentei fazer aqui, mas não, mas se é fluidez que queremos aqui avaliar então sim… muito fluído.

I: A própria linearidade (ou não) fizeram-te um pouco guiar ao longo da experiência? Foste-te deixando levar através da fluidez que referiste?

P11: Sim sim, sim. A partir do momento que percebi melhor o que estava aqui a acontecer… quase que entras na paisagem. E isso da linearidade eu vejo-a como uma linearidade… Se quiseres, múltiplas linearidades. Eu sinto que isto é linear no sentido de ser contínuo, mas que o teu papel enquanto utilizador te permite navegar por vários contínuos. Não te permite criar um contínuo, mas sim navegar por vários contínuos.

I: interessante

P11: Senti que podia ir para onde queria, mas não violar o caminho. Ou quase alterar de maneira maquinal o processo. Senti muito um percurso humano de alguém que sabe para onde vai.

I: É muito interessante o que disseste.

P11: Fico contente. Mas é verdade, senti mesmo isso mesmo com a coisa de brincar… sei que havia aqui um sample no 0.79… um excerto…

I: Conseguiste já então identificar… ter memória a curto prazo de onde as coisas estavam no…

P11: Não tenho a certeza, mas sei que havia aqui num quadrantezinho… Que havia um sujeito que dizia qualquer coisa, qualquer coisa que me interessava ouvir e eu queria voltar lá, mas forçar a dizer a fase que ele disse inicialmente...repetidamente… Por aí. Mas não! Como se passa na vida real e quando passo por algum sítio e ouço alguém a dizer alguma coisa eu não tenho a capacidade de voltar atrás e fazê-lo dizer a mesma coisa.

I: Tens alguma observação que eu ainda não te respondi ou algo que notaste?

P11: É assim, falamos aqui muito da fluidez, não sei que mais queiras...

I: Tocaste em todos os pontos que eu estava à espera que respondesses. Da ferramenta, da tua experiência… do próprio percurso da experiência e das coisas a acontecer e gostei da parte em que tu falaste agora mesmo. Conseguias entender uma linearidade nas coisas que aconteciam, mas não no que se reproduzia.

P11: Sim, exatamente, ou seja, o que acho que é fixe é por ser claramente uma linearidade. Ou seja, não haver quebras, mas ao mesmo tempo não ser uma coisa repetitiva. Porque podia perfeitamente ser sempre a mesma sample continua a tocar qualquer coisa para onde te movesses. Mas não senti isso, senti que tinha controlo… Mas não fora da realidade. Ou seja, era

um controlo que podia ter perfeitamente auditivamente… Mas claro, ai teria de estar a correr para conseguir passar de paisagens sonoras tão distintas...

Mas poderia ser na realidade se estivesse numa situação aflita… como a correr do metro imediatamente para a praia, por alguma razão, poderia ter feito um percurso acústica exatamente como fiz aqui. E no início foi tentar perceber se era isso que eu sentia ou se não… Se tinha a capacidade controlar algo que foi tão humano.

Acho fixe na interface teres aqui um retângulo cinzento, se calhar e se eu não tivesse feedback das coordenadas tinha me baralhado um pouco, mas o facto de lá estarem permitiu a possibilidade de voltar onde já estive anteriormente.

Achei mais fixe para a questão de exploração teres uma interface tão simples, sem feedback visual a nível de diferentes paisagens visuais, como fotografias de estações ou assim. O facto de ser uma folha branca permitiu-me perder realmente aqui. Para mim… isto foram 5 minutos? Isto pareceu-me 1 minuto.

Andei a ver o que soa aqui, aqui, ali… Como soa na vertical… horizontal.

Fazendo parte da mesma especialização que tu, claro que andei a ver o que se passava aqui… Os cinco minutos esgotam-se rapidamente.

Senti-me o compositor do meu fado… do meu destino. Estava a tentar caminhar.

I: Obrigado mais uma vez por participares no estudo. Espero que tenhas gostado.