Aurora Machinery: Computer Application for Interactive Audiovisual Performance

Author: Anastasios Georgiopoulos (MTA25)

Supervisor: Nikolas Valsamakis

A Thesis in the Field of Audio Technology

for the Degree of Master of Science in Sound and Music Technologies

Hellenic Mediterranean University

Rethymno, February 2024

Copyright 2023 Anastasios Georgiopoulos, Nikolas Valsamakis

Table of Contents

Aurora Machinery: Computer Application for Interactive Audiovisual Performance 1

Abstract.....6

Introduction 7

Chapter 1 Anthropological Perspective 10

1.1 Interconnection of Music and Culture 10

1.2 Space and Phenomenology 14

2.3 Chronology 18

Chapter 2 Aesthetical Perspective 23

2.1 Ambient 23

2.2 Noise 26

2.3 Drone 31

2.4 Glitch – Microsound 37

Chapter 3 Technological Perspective.....41

3.1 From Tape Recorders to Computers 41

3.2 Computer Music Software 44

3.3 Dynamical, Sensorial and Interactive Compositions 47

Chapter 4 Aurora Machinery 52

3.1 Overview 52

3.2 Patch Analysis 53

3.2.1 OSC Routing 53

3.2.2 Motion Detection 55

3.2.3 Crossfaded Looping 56

3.2.4 Subtractive Drone 58

3.2.5 Generative Pad 59

3.3 Live Setup 61

3.4 User Interface and Personalization 63

3.5 Conclusion 65

Apendix I - Software Photos 67

Bibliography 74

Abstract

‘Aurora Machinery’ is system designed in the visual coding environment of Max/MSP to implement an audiovisual interactive installation, where the audience can interact and affect the sound output with the motion of their bodies. This thesis focuses not just on the examination of such a system and its creative use in composition. It provides a relevant chronological retrospection from anthropological, aesthetic and technological standpoint, delving into theoretical primary concerns such as how humans relate to music, the interconnection between music and society, the potential of technology as a creative tool, and the blur limits at which it becomes an end in itself.

Introduction

‘Aurora Machinery’ is a computer application created in the environment of Max/MSP that implements an interactive, audiovisual installation. On functional level, it manipulates samples, synthesizes sound and shapes them with effects, while it provides certain real-time controls that affect important parameters. The mediums that the users have at their disposal to control those parameters, are their mobile phone’s sensors, transferring information via the OSC protocol and their computer’s camera, using the OpenCV’s computer vision technologies to detect motion. Yet it may be conceived as a contemporary work that relies on proficient technological innovations, genealogical way of thinking could find relations with it up to ancient times, when even the word technology had a different meaning. This thesis explores of these intricate connections, focusing on anthropological, aesthetical and technological concerns that subsequently relate to Aurora Machinery.

In the first chapter we examine our case from an anthropological and sociological point of view. How interwind music and culture are, how art reflects society’s ‘fundamental mood’ and what could be the subconscious impact of musical ques. How music can become space and how space can carry memories. How music is capable of forming conceptual surroundings and how could we find a language to describe the first-person experience of an atmosphere. How silence may carry an ocean of meanings and how textural abstractions like fragility could evoke related inner feelings. Following we deal the most primary concerns of aesthetic philosophy. What indicates an artwork and how wide that spectrum can be, where is the limit that technique shadows creative expression. How tools and

mediums can be used to protest against norms and oppression, while at the same time they shouldn't really matter.

In the second chapter, we examine four genres of electronic music that Aurora Machinery is inspired from. Ambient, Noise, Drone and Microsound. Musical aesthetics serve as the guiding force behind our exploration. Through an analysis of musical aesthetics, we aim to decipher the artistic intent behind each genre, dissecting the elements that contribute to its one's sonic characteristics and the inductive values that they all share

.

The third chapter examines the historical evolution, including key milestones, innovations, and paradigm shifts of audio technology from pre-Schaefferian period to the present day. Since the thesis provides a contextual backdrop for understanding the technological landscape within which Aurora Machinery exists, we dive more into 'Computer Music' —analyzing the sub-categories of 'Visual Programming Environments', 'Modular Synthesis Environments' and 'Code-Based Systems'— and into the compositional forms of 'Dynamical', 'Interactive' and 'Sensorial' music compositions.

The fourth and last chapter is concerned with a practical analysis of our application; Aurora Machinery. It starts by providing a quick overview of the system and then focuses more on each individual component separately as well as their interconnections. Then we analyze how it would work on a live setup and demonstrate interesting outcomes and thoughts from an actual implementation of it. We close by explaining the GUI and suggesting tips and ideas about personalization and future improvements.

Chapter 1

Anthropological Perspective

Without music, life would be a mistake.

— Friedrich Nietzsche

1.1 Interconnection of Music and Culture

The world we live in now would be vastly different from a world without music. Almost every civilization in history has included music as a fundamental component of its culture, making it hard to picture a world without musical noises and harmonies. Its roots are deep inside the human structure reflecting most of their questions and concerns about life, since music has been always employed in spiritual rituals, marriages and funerals, work activities, gatherings and other significant life events. It is a tool for narrative, expression, and communication, along with its many psychological and physiological advantages, like stress relief, mood enhancement, improved cognitive function, and more metaphysical benefits like connecting with inner, inexplicable feelings and states that we cannot rationally express. A world without music would be quieter, more unbearable, less expressive.

Our cultural experiences and background have a significant impact in our musical choices and perceptions of different musical genres and styles, as well as in our reactions to musical cues, via influencing the creation of musical schemas, or mental models that

people use to order and analyse musical material. These schemas are formed by cultural norms and conventions, which may influence how we expect and interpret musical structures and patterns, noting the most basic one; our language. Regarding the instrumental component of urban space, for example, it is critical to acknowledge that no sound event — music or any other type of sound — can be separated from the temporal and spatial factors that determine the path of physical signals. Subjective shaping of sound can only partially happen when a person's mentality, psychological composition, cultural background, and hearing capacity are carefully considered. Since various people, communities, and cultures perceive sound in different ways, listening cannot be understood as a common practice, but rather as a diverting and adaptive one.

According to Heidegger, music may convey the ‘fundamental mood’ or ‘ground tone’ of a certain society or historical period. In his lecture (Heidegger 2004), he made the case that music, which is not constrained by the particular meanings and associations of words, may more precisely convey the essence of a people or a historical period than language. By this mean, culture is not static, it may carry some heritage, but it may also create. Even a culture fading away, indicates the culture of the era. In the 1970s and 1980s for example, while music scholars were contemplating how the continuous influx of electronic sound production was reshaping the landscape of music, inventive composers like David Tudor, Pauline Oliveros, La Monte Young, Eliane Radigue, Gordon Mumma, and David Behrman were improvising new instruments using early digital components. Behrman, recollects being on Merce Cunningham's bus in the early 1970s with manuals on logic circuits as he engaged in learning about the emerging generation of electronics (Holmes 2002). These inventors created instruments to further a cutting-edge musical style

and as a result formed the ‘fundamental mood’ of the era. Their explorations necessitated the learning of new skills and a willingness to explore, which ultimately resulted in the different degrees of electronic music approaches being incorporated into most worldwide cultures. During the same time that mass production of synthesisers reduced costs and made them accessible for home use. The outcome was the emergence of new channels for artistic expression, entertainment, emotional connection, and musical awareness that opened new paths on sound explorations and the rise of dance electronic music in the early 1980s. This whole new world of possibilities, had a significant impact to the way that the observers tended to relate to music as well.

John Cage's perspectives on the link between music and culture, were characterized by an appreciation for open-mindedness, curiosity, openness to listen to the sounds of the world around us and participate with them, regardless of cultural background or preconceptions. As a composer, he accomplished this by employing randomization and detaching himself from the composition, allowing him to observe it from outsider's perspective. This manner of thinking can be associated to Deleuzian philosophy (Deleuze 2003), which states that everything does not have a common origin and by conceptualizing everything we encounter related to previous assumptions and abstract structures, limits every possibility of imaginative thought and being. Experiencing awareness may be defined as actively participating to the incoming stimulus. In case of music, is staying in the present moment and seeing its different components, such as melody, harmony, rhythm, timbre, creative allegories and metaphors, or even the inner thoughts that arise when music becomes silence.

We could learn that auditory cues subconsciously control our conduct. Our current experience occurs against the background of a large reservoir of memory, the majority of which is unconscious. So let us not be constrained by cultural or stereotypical assumptions. Anamnesis has an archetypal dimension, despite being primarily subjective. Noises of flowing water, rain, crackling fire, thunder, and singing birds, as well as noises of industrial automated systems, vehicles, and urban drones, can provide common references for a certain culture. Individual impressions are built on a variety of common origins. Although archetypal anamneses are less aware than others, they can be as powerful. People who work in cinema audio effects are fully aware of this and they usually choose helpful sounds for their effect on the audience rather than for a true relation to the recorded scenario.

As is often the case, art perceives what knowledge does not. Each of our conscious senses is founded on a massive swarm of components that are not accessible to conscious cognition. Such unconscious sensations have a virtual life according to Leibniz, shaping conscious perception without being aware of it, a quite similar procedure as memory. Even when they are not included in the language abstraction of scientific discourse about music or acoustic engineering, common sounds still function via everyday activities and communication, impacting many of our daily life practices. However, a snapshot, a song, or a fortuitous meeting might bring a bit of this reservoir into reality, lighting it briefly and providing a glimpse of the entirety (Cox 2018). Being conscious of our own emotional and physical reactions, including any anxiety, excitement, grief, joy, or peacefulness, as well as how our bodies are responding to them, are crucial concerns of being a human. Fortunately, we have music that provides space for such explorations, relating with emotions and building bridges between layers of consciousness. It is just a point of personal

taste and life approach then, which types of music we tend to appreciate and how we absorb and translate them.

1.2 Space and Phenomenology

Numerous methods exist for music to become space, both literally and more metaphorically. In terms of the physical medium, it is achieved by the application of soundscapes and spatialization techniques, which involve using music and noises that suggest different environments, such as busy markets, forests and cities. Sound always travels as vibrations via a medium—precisely air in most of our cases—acting like a vector, beginning at one location and spreading to many others. Our perception of sound is inextricably tied to our position in relation to both the sound source and our immediate surroundings. Using tools like panning, delay and reverb spatialization techniques to create depth, distance, and spatial movement are some ways to adjust the placement and movement of sounds in space.

By evoking an atmosphere, a mood, or an emotional resonance, music may, in a metaphorical sense, become space. For instance, a piece of music may arouse feelings of energy and excitement that encourage dancing and celebration, forming an active and uplifting space, or it may elicit feelings of quiet and tranquility that provide a sense of space for introspection and thought. We can identify a number of ways in which music functions as a space: it can function as a sonic environment, converting a physical area into an immersive and interactive experience; it can function as a cultural space, bridging gaps in language, time, and location; it can function as a psychological space, enabling us to explore and express our innermost feelings and thoughts; or it can function as a social

space, drawing people together and promoting social interactions. Space is frequently mentioned in conversations about acoustics, since it is via the manipulation of sound reverberations that music transmits information about the surroundings in which it is encountered, whether accurately or not. It is concerned with the conditions, whether man-made or natural, that give origin to sound, while location refers to the physical positioning of both listeners and sound sources. While it can be a literal place, it is typically a perceived one, especially since recordings excel at presenting auditory circumstances that may or may not exist in reality.

This idea is studied by the philosophical discipline of phenomenology, which places an emphasis on the subjective experience of things and the first-person viewpoint. All of the ways that we see stimuli are cocooned by Husserl's phenomenological technique, which holds that our perception of the world is produced by a collection of diverse perceptions relating to a particular item or phenomenon. We may, for example, tackle this subject from a linguistic and poetic perspective, as Gaston Bachelard did in his studies. He investigates the way that poetry and art arouse memories of the childhood houses we grew up in. These childhood homes are the places our minds revisit throughout our lives and he suggests that poetry has the ability to transport the reader back to the emotions associated with the spaces of their youth, even those long relegated to the recesses of memory or left behind (Bachelard 1994). Approaching the same topic from a musical perspective, the phenomenology of music and space are the ‘musical atmosphere’ and ‘musical embodiment’ that the listener experiences, discussing the ways in which music and sound, whether intentionally or unintentionally, enters our physical and sensory experiences of the

world. How music may evoke a feeling of place, atmosphere, and mood to which one might belong?

> '[...] approaching atmospheres from both a consumption and a production side, Böhme indicates [...] how atmospheres may seem [...] commonplace and work as a premise for engaging with the world, but there is a production aspect with political potential when atmospheres are staged [or constructed sonically]. That is, atmospheres are active in shaping the world, thus showing the two sides of atmospheres where the environment 'radiates' a quality of mood and the person participates in this mood with his/her own sensitivity. (Mikkel Bille 2017)

The regular progression of daily life follows a pattern that combines elements of both familiarity and uniqueness, with the central element being the impact of repetition. In a familiar environment, sounds are positioned and anticipated, sometimes even at a subconscious level, becoming integrated into the typical surroundings, which, once they become routine, tend to fade from immediate awareness. Simultaneously, each sound is only briefly acknowledged, as if its ability to deviate from the usual framework is assessed within a fraction of a second. Anamnesis, characterized primarily by a chronological shift, can also include similar geographical and cultural alterations. For example, when a western adult travels to nations where traditional activities related to craft and rural life are encountered, certain auditory elements—specific sorts of equipment, tools, or commercial practices—may remember the traveler's youth. Some activities, which have been supplanted by the technological progress and lifestyles of so-called 'advanced' countries, continue to exist in other countries, and their reintroduction via travel may revive circumstances or feelings that have altered in time. Music does not always conjure an individual's prior experiences; it may also connect one to a current situation through an altogether new environment, area, or culture. (Augoyard & Torgue 2006)

Similar procedures happen, when we respond to a gesture, in other words, a movement with a specific character and meaning, which can be more or less culturally coded. As musical expression, gesture is the way the music ‘behaves’ or moves, and is connected with the body perceiving it. The movement or the quality of the gesture is felt as a disposition or an encounter, triggering pre-representations and translating abstraction to conscious meanings. Perhaps that's why Pythagoras employed a curtain to block the optical channels that connect his students to his appearance and gestures, emphasizing the value of acousmatic conditions. Each of our distinct senses need some effort and concentration in order to function on a conscious level, so that when we restrict the usage of some, the others become more effortlessly active and intended.

Doyle, in his work, describes compositions as the ‘listening space’ (Doyle 2005), while Demers defines it as a combination of the perceived spatial qualities of a work, typically in recorded form, along with the emotions these characteristics evoke in the listener (Demers 2010). The idea that sound can serve as a means to convey spatial attributes aligns with Smalley's concept that sounds carry their own spatial characteristics, effectively acting as ‘space bearers (Smalley 2007). Although the interaction between the listener's understanding, prior expectations, and the music provides a useful framework for understanding the formation of the listening space, it's equally important to take into account the impact of the listening environment. We can separate then, three key elements: the listener, the music, and the environment. As listeners, we exhibit a high level of sophistication in how we manage these interrelationships, often unconsciously. This is exemplified by our choice of specific music for various situations, whether it's for relaxing, studying, or partying. It's then probable that we would select different pieces of music to

enhance our experience in each of these scenarios, an idea that runs counter to the phenomenological point of view, giving importance to the objective attributes of atmospheres and listening space. As Bohme stated:

> atmospheres are neither something objective, that is, qualities possessed by things, and yet they are something thinglike, belonging to the thing in that things articulate their presence through qualities - conceived as ecstasies. Nor are atmospheres something subjective, for example, determinations of a psychic state, And yet they are subject-like, belong to subjects in that they are sensed in bodily presence by human beings and this sensing is at the same time a bodily state of being of subjects in space. (Böhme 2016).

2.3 Chronology

Aesthetic philosophy was long centred on arguments over which piece of art is better than another. In the multicultural academic environment of today, aesthetic theory might seem like a step backward. Reexamining the basic principles of aesthetic theory in the context of electronic music might actually aid in clarifying some of the more complicated difficulties resulting from an increase of genres. What does aesthetics actually suggest? Do they refer just to issues of style or taste, or do they cover more ground? Is it possible to extract a shared style from the wide range of electronic musical genres? If this is possible, does this effort go counter to the larger goal of sociology and cultural studies, which is to show how interconnected art and culture are? More significantly, are cultural studies and aesthetics independent fields that need to be addressed? It is by no means obvious how to answer these questions. As every dipole of conceptual thinking, there are many reasons for and against the applicability of aesthetic theory, making it a topic of ongoing discussion.

Starting with the perspective of German philosopher Theodor Adorno—who saw culture and society as deeply intertwined—music was more than just a kind of art or

amusement; it was also a mirror of the social and economic climate of the day, a reflection of each society's inconsistencies and conflicts as well as a product of it. He believed that the emergence of mass-produced music in the 20th century was a reflection of how modern capitalist cultures had made the individual feel alienated and commodified culture, while he also thought, that music might be used to question the current quo and oppose the prevailing society.

Adorno argues that we pay more attention to the 'becoming' of an artwork than its 'being'; a distinction that relates to our perception of art as either living organisms or prepared, static objects. When a piece of writing, art, or music is completed, it stops trying to be something it isn't. The most important difficulties pertaining to creative progress within aesthetic time are essentially fictional, since they are conceptualised inside the work itself. In actuality, aesthetic time mostly rejects accurate time, rendering it meaningless. To put it another way, the moment an artwork is stamped on a surface, it becomes objectified, and our sense that its component pieces organically transform into something else, is only an impression or an illusion. In musical terms, tonality, memorable melodies, rhythms and emotional themes are examples of easily consumed musical language, elements that make music into a commodity that can be sold for the transient enjoyment that it provides to listeners. Adorno believed that the inclusion of these commodifying aspects devalued music and turned it into a mass-culture commodity; thus, in order for modern art music to maintain its integrity, these elements had to be rejected (Adorno 1996). His approach to music was characterized by a kind of 'musical materialism,' which emphasized the internal qualities of music as an art form. Danto on the other hand, claims that the end of art history brings in a period in which all forms of art, from cartoons to avant-garde Fluxus

installations, to traditional perspective-based paintings, are all possible and acceptable. He argues that the basic question we must address is what essential characteristic defines art as art if it isn't based on components like plot, meaning, or quality (Danto 2014). Despite the fact that both viewpoints have some essence in concepts such as quality, they are diametrically opposed in terms of meaning and approximation.

In his essay ‘Musik und Technik’ or ‘Music and Technique’, Adorno investigates the relationship between method and art. He draws attention to how closely content (Gehalt) and appearance (Erscheinung) in art are related to one another, while they keep remaining separated due to technique (Adorno 1990). Even though the mind is capable of generating ideas in the creation and appreciation of artworks, he contends that there is a ‘fetishism of means’ and that art loses its fundamental qualities, when technique becomes merely technological, when tools become frighteningly in charge of the creative results. The perspectives of Martin Heidegger about the ‘Frage nach der Technik’ (Question of what Technique Is) from 1949-1954, are in opposition to this viewpoint (Heidegger 1991), which have been extensively discussed in relation to electroacoustic music. Heidegger's notion of ‘Gestell’ (Framework) illustrates the relationship between ontology and contemporary technology without being exclusively technical. Unlike technology, reality cannot be controlled by humans when it comes to its revelation or camouflage, a topic that he clarifies by referring to Plato's concept of ideas. He maintained that contemporary technology is fundamentally an instrument of revelation that alters our perceptions and interactions with the outside world, ourselves and nature. Technology enframes or arranges things in a way that fits human interests, rather than recognizing them as unique entities.

This enframing establishes the terms for how objects are experienced and interpreted, reducing them to resources for human use.

Yet their ideas and precautions are quite different, they both have their roots in the socio-political, historical and economic theories that came from Marx and Hegel, which had a significant impact on nearly every aspect modern life, including music performance and creation. Hegel believed that different art forms correspond to different stages in the development of human consciousness and self-awareness. Music, with its non-representational and abstract nature, was perceived as a direct expression of the emotional and inner life of individuals, that has the capacity to convey feelings and moods without relying on the specific content or narrative. In his 'Lectures on Fine Art,' Hegel emphasizes the importance of art as such an embodiment, that expresses the Absolute and acts like a direct manifestation of the inner emotional life and spirit (F. Hegel & Knox 1988). His concerns with the unification of form and content in art are centered around the idea that emotional content is inextricably linked to the formal framework, a connection that is much more visible in musical contexts. Marxist ideology from the other hand, emphasizes heavily in the need of group creation, prioritizing participation and collaboration over individual success. He argued that the means of production in society, including art and culture, belonged to the ruling class, and that all the social unrest emerged from the exploitation and inequality that followed. Terms such as mechanization, excess, dread, and ecstasy used to characterize the 'technological sublime', the point at which industrialization and machines started to be seen as genuine things with artistic value rather than just tools. This enhanced the critique that music industry constitutes a capitalist enterprise that prioritizes profit over artistic expression and by turning music into a product

that can be sold, the industry reproduces and propagates dominant worthless views and values. The strong need of social justice and equality, that never takes actual place, reflects the struggles and experiences of those who are excluded, such as poor, women, and other minorities.

The Avant-Garde movement is a notable instance of defiance against norms and traditions, as an experimental wave that questions societal and cultural standards and pushes the boundaries that conventional musical genres and techniques created. A significant portion of avant-garde artists have taken part in politics and used their music as a vehicle for social and political change. In the 1980s, industrial music artists like Throbbing Gristle and Cabaret Voltaire, as well as groundbreaking art groups like Fluxus, used their music to protest capitalism, war, and other forms of social injustice, investigating themes of gender, sexuality, and ethnicity, which has contributed to the formation of identity politics. These new ways of thinking and acting, placed a strong emphasis on experimentation, improvisation and teamwork. They aided the evolution and determination of new organized ideologies around autonomous politics, that always tend to balance out the turned scale of equality. For example, subgenres of punk and specifically queercore musicians, utilized their music to oppose heteronormativity and advance LGBTQ+ rights in the 1990s, that became a medium for oppressed personalities to address, confront, and disrupt social norms. Through their lyrics, performances, the DIY ethos and overall aesthetic, those artists engaged in a form of musical activism that openly expressed non-normative sexual identities and tackled issues like homophobia and discrimination.

Chapter 2

Aesthetical Perspective

Up to an hour you think about form but after an hour and a half it's scale.

— Morton Feldman

Aurora Machinery, the subject of this thesis, may be an interactive audiovisual setup, but it is a tool for making a musical composition regardless of how it was created or how it runs. In this chapter, we will discuss the genres from which this work is influenced, specifically Ambient, Noise, Drone, and Glitch. It is crucial to note that while all of these genres have very diverse histories and characteristics, they do contain overlapping elements and basic concepts, which will become increasingly apparent as reading through and discovering that many of their ideas are looping between them. An ambient piece could contain fragments of drone, noise or glitch aesthetics, similarly to every other connection we could do.

2.1 Ambient

Location, environment, stillness, time and active listening are central terms to the ambient music genre. 'Ambient' refers to something's immediate surroundings, a conception of a place, formed as an atmosphere or landscape. Trying to capture the sonic properties of

these places, wanderers, birdwatchers, historians, and psycho-geographers shape soundscapes, compositions that unfold like a quiet conversation with the cosmos. With a delicate touch, these sonic alchemists conjure atmospheric landscapes that transcend the boundaries of the ordinary, guiding us through realms where time dances to the slow heartbeat cycles. Artists like Brian Eno, Harold Budd, William Basinski, Pauline Oliveros, Sun Ra, Rafael Anton Irisarri, Tim Hecker and others generate a feeling of location, whether it be actual or imagined, as discussed in the phenomenological section. Their auditory landscapes and surroundings though, are not only ethereal tapestries that gently cradle the listener in a dreamscape of sound, but also an opposition to the problematic nature of human-centered ecologies, the imbalanced politics of listening, and the widespread commands of hyper-productivity and self-realization in neoliberal societies. With time, ambient music has evolved and is currently used for many different purposes. Initially began as a useful tool for well-being, providing a calm perspective on life, but it managed to infiltrate and get assimilated in tense and overcrowded environments like shopping centers, super markets, and airports as a release, a pressure valve for decadence and a channel to hedonism. (Music Beyond Airports: Appraising Ambient Music 2019).

Unsteady, fragile ambient music creates contrast and tension, interspersed with fleeting moments of calm and relaxation. Noise, often associated with passion and transgression, might be both an expressive or destabilizing aspect of the genre. The atmosphere that the composer creates is perceived subjectively by the listener as an almost objective experience that resembles space and forms a zone. Fragility then offers a sonic experience, where both the possibility of stability and the possibility of its obliteration have been demonstrated. (Nomi Epstein 2017). The works of Irisarri might provide outcomes of

a such a nature. Unquestionably, ‘A Fragile Geography’ captures the challenges presented by many challenging environments, such as those in the personal, social, and creative spheres. In order to acknowledge the complicated and confusing dynamics of the contemporary world, it links issues on both a local and global scale and manages to provide a reflection of their instability. As Deupree put it on one of his interviews;

> I often make my music balance on the edge of fragility, which comes from a specific design of the sounds and the composition. When it’s successful you have this very gentle, hushed music that has a lot of tension in it. It’s a very strange, but effective contrast. The tension keeps you engaged, in a way fearful that at any minute it’s going to fall apart, while the gentle qualities can relax you and ease that tension. It’s playing with this dichotomy that I find the most interesting music can live. (Deupree 2019)

Due to our bodies' physical constraints, such as our limited hearing ability and propensity for our thoughts to meld with the sounds we hear, ambient music's absence of a distinct foreground challenges the line between the observer and the observed. By getting exposed to ambient pieces for an extended period of time, one might experience complete silence, which Rebecca Solnit, brilliantly describes as ‘the ocean of the unsaid, encompassing the repressed, unheard, and erased.’

> You hate silence and you hate opposition. You always think people’s minds are blank when they are silent. It’s just the other way around. Only of course there are so many kinds of silence. But the test of everything in life is the quality of the in-between silences. It’s only in silence that you can judge of your relationship to a person. (Richardson 2010)

Ambient music represents the unwillingness to give up hope for the future while admitting the invincible decay everywhere around. It enables a meditative experience in which time melts and the boundaries between past and future become blurred. Anybody who tried to focus on sea movement, or the dancing branches of a tree and the noise they

create, or the schemed colors revealed with eyes closed, already understands as well the essence of ambient. Slow Music, like ambient music, advocates for a societal shift towards slowing down life's pace, active listening, and meaningful connections with others and the environment. Such music can really provide a refuge to the listener, mentioning a personal one; William Basinsky's 'Watermusic'. I'm aware that there is a parallel reality, where I may enter whenever living becomes too complex or intolerable by immersing myself for a lengthy amount of time in those monotonous, fluid loops that merge my thoughts within them and to one another. Forming those impenetrable walls of isolation and awareness, are crucial human practices that our society degraded with the aliases of 'boredom' or 'inactivity', disgusting states that no one wants to be in. Viewing a screen filled with fast-moving, meaningless information is far more socially acceptable than looking at the void of limitless notions and ideas, a reality that ambient attempts to protest against, providing ground for those long-forgotten practices to ascend and exist within that new form.

2.2 Noise

As defined by Torben Sangild, there are three distinct yet overlapping definitions of noise. Subjectively, noise is defined as unpleasant sounds (Sandild 2002). Acoustically, noises are unclean and irregular sounds, with almost equal distribution of frequency amplitudes on the spectral domain. Communicative noise is defined as an interference, which distorts or interrupts the signal to be sent. Noise music, focuses on the use of sound, and audio elements that are typically considered unconventional or disruptive. It is characterized by its rejection of traditional musical structures like melody and rhythm in favor of exploring

the aesthetic and expressive qualities, such as possibilities of sound itself, musicalization of pain and dissolve feelings, a situational decay, or the evoke of lost and corrupted memories. Frequently, these sounds are altered, layered, and put together in ways that challenge the listener's endurance on pain and focus in 'undesirable' objects, as an attempt for mirroring and acceptance of the harsh reality we reside. A simple way to think about noise is as a sound that occupies space, drowning out or even erasing other sounds, and persistently pushing the boundaries, eliminating any headroom and unoccupied auditory space. Something that keeps pushing and expanding, better perceived as a problematic move that continues to magnify, rather than a static aesthetical position. Noise becomes more than just an aural signal; it becomes a bodily experience that when it hits each listener's subjective threshold, fragments of corrupted soundscapes can thicken the breathing air and blur our familiar vision.

The creative evolution of noise music is a complex historical narrative that includes key personalities and social movements that span more than a century. It has been linked to subversive, countercultural movements and has significant connection to avant-garde and other experimental art groups, notably the Dadaists, Surrealists and Futurists—also linked with Italian fascism propaganda— that adopted experimental approaches to musical conception and creation, from the early twentieth century. Luigi Russolo in his manifesto in 1913, expressed the Futurists' interests in speed, technology, and modernity, by incorporating noise and industrial sounds into music, using noise-generating machines known as 'intonarumori'. Noise was probably introduced as an intentional and positive musical term for the first time in music history, laying the groundwork for the Dada movement, which emerged in 1916 at the Cabaret Voltaire in Zurich, led by artists such as

Kurt Schwitters, who experimented with unusual instruments and vocal approaches. John Cage experiments with random operations and non-traditional sounds, Lou Reed explores for possibilities of aural pleasure through plain guitar noise, in his album ‘Metal Machine Music’, whereas Gordon Mumma hunts for them through noisy drones. Performance art by the Fluxus movement in the 1960s, which included Yoko Ono, Nam June Paik and George Brecht, often used noise elements combined with a collage of different artistic disciplines, everyday objects and participatory approaches, as mediums to challenge the distinction between art and life. Later, artists associated with Industrial Records, such as Throbbing Gristle and Whitehouse, pushed the envelope with severe and aggressive noise in the 1970s, paving the way to the ‘Japanoise’ movement of the 1980s, headed by musicians like Merzbow, Hijokaidan, and Hanatarash, that was essential to the international growth of noise music, creating representations that influenced many post-industrial bands and artists, such as Coil, Einstürzende Neubauten, Lingua Ignota and so on. Since the late 1990s, experimental electronic and noise music has benefited immensely from the Mego label's slightly gentler touch, with musicians like as Tim Hecker, Fennesz and Farmers Manual, who used new and more complex digital tools and experimented with wild time-stretching techniques. Though they are not considered part of the genre, Autechre is another honorable mention, since they are constantly alienating their sounds and beats through the years, or many times through their tracks, like ‘Surripere’. This track feels like a train getting destroyed as it goes on, until it gets completely annihilated and falls out of rails. A round, melancholic and quite euphoric melody, transforms gradually to a claustrophobic and completely damaged environment, intentionally destroying the beauty that just got created. This varied past is a reflection of the development of noise music and

its ongoing interactions with other fields and creative forms. Though every attempt of such creations, may circle the same axis, there is a huge diversity on the aesthetical values and sound qualities that may define noise music. As Torben Sangild describes that axis, ‘Noise has the power to overwhelm you. It embodies feelings of anger, ecstasy, and psychedelia. Noise often hovers on the border between irritation and euphoria… distorted guitar serves as a symbol for 'abrasiveness,' representing something torn, fragmented, and disintegrated. Noise communicates physical, emotional, and mental instability (Sangild 2004).

To produce and control their soundscapes, noise artists might employ a range of instruments and production methods feedback, distortion, static noise, electrical interference, circuit bending, field recordings, industrial and city soundspaces and other unorthodox equipment and methods. The excess of the particular characteristics inherent in analogue tape technology, creates an atmosphere that suggests an antiquity and a fragility rather exotic and otherworldly, deviating from expectations of something obviously strange or absurd. It gives us the impression that it was sent to us from a far-off time, creating a nostalgic atmosphere, a type of bittersweet happiness that may be discovered in depressing times. As Abraham Moles quotes ‘there is no absolute structural difference between noise and signal. They are of the same nature. The only difference which can be logically established between them is based exclusively on the concept of intent on the part of the transmitter. A noise is a signal that the sender does not want to transmit (Moles 1966).

Since art sees culture from a mirror, it is only natural that noise becomes more than simply an extreme aesthetic, but a tool that is widely used to express messages and

experiences, that grow on quantity and quality, the more noise grows among us. People are readily influenced by noise and disintegration because they live within them. The article 'Art and Violence' by Paul Virilio for example accepts that truth, but hopes for the opposite and attacks several twentieth-century artworks for defiling the human body (Demers 2010). He contends that the speed at which we receive and process information affects our perception of reality, leading to what he calls the 'picnolepsy' of contemporary culture—a condition characterized by a fragmented, flickering experience of events. Undoubtedly, cultures that value human life, create art that values the human body, a fact that unfortunately has long been breached in real life. Post-World War II art shatters the human flesh and even aestheticizes suffering and mutilation, indicating the era of no return from societal degradation and control perspectives. Noise welcomes and embraces reality, understanding that the only way to overcome pain is to experience it firsthand.

Any notion that tries to sweep truth under the rug or pray for a change from above, would be dismissed as romantic fanfare, a standpoint that completely agrees with Bataille's unique theories. He goes into great length on how the juxtaposition of beauty and loudness may contribute to a sense of excess or plenty and how markets, civilizations, and physical things are motivated by excess rather than scarcity. Through his analysis of Aztec civilization, in which sacrifice—especially human sacrifice—was a common practice, Bataille argues that excessive consumption contradicts the widespread notion in contemporary Western society that the past must always come first. An extreme comparison between his conceptual axis and noise music's principles, could derive from his obsession with a 1905 picture, that shows a Chinese assassin using the infamous 'slow-slicing' technique called 'leng chi', where opium injections are given to the victim to keep

him aware and alive, while parts of his body are getting removed. The click, probably happened just before the victim passed away, capturing his twisted visage. Showing a person that literally dies from torture, yet smiling and paradoxically looking up into the sky deliriously happy, forgetting his tragedy and despair, alludes to the strange feeling of release that can result from slavery. This viewpoint clarifies Merzbow's claimed fascination with sadomasochism and, or Hegarty explained in 2007, his application of noise as a punishment and limitation technique (Hegarty 2007).

There is a unique area for sound exploration in the intriguing domain of noise music, where conflict becomes harmony and chaos finds its strange order. It's a genre that defies expectations, encouraging listeners to accept and discover beauty in the chaotic fabrics. Beyond the unusual, noise music has a nostalgic quality—a reminder that underneath the apparent confusion comes an opportunity to confront and enjoy the raw, unfiltered emotions that resonate via noisy waves. There's an intimate and cathartic release in its harsh tones and unorthodox melodies, a heartbreaking reminder that beauty frequently develops from the most unexpected dissonant locations.

2.3 Drone

Entering the world of drone music is like venturing into an aural universe where time appears to bend, by exploring immersive worlds of long-lasting tones and wide soundscapes. Drone music's aesthetical aspects as well as its resonance and transformational power, could sum up to some ethereal hums and delicate harmonies stretched out, which create an atmosphere that could reflect the surface of a still lake and a peaceful voyage within. By this mean drone music is more than just a series of extended

sounds; it is an introspective journey that resonates within the soul and calls for inner spirits. As the sustained tones fade into the silence, drone music leaves an imprint—a meditative echo that invites introspection and carries a quiet, sentimental grace.

The ‘drone effect’ though has a wider sense; the existence of a continuous layer of slightly steady pitch sounds, with no obvious intensity change, that are usually concentrated in bass and low-mid frequencies and continuously playing over and under other parts. Such sounds may also be heard in nature, cultural traditions, urban and industrial settings or other technical systems that produce continuous noises, resembling the drone. The ‘noise drone’ is a timbral or textural constant rather than a drone in the sense of a harmonic core and its sound is different from the typical contemplative drone gesture; instead of conveying calm, it conveys anxiety or even chaos, the gestures of no progress. The drones we are exposed to occasionally in everyday life, do not just belong to the bass range that was historically associated with them and they give rise to other drones that we have some influence over. For example, we switch on a sound-productive machine, like television or radio, when we get back home, producing a fresh drone or background sound as a quitter replacement the urban ones that we heard on our way. Unlike other drones used throughout the day, this one is meant to denote one's personal space, a practice that shows how important it is to provide a comforting background atmosphere in the absence of sound, how to reject imposed sound aspects and how drones can also highlight the location of the action. The sound of wind blowing through doors makes you think of the physical discomfort of old buildings and the agonizing atmosphere that is frequently depicted in movies. The more optimistic interpretation of the wind in a chimney could be a representation of a comfortable and warm fireplace in an otherwise harsh

environment. The murmur of the waves and heavy rain, may evoke a range of contradictory feelings, from existential fear and anxiety, to the discovery of beauty and wholeness, depending on the perceiver's personality, cultural traits, and subjective mood. Growing in urban environments replaces those physical sounds with the sound of machinery that produce a continuous buzzing, transforming every metropolis to a massive music band can be again, either uncomfortable and unsettling or peaceful and relaxing. This antithesis is demonstrated very well in the documentary ‘Tokyo Noise’. Confessions of a noise musician and a street photographer about the noise of the city and how they appreciate and interact with it, are completely opposite from most of other opinions. This shows how different can the experiences of a place be, from person to person, even if they were born with similar cultural incomes.

Let's now explore the world of musical drone compositions, which have an amazing ability to alter the places and settings they occupy, providing significant effects on our physical and auditory senses. These pieces are powerful because they have the power to control our interaction with sound, testing our capacity to focus and at times, how much discomfort we can tolerate, due to their long play times and loud volume levels. At their core, these compositions predominantly utilize drone effects, assertive elements, and repeating rhythmic patterns, purposefully excluding intense sounds that might divert attention from these fundamental components. Drone music dates back to the middle of the 20th century, where gained popularity due to musicians like La Monte Young and Pauline Oliveiros, later Eliane Radigue and Phil Niblock, artists who intentionally invite the listener to investigate tiny changes within prolonged frequencies, in order to lure them into a gloomy and introspective auditory realm. Through its deliberate use of repetition and

auditory simplicity, drone music amplifies the listener's awareness of time and surroundings. This method defies accepted musical conventions and provides a unique aural experience that come from its fascinating intersection between avant-garde inquiry and spiritual revelation. Although drone music is present in many different cultures and genres, it is notable that there is an apparent absence of written commentary on the topic outside of the field of ethnomusicology, underscoring the necessity for a more comprehensive discussion that takes into account the genre's numerous aspects and cultural implications. Even in ethnomusicology, debates tend to focus on particular drone case studies, with little attempt made to draw generalizations across cultural boundaries. Most emphasis for instance, has gone to La Monte Young, who frequently explores the technical details of tuning systems. Young is a minimalist musician and composer renowned for his experimental approach to music, with sound being a basic component of both existence and awareness. His philosophy is based on the notion that sound may be used to investigate the link between sound, time, and place, leading to his central philosophical idea; ‘dream state’, which he defines as a profound listening and meditation-induced condition of enhanced awareness and perception. His work often includes long durations, sustained tones and experimentation with natural harmonic-based tuning methods, which he believes that have a deeper and more spiritual effect than the conventional western tuning systems and manage to provide the listener with a sense of immersion and timelessness. Many other musicians and artists have been affected by Young's ideas, especially in the domains of minimalist and experimental music. The discipline of sound art, which investigates the aesthetic and emotional aspects of sound as a creative medium, has been significantly influenced by his focus on sound as a basic part of existence and awareness.

However, Éliane Radigue's pieces successfully refute the notion that all drone music is like Young's. Before embracing a style, close to Terry Riley's, the French electronic music composer initially worked with musique concrète, having trained under Schaeffer and Pierre Henry in the 1950s. Although Radigue had always been interested in fusing drones with spontaneous melodies. Her conversion to Tibetan Buddhism in the 1970s had a big impact on her later works. Inspired by her experiences with meditation that influenced her musical sculptures, she managed to create a sound that is distinguished by its enormous breadth and stillness. These sounds may be quite reassuring due to their soft and calming nature, enabling sonic experiences with the ability to put you in a relaxed mood that makes it easier to fall asleep. Even when listening to music while completely conscious, listeners may frequently let these sounds surround them without consciously analyzing the connections between various portions, and they may only dimly, if at all, recognize the presence of discrete sections.

The acoustic environment of drone conception has been profoundly impacted as well by Phill Niblock, a pioneer in the fields of avant-garde composition and modern experimental music and filmmaking. Born in 1933, Niblock focused his body of work on the transformative potential of sustained tones and microtonality, by layering many recordings of related instruments, and applying distinctive composing and sampling techniques to create rich, complex soundscapes that develop gradually. Niblock's ethical issues are directly associated with his music. In order to emphasize the sounds and events of the natural world and mimic the gradual, subtle changes that occur, as well as to question the consequences of human activities on the environment, he frequently incorporates films of workers and other archetypical activities, combined with field recordings and microtonal

drones. His documentaries, frequently provide a visual complement to his drone compositions, giving the auditory landscapes he experiments with a distinct setting. The aural and visual components of Niblock's work have a symbiotic relationship thanks to the flawless integration of these two seemingly unrelated mediums, aiding his audiovisual performances to transform into fully immersive experiences that enhance the auditory impact of his drone music. Both sound and picture help each other to contort time and deepen the viewer's comprehension. Niblock believed that any drone work must have extended period, since you start feeling its impact only after a decent level of exposition.

In drone music, time is introduced into the perceptual field by the wave effect. The wave controls the sound stream by establishing a cycle and enforcing its rhythm and limitations. As a result, the fear of submersion is more of a sensory contrast than an actual threat. The wave effect pads incidental qualities and paves the path for habit or custom by repeating the same sound occurrence without strict replication but through the reproduction of the same formal framework. As a result, while it is part of the ordinary sound domain, its perception is mostly unconscious. Only exceptions related to the arrival or disappearance of a sound message have the potential to arouse consciousness. (Augoyard & Torgue 2006) Sounds or groups of noises that have a wave effect and move in cyclic patterns are commonly associated with the world of machines in the urban environment. One of the most noticeable instances is vehicle traffic, which is punctuated by traffic signals. The sound wave of automobiles increases at regular intervals, reaches a maximum, and then falls to idle while the wave of the opposite road takes the relay. This urban wave effect, which is as unconsciously perceived by seaside residents as the sound of the sea, often imposes itself on the listener when it reaches a threshold of discomfort. Drone music's

effect on the listener is in general a complex topic with aspects related to cognitive, emotional, and physical aspects. Cognitively, the genre demands concentrated attention because to its distinctive aural environment created by its continuous and repeating tones. Drone compositions' progressively changing soundscapes can induce a contemplative state that encourages intense focus and reflection. Emotionally, drone music has the potential to induce a range of feelings, from tranquility to introspection, offering listeners a sonic space for emotional exploration and expression, while physiologically, it may lower heart rates and cortisol levels, showing its potential as a stress-relieving and ‘biohacking’ agent. Drone music's immersive nature enables listeners to go beyond the traditional bounds of musical experience, promoting thoughtful participation that may significantly alter the listener's mood, attitude, and general well-being.

2.4 Glitch – Microsound

Glitch music emerges as a sonic world in which intentional utilization of audio abnormalities and technical failures, become a fundamental creative aspect. Bitcrushing, granular synthesis, circuit bending, custom algorithms and sampling techniques are essential tools for glitch artists, allowing them to alter the tiniest units of sound, in order to produce elaborate patterns and broken melodies. The intentional use of digital noise and unexpected sound artefacts, enable the listener to connect with the aesthetic of imperfection and unpredictability, that craves gratitude from error and dysfunction. Microsound, is ‘micro’ in the sense that it relies on software tools that can analyze, edit, and process sound to tinny portions. However, unlike institutional microsound, which is too diverse to have

any distinguishing stylistic traits, the distinguishing feature of independent microsound is its supremacy of digital noise, so much so that microsound is frequently associated with the minimalist post-techno genre known as glitch. The glitch is noise, the sound of an error in digital recording and playback, such as the skipping sound produced by a damaged compact disc. Kim Cascone—pioneer of such techniques—argues in 'The Aesthetics of Failure' that artists have gotten disillusioned with technology and are increasingly employing digital signal processing to focus on mistakes and defects in sound reproduction (Cascone 2000). These failure noises are memorable because they enable musicians and listeners to deconstruct technology, which otherwise threatens to overgrow and subsume them, encouraging them to reconsider their definitions of acceptable and unacceptable sound in a musical piece, concepts that could remind us Adorno's concerns mentioned above.

Artists such as Autechre, Oval, Alva Noto and Phoenecia played crucial roles in pioneering and defining the glitch and microsound aesthetics, when they emerged in the late twentieth century. Their emphasis on crafting personalized software tools not only fueled a desire for technological advancement, but also sparked a quest for more individualized approaches to sound design. Sean Booth and Rob Brown from Autechre, used glitch elements in their complex and abstract compositions, experimenting with microsound methods to create elaborate auditory patterns. Granular synthesis, a process that dissects sound into minute pieces known as grains, is central to their approach, allowing them to create rich acoustic textures and abstract rhythms. The duo experiments with time stretching techniques, modifying the temporal characteristics of sound, as well as algorithmic compositions, offering mathematical techniques and randomness that

increase the unpredictability and complexity in their compositions. Phoenecia with their album ‘Burnout’ (2001) established a new direction on musical aesthetics characterized by intricate beats, glitchy textures, and atmospheric elements. Their beats were often complex, featuring irregular time signatures, syncopation, and a meticulous attention to detail. The incorporation of glitch elements extended to the rhythmic domain, where unexpected interruptions, jittery beats, and unique patterns added to the overall complexity of their compositions. Oval, directed by Markus Popp, was known for its use data distortion and CD skipping. Rather than dismissing these artefacts as mistakes, Oval uses them purposefully, transforming clicks and unexpected audio abnormalities into fractured rhythms and unanticipated sound patterns, forming by this way the components of his distinct design. Carsten Nicolai—aka Alva Noto—had a similar, yet different approach on glitch music, characterized by a minimalist perfection that emphasizes the intentional use of digital faults. Nicolai uses flaws and artefacts in computer systems to create harsh yet immersive soundscapes. His work frequently exhibits a style of deliberate simplicity, concentrating in the tiniest of digital defects and the beauty that one can elicit from an intentional management. By listening to ‘Opto Files’ from 2001, a collaboration between Opto, Opiate and Alva Noto, we experience this sonic juxtapose, that those seemingly calming and euphoric components, derive from damaged and fragmented entities. When errors are not considered as errors, they may provide possibilities to extend and transform. With gently touch and intentional moves they can become a limitless virtual instrument. Last but not least, Kim Cascone, a key figure in the early development of glitch music, investigates the creative potential of digital flaws and how to apply them to an ‘ambisonic’ setup—a full-sphere surround sound environment that replicates the full-depth listening

experience. In an effort to eliminate any links with the outside world, his work often highlights the beauty in disorder, that is represented as audio flaws that merge with lush soundscapes. Focusing on those minuscule, faint noises that taint the otherwise flawless digital quiet is probably the whole essence of the genre.

This combined examination of technological innovation and aesthetical depth within glitch music and microsound, leads to a more comprehensive knowledge of electronic music's expressive possibilities. They build a bridge between deliberate disruption and the tiny beauty hidden inside the digital universe. Glitch artefacts are intentional 'noises' that aim to fracture the auditory continuum and disrupt melodic and harmonic content both temporally and functionally. There might be a consistent framework of synthetic or instrumental timbre, but its disruption is the key that unlocks this restless surface that attracts attention to these micro-fractures in the temporal continuity. There are circumstances where some traces of harmonic or melodic grace remain present, but they get interrupted and alienated by functions of noise, glitch, data corruption and distortion, shifting them to negative beauty pathways. Such pleasures, definitely don’t comply to Kantian ideals of balance and semblance, yet strive to reach attractive aesthetical states. All this dedication to investigating the tiny complexities of sound is consistent with the broader microsound and glitch movements, expressing an artistic perspective that values the beauty found in the tiniest auditory elements. Similarly, to noise or ambient genres, microsound composers and listeners, seek for satisfaction inside fragility, uncertainty and noisy universes. Though these notions are perceptually linked, those genres share so little aesthetical characteristics, showing the diversity and plurality of the never-ending social growth.

Chapter 3

Technological Perspective

The basis of computer work is predicated on the idea that only the brain makes decisions and only the index finger does the work.

— Brian Eno

3.1 From Tape Recorders to Computers

The invention of tape recorders was the key technology that transformed experimental music and expanded dramatically the possibilities of any musical creation and though now they might seem outdated, many artists still consider them as an essential and irreplaceable tool. Pierre Schaeffer and Pierre Henry pioneered the manipulation of recorded sounds on tape in Musique Concrète, offering unparalleled control over auditory aspects. Artists gained the opportunity to create compositions, that they couldn't even imagine with the earlier mediums, by using techniques such as cutting, splicing, and layering sounds. The creative ways of splicing tape loops, experimenting with reverse playback for unique and otherworldly audio effects, and altering tape speed to impact pitch, demonstrated the transformational power of these new tools. This was a revolutionary break from traditional musical techniques, revealing a field of aural possibilities that challenged established conceptions and expanded the limits of musical expression. If wanted to edge those machines, one could experiment with sound-on-sound layering, generating wild feedback

loops and surprising soundscapes, or degrade tape quality intentionally for lo-fi textures, or experiment with homemade or modified tape heads for unique playback characteristics.

The emergence of synthesizers and early electronic instruments broadened the aural palette of experimental music even more. The Moog synthesizers are a great example, as the first brand that cheapened the prices and constructed squeezed and prepacked synths, giving artists new and way more affordable techniques to produce and shape sound electronically. Meanwhile, advances in computing technology resulted in the birth of computer music, with composers and inventors like Max Mathews, who pioneered the use of computers to produce and modify musical sounds, paving the way for algorithmic composition. He worked at Bell Telephone Laboratories in the late 1950s and early 1960s, where he had the ability to use early computers to produce and control sound. MUSIC I, the first computer program developed for sound synthesis, was one of his most important accomplishments, since it allowed composers to input musical data via punch cards and use the computer to generate synthesized sounds. A collaboration between Mathews and the composer Joan Miller to create ‘The Silver Scale’ (1957), was a turning point in music history, as the first actual piece of music generated by a computer. Several composers and researchers, fascinated by the promising possibilities of computers, welcomed them as a musical exploration tool, creating fertile ground for significant experimental pieces, such as Iannis Xenakis' ‘Concret PH’ (1958) and Karlheinz Stockhausen's ‘Kontakte’ (1959-1960).

The Fairlight CMI (Computer Musical Instrument), released in the late 1970s, was one of the first digital synthesizers that supported sampling and digital sound modification, techniques that proved crucial in the evolution of electronic and

experimental music and still conclude an ongoing research and experimentation. This expanding technology landscape aided in the development of many electronic music genres. Kraftwerk and Tangerine Dream, among other German Krautrock bands, embraced synthesizers and electronic instruments, providing the framework for the eventual creation of electronic dance music (EDM) and ambient music. In the late twentieth century, the introduction of Digital Audio Workstations (DAWs) democratized music creation by allowing musicians to generate and modify sounds on personal computers. Glitch and IDM are two genres that arise through that period, since they are based in the ease of a home computer, in order to emphasize on digital processing, sampling and sophisticated sound modification, methods that basically establish their whole existence. Following, the twenty-first century saw significant developments in processing power and software capabilities, allowing real-time processing and increased data manipulation, opening up the possibilities for live electronic performances. Max/MSP and Pure Data allowed artists to construct unique software instruments, musical algorithms and interactive systems, as environments that are characterized by a great versatility, personalization and integration with other system and technologies. Artificial intelligence models are a great example, especially when it comes to implications of computer vision, emotion and sentiment analysis and human sense mimicking. Those trends become more and more the main orientation of application development and research.

In a digitalized culture, where every computer enthusiast has all the tools at their disposal to develop any algorithm or program, history becomes quite untraceable, a reality that brings independence and liberation, but may also carry confusion and loss. This is maybe the greatest dipole of evolution, leading many philosophers to express their

concerns about how is possible for the individual not to stuck in prefixed ideas and preferences. To seek traces for answering such question, it would be useful to share personal opinions people that were present throughout all these years. Yoko Ono is such an example, that shares her perspective on tools, whether those were tape recorders or digital systems.

> By the time I used tape, it was not something that was that special, although the ways that I used it were rather unusual. I used tape from 1961. Before that, I didn't have the access to tape and tape recorders. Even in 1961, for the rather infamous show of mine at Carnegie Recital Hall, I just borrowed a few tape recorders to do my stuff. In those days, tape recorders were used to record things and listen. In that particular concert, I used tape recorders as instruments on stage and off. It was the beginning of the Plastic Ono Band. There's a photo of the band—which did not have any humans in it . . . just technological machines.
>
> Like everybody else, I am now into the digital. It is creating music by translating sounds into visual messages. It's another musical revolution. Read Notations edited by John Cage and published by Something Else Press. In that book, you will discover that many of us composers were getting there already without the help of the computers. It is the merging of the visual and the audio. It is the sign that the soundscape we create is getting closer to our original brain map.
>
> I actually don't have a particular choice of technology. When I make music, I just keep on moving, using anything around me that works. I have no preference and no prejudice in using or not using anything.
>
> Yoko Ono, February 2007

3.2 Computer Music Software

There is software meant for users and software meant for developers. 'Computer Music Software' is an umbrella term used to describe tools that may have different approaches and workflows, but still process audio and occasionally video in real-time. We could

separate them in three main categories; ‘Visual Programming Environments’, ‘Modular Synthesis Environments’ and ‘Code-Based Systems’.

‘Visual Programming Environments’ are software tools that let users create and modify musical processes using a graphical user interface that allows them to link objects to each other and attribute specific variables. Max/MSP and Pure Data, both very similar, constitute the main two examples. Max/MSP created by Cycling 74' and named in honor of Max Mathews, at its core provides a graphical interface that allows users to create elaborate and customized real-time audio and multimedia applications using a patching environment. It is popular among composers, sound designers, and multimedia artists because of its versatility and ease of use in generating complex auditory constructions and interactive experiences. Pure Data (Pd) is an open-source visual programming language similar to Max/MSP that was created by Miller Puckette, who also contributed to Max’s creation. A notable mention that partially belongs to this category, is ‘Max For Live’, a collaboration between Max/MSP and Ableton Live that allows users to design custom musical algorithms in Max and integrate them effortlessly into Ableton, building guided and easy to develop graphical user interfaces. This package offers the great complexity and versatility of Max, but also the convenience, adaptivity and availability of other tools that come with Ableton, constituting a powerful tool, widely used for either personal use and software development.

‘Modular Synthesis Environments’ are systems that let users to generate sound by connecting different prefixed modules that represent various audio-processing capabilities. In a digital space, these setups mimic the patching method of analogue modular synthesizers, allowing for variable signal routing, and customization, using individual,

replaceable modules that perform specialized functions, such as oscillators, filters and envelopes. The widely accepted Eurorack format enables the integration of such modules from many manufacturers, supporting a diversified ecosystem, usually of a hybrid nature, since integration both digital and analogue components can be used to enrich the blend of accuracy and warmth. Most widely used examples of software are Native Instruments' Reaktor, VCV Rack open-source virtual modular synthesizer and Softube Modular. These software carry and share many advantages, like the involvement of hands-on engagement with knobs and sliders that adds a performative element, the openness and collectiveness of the community with musicians often exchanging patch ideas, module suggestions and DIY projects, or the combination affordability, accessibility and creative power that characterizes them.

‘Code-based systems’ in the context of computer music, refer to software tools that use textual programming languages to create, manipulate, and synthesize musical parts. In contrast to visual programming environments in which users link graphical elements, code-based systems require users to write code to specify the intended musical processes. Like all the categories above, they have implementations on algorithmic compositions, sound synthesis and processing, with examples like SupperCollider, Csound and Faust. A huge branch of this category is ‘Live Coding’, noting TidalCycles and ChucK software, that allow the user to create blocks of code and produce musical loops that they can then playback, alter and modify by changing variables and rewrite commands. This dynamic and improvisational technique entails developing and running code on the fly. The most common audiovisual setup case is projecting the computer screen that the programmer

sees, as a background for the audience to see, which definitely could be an aesthetical pleasing situation for many people, but may also carry some traits of medium fetishism.

3.3 Dynamical, Sensorial and Interactive Compositions

‘Dynamic music composition’ is a term describing compositions that can alter, adapt, or respond to the dynamic circumstances of a real-time performance, usually using predetermined patches and sequences that have the ability for modification and alteration, while the performance is happening. Interaction, is a term that describes the communication between a transmitter and a receiver. In the case of an ‘Interactive Audiovisual Performance’, we have the ‘Performer’, who feeds real-time inputs into a system through predetermined mediums, and the ‘System’, an ongoing synthetic procedure that adapts its behavior according to the given values and results to the affected output. ‘Interactive Systems’ or algorithms inevitably belong to the dynamic category as well, since they allow the creation of music that is not fixed or predefined, but rather changes and adapts in response to numerous inputs, usually controlled through normalized parameters captured from the environment. It's an umbrella term that can refer to a wide range of applications, from ‘generative music’ software that creates new music based on user input or random variables to ‘interactive installations’ that let the audience change the music in real-time, such as this thesis application. Other great examples, are Brian Eno's ‘Generative Music’ project, which involves the use of software to produce music that is continually evolving and changing over time, or the work of composer David Cope, who has created algorithms that can analyze current pieces and generate new musical material.

Augustino Di Scipio's work is another one that examines the intersections of sound, technology, and perception. His works usually use complex systems and algorithms that interact with and respond to auditory input from performers. One of Di Scipio's major contributions is his investigation of the notion of "action-sound," in which the performer's actions directly impact the sound output through the use of technology. There is such beauty underneath such compositions, because they sing songs of unknown, they praise randomness and let the events unfold, while they may provide each listener with a unique and personalized experience when the music changes and grows in response to their interactions with it. This is especially successful in interactive installations or performance art, when the audience is urged to interact with the music, participate in the performance and inevitably be a part of the artwork that they intended to observe.

Sensorial, as another subcategory of a dynamical music, since it is music dynamically manipulated specifically from sensors and responds to changes in the environment or the movements of the listener. The primary concept behind this sort of music is that sensors are utilized to monitor environmental changes such as temperature, light, or movement, scale and map these modifications to specific musical factors like pitch, loudness, feedback amount, or different ways to trigger samples. As the environment changes, so does the music, resulting in a dynamic and shifting soundtrack on a patchwork of conflicted dimensions. Biofeedback music is probably the most advanced and complicated kind of sensor-based music, where the use sensors monitor changes in the listener's physiological condition, such as heart rate or brainwave activity and utilize this data to change the music, resulting in a feedback loop between the listener's physiological condition and the music being heard.

Participative collective music and music installations are creative and collaborative methods for musical creation and experience, that combine audience engagement and artistic expression in unexpected ways. Participatory collective music, usually a merged term with ‘Interactive music’, reflects a paradigm shift in which the line between performers and audience members becomes blurred. It revolves around active involvement, in which listeners transform into co-creators, influencing the musical output in real-time using various interfaces such as body sensors and mobile devices, that are used to capture movements and gestures and translate them to musical attributes. This approach has been fueled by technological advancements, which allow listeners to connect with music in ways that extend the passive consumption of recorded or live performances, making each experience unique and dynamic. Music installations, on the other hand, are immersive, multi-sensory experiences that transcend standard concert settings, converting physical places into complicated, creative soundscapes. These installations have strong roots in the history of sound art, experimental music, and minimalism, with examples like Terry Riley and his famous collective piece ‘In C’, where each member of the band is given a single musical phrase to perform whenever they feel like it, resulting to a work that is anything but static, a living organism with a large etiological tree that will never repeat itself. As he quotes ‘Out of doing all that experimentation with sound I decided I wanted to do it with live musicians. To take repetition, take music fragments and make it live. Musicians would be able to play it and create this kind of abstract fabric of sound.’ John Cage with ‘Musicircus’, an innovative format that involves the simultaneous occurrence of diverse performances within a shared space, like music, dance, theater, poetry readings that intentionally overlap, creates a dynamic and unpredictable cacophony of sounds and visual

stimuli, where audiences are active participants, moving freely through the space and choosing which performances to engage with at any given moment. Nam June Paik with ‘TV Garden’, conceived in 1974, transformed the standard television set, to immerse viewers in a lush, jungle-like environment where numerous suspended monitors, each displaying diverse images, coalesce with the surrounding greenery, creating a captivating synthesis of technology and organic elements. These contemporary music installations and pieces that seamlessly combine sound and space, inviting users to travel and interact with the environment and influencing their aural and visual experiences, have resulted from the visionary merge of technology, art and nature, as well as the variety of concerns that circle those terms.

Various genres, movements, and technical breakthroughs have challenged the concept of music as a passive listening experience. This transition may be traced back to the avant-garde movements of the twentieth century, when artists like as John Cage and the Fluxus group introduced notions of chance, indeterminacy, and audience engagement. For example Cage's innovative pieces, such as ‘4'33’’, where musicians remained silenced, in order to enable the listeners to participate in the musical experience by focusing on tinniest ambient noises and environmental elements they created. According to Cage, modernism was defined by ‘collage and juxtaposition,’ which was shown in pieces with a busy blending of audiovisual components (Kuhn 2001). This is the completely opposite approach from La Monte Young's creative path, that was more like a slow immersion centered on a laser-like focus on one thing, whether it is a sound, a method, an action, a concept, a setting, or any other possible aspect of a performance. In an interview with Thom Holmes in April 1981, John Cage states;

I think the thing that underlies my works since the use of chance operations— whether it's determinate or indeterminate—is the absence of intention. I've used the chance operations as a discipline to free the music precisely from my taste, memory, and any intentions that I might have. It's a discipline equivalent, I think, to that of sitting cross-legged, but the cross-leggedness would carry one, so to speak, in toward the world of dreams, the subconscious and so forth, whereas this discipline of chance operations carries one out to the world of relativity.

—John Cage

Chapter 4

Aurora Machinery

When I started, I didn't know if I was composing or not. But I was painting with sound, making something out of nothing.

—William Basinski

3.1 Overview

Aurora Machinery is an interactive, sensorial and dynamical application for audiovisual installation, built using the Max/MSP visual programming environment. This so-called 'patch' generates and plays back sound that may be controlled dynamically and in real-time by actual body motions and gestures, caught by a camera and a mobile phone's sensors. The data that these two mediums provide, are then transmitted back to the system and get translated into normalized value messages that are used to affect and shape the sound. There are several sub-patches that may both connect and interact with each other or function separately. By that mean, there are ongoing procedures that create a constant layer in the sonic field and gesture-triggered procedures added on top that may either activate whole musical sub-patches or change specific values that unfold each component's hidden characteristics. Aurora Machinery could also be conceived as a musical instrument, that its texture is based on the samples loaded and the algorithms that synthesize and shape sound, while its gestures are semantic body movements, characterized either from the placement that the motion detected on the camera screen, or from orientation and acceleration of

phone in different axis. In order to implement this application on an actual live setup, it is essential to use a projector pointed back to the camera's field of view, so that the motion of the bodies is projected back to them, creating a visual feedback loop, that inevitably affects the sound as well and generates micro events that prevent it from resting in constant states.

3.2 Patch Analysis

This section will concentrate on Aurora Machinery's functioning. The primary concerns that follow are how the sound is created, how the user can operate the system, and what control and personalization options are available. There are five separate sub-patches that also merge with each other and contribute to the final outcome of the system. Three of them responsible for the sound and two operating in control level of camera movement and mobile phone's sensors. In order to understand the system and how it operates then, we are going to analyze those sub-patches separately.

3.2.1 OSC Routing

The Open Sound Control (OSC) protocol is a widely used communication protocol designed for real-time, high-performance multimedia applications. Its primary purpose is to facilitate the exchange of messages containing control information, such as parameter values, gestures, or commands, in a format that is both human-readable and machine-parseable. Sending OSC signals from a source to a certain receiver or destination is known

as ‘routing’. This is essential in situations when a networked environment is required for communication between many devices or software programs. It's important to take into account the particular needs of your setup as well as the capabilities of the tools or middleware you select when implementing OSC routing in your apps. IP Address, port and network are the basic configurations that need to be done in every implementation of OSC. In order to achive that, you need to assign unique IP addresses and port numbers to each OSC sender and receiver and then ensure that the OSC sender is configured to send messages to the correct IP address and port where the OSC receiver is listening. Then configure firewalls and network routers to allow OSC messages to pass through —a concept what can be found also as port forwarding, and ensure that the necessary ports are open for OSC communication. In our instance ‘OscHook v2’ (https://apkcombo.com/oschook/com.hollyhook.oscHook/) android app is the sender, that recognizes mobiles sensors and sends them as a pack to a specific IP address and port determined inside the app. Then the sub-patch ‘OSC Routing’ listens to this specific port and receives that pack of data in real time and distributes them to separate variables. Those variables are now connected to the gestures of the phone and available for the other sub-patches of the project to use them and manipulate other procedures. The patch specifically uses the orientation and acceleration in axis X of the phone, the orientation in axis Y and acceleration in axis Z, noted as ‘or-x’, ‘or-y’, ‘la-x’ and ‘la-z’. ‘or-x’ is controlling a filter in the ‘Subtractive Drone’, ‘or-y’ is controlling the growth of the ‘Generative Pad’ and ‘la-x’ and ‘la-z’ bring in continues loops of samples that may play with different delay amounts and volume, depending on the steepness of movement.

3.2.2 Motion Detection

The projection of the computer camera, an essential aesthetical component of the project, also serves as the second medium through which the user may control musical parameters. The motion detection and tracking tasks are handled by ‘OpenCV’ or ‘Open-Source Computer Vision Library’. Max/MSP provides a set of external objects that interface with OpenCV Libraries. These objects allow you to integrate OpenCV functionalities, such as video analysis, image processing, computer vision, object detection and feature extraction, directly into your Max/MSP patches. You can capture live video from a webcam or another video source and apply various OpenCV algorithms to analyze and manipulate the video stream. In our case, camera is used to detect the biggest blob —in other words the biggest concentrated space that movement is taking place, as well as the mean value of total movement. From those we extract five variables; the position of the middle point of the biggest blob dictates us ‘x’, ‘y’ and ‘xy’ (multiplication of x and y), the mean value of movement is mapped as ‘am’ and ‘am2’ is the same stream of data, with the difference that it transmits less frequently. The first four variables ‘x’, ‘y’, ‘xy’ and ‘am’ are used in the ‘Crossfaded Looping’ sub-patch, to dictate whether some constantly playing loops will gain volume and appear in the auditory spectrum. The other variable ‘am2’ is used in the ‘Generative Pad’ sub-patch to decide the note that the samples are re-pitched, working like a logical gate, that takes five different values, representing them to three octaves of ‘D’ and two octaves of its fifth ‘A’. While exploring the patch we may realize that those variables, are controlling similar procedures by both mediums and this interconnection is that provides a wide range of adaptivity and diversity. For example by feeding data to the

camera movement, we may bring out sounds, but also control other parameters, such as the pitch just described.

3.2.3 Crossfaded Looping

Since we explained the functional components of the system and how the user may interact with it, we can now look over its musical components. ‘Crossfaded Looping’ is the first from the three sub-patches that produce and manipulate sound and it is divided in two sections, one controlled via phone and one via camera.

First, we have a loop that crossfades randomly between audio, stored in five different buffers and randomizes the tempo, every time a different buffer is triggered. The sound of the loop is constant, but will not always appear. Acceleration in axis Z of the phone is the handler of its volume knob. Multiplying axis Z data stream with the musical signal of the loop, will sum up to a signal that is zero when the phone is still or maximum volume, when the phone is highly accelerated in the axis. These buffers contain recordings from several sized gas tanks collided with each other that together with the plate reverb passed through, they provide that metallic, transient, yet sustained sound. Every time movement is feeding volume to the output, the randomized procedures have already decided which sample is going to appear, as well as in which pitch and playback speed, leading to an outcome that is diverse and non-repeating, but shares an aesthetical and timbral orientation.

The second section of the sub-patch follows a similar principle of constant looping and volume triggering, except that this time the camera is the controller instead of the phone

and that we have four buffers playing four separate loops that crossfade between themselves. These loops are then divided in groups of two, so that we can project them into a two-dimensional axis, with origin (0,0) placed in the top left corner, representing zero volume of both loops. When x rises, so does the volume of the first loop, correspondingly y, handles the volume of the second loop. These two pairings are represented by the variables 'x', 'y', 'xy', and 'am', which were previously discussed in the 'Motion Detection' section. Loops are enabled in the first instance of (x,y) depending on which side of the screen the movement is caught. Left-side motions enable the first loop, right-side motions enable the second, and centre motions allow a part of both to pass through. The second pair (xy,am) gains quantity through the overall movement, related to the distance of the biggest blob from the origin (0,0), meaning that the third loop gains volume according to motions in bottom and slight right side of screen and the fourth loop to the overall mean motion value. These loops are all passed through the same reverb with the single loop, so that they all occupy similar space in the auditory spectrum, grouping and standing out from sounds. The stream of data that comes from the ‘Motion Detection’ sub-patch are extremally rapid, thus a slowing algorithm is required to take instances less frequently and prevent from spastic sounds that change suddenly and continuously. These four loops share as well a randomized playback speed procedure, that aids non-repetition and variation and each one provides four parameters, to adapt the crossfade operation to different samples that could be used; ‘start time’, ‘duration’, ‘fade time in msec’ and ‘fade curve’. The samples that are utilized in those loops respectively are; a glitchy drum loop, a recording of ambience passed through changing speed delays, many gas tank beats happening simultaneously and a basket of glassed shaken so that the glasses hit each other.

3.2.4 Subtractive Drone

'Subtractive Drone,' like the preceding section, is a sub-patch that may be separated into two parts. It is consisted by a persistent low humming that drones throughout the piece, and a field recording that has been processed with a shifting delay. Beginning with the second, since it shares the concept of the previously explained loops, a field-recording of a train debarking that is constantly playing. In this example, the accelerometer on the phone's axis X regulates the sound's extremely brief delay amount, guiding it around near-edge feedback places. The drone activity of the composition is aided by the extremely short delay that is constantly present, as well as the timbre of the sample itself and this is why they are merged to the same sub-patch.

The word subtractive as indicated by the name of our second main component, comes from the term ‘Subtractive Synthesis’. In this technique the tones are formed by deduction, starting from a rich spectral sound source and eliminating undesired frequencies to obtain the desired sound. It can easily be conceived as a sculpturing technique, where a solid piece of marble transforms to a sculpture by chipping away parts of its body. In musical sense the rich sound —in our case pink noise— is the whole marble and the sculpting tools are the filters to shape the timbre by subtracting specific frequency components. There are three drones focusing on the D minor scale. First concentrates in D_2, the second in E_2 (its minor third) and the third D_3 (an octave above). Every one of them starts from pink noise and keeps only six intervals of resonance that belong to the musical scale. Summing up those selected spectral areas creates a lush low-end focused soundscape, that is then processed through an analog soft clip imitation algorithm and a filter that the user can control. The orientation in axis X of the phone, handles the cutoff

frequency of a low pass filter with high resonance, meaning that rotating the phone towards right will open up the filter, and counter-wise. The high resonance in the specific audible low area of 40-100 Hz, provides a subtle but powerful impact in the composition, since it lays underneath any other sound and determines whether they suffocate or have the ability to breath.

3.2.5 Generative Pad

The final section of the project may also be considered as the most frequent attention grabber in the composition. As the name indicates it's about lush sounds with lengthy tails and decays, immersive soundscapes that vary within a wide spectrum of timbral moods. The sound in this sub-patch, comes from sampling techniques, multichannel manipulation and delay engaging and the overall output derives from two faders, one controlling the wet and on the dry signal. There is a critical parameter—accessible to the user via the phone's orientation in axis Y—that regulates the evolution and growth levels in which the generative algorithm functions and the amount of harmonic content. As the top side of the phone is turned upwards, fluctuations and abnormalities begin to occur in the sonic environment. Shifted octaves and micro fragments enrich the sound, transforming it from peaceful and euphoric waves to noisy and harsh metallic swells. Every gesture that reveals such agitated textures, feeds as well a wide delay, meaning that calmness takes a while to reappear even when the phone is completely horizontal. When this parameter is in its maximum, the pad limits constantly in the threshold of break down, devouring most of the other sounds.

The mean value of movement detection that is regulated to take values from zero to six, passes through a logical gate that decides between four notes, three different octaves of ‘D’ and one of its fifth ‘A’. In other words, when camera detects no movement, the sample is going to be played back in the lowest ‘D’, with a little movement is goes up and octave etc. Initially the sample is stored on a static buffer and the chosen note applies on the sample’s playback pitch, while the speed is given by the expression $-2^{(note-60)/12}$. The multichannel buffer that contains the signal, is then multiplied by different function for different channels, creating waving effects, that then get merged together in to two signals, so that they can play stereo. Before the dry signal goes out to the speakers, it is passed through a hyperbolic tangent function that merges it with the signal coming from the wet part of the algorithm, creating a feedback loop that then feeds a dynamic buffer that is refilled every 5000 msecs. The wet part of the algorithm, starts by creating different types of LFOs that are going to apply to each individual channel of the 10 channels buffer, feeding back some slow movement to the dry part and inevitably to the same buffer that this sound derives. Then the signal splits. First direction goes back to the tangent function multiplied by the ‘growth amount’ that the user controls by phone orientation. Second to a wide delay, a series of biquad filters and a soft-clip algorithm and then straight to the system output. The ‘growth amount’ is definitely the most crucial parameter of the algorithm, since it indicates how much is the loop is going to feedback, as well as how much these two parts of the algorithm are going to interconnect and thus, aid each other to be more present.

3.3 Live Setup

Aurora Machinery had the chance to take actual place in a live audiovisual setup, which included a camera facing the audience, a projection displaying the output of the 'Motion Detection' sub-patch, and a mobile phone positioned in the center of the room and identifying itself with a little light. Before entering this fairly dark room, some basic instructions on how the setup works were offered, but the most essential teachers were the same individuals that attended, supporting each other, playing, and interacting. The voyage of individual and collective psychological states was maybe the most fascinating and delightful thing to observe. The majority of those who entered the space were initially terrified and intrigued. Since the gateway was wide open, some of them were able to witness before exposing their own bodies to this experience. Those were usually the same people who were more subtle to the system, making less noise and seemed to be attempting to locate its tranquil areas rather than its extremities. Others who were drawn to the sound before entering, mostly outstretched the system, generating feedback and frequent sound occurrences. They most likely did not read the directions and simply entered and browsed freely the given zone. A highlight of the entire three-hour performance was when a creative group of people exposed themselves longer inside and began experimenting with their mobile torches. The sounds that came out, expanded the spectral field to areas that surprised me, sounds that I have never heard before coming out from this patch. Some other people's participation followed an almost exponential slope. In the beginning they could be found outside or within the room, quiet and silent, but their stillness droned them into the aurora world. They began to communicate, ask for the mobile and eventually performed in virtuoso mode. After a while, you could notice them

offering directions and explaining things to others, showing the beauty of group spirit. Probably, the most noteworthy accomplishment of this attempt, was the creation of a temporal framework in which individuals may share space, communicate their concerns in abstract ways, and therefore leave their distinct identities behind for a moment to become whole with each other and the stimulus. The optoacoustic environment, which everyone shared and was able to alter, served as a communication channel, breaking down the boundaries and social norms that our regular daily activities erected between us.

A very fortunate coincidence that occurred during the performance was that the projector, which was supposed to serve only as an aesthetic component, turned out to have a significant impact on the sound as well. The motions captured by the camera are essentially the areas where the light intensity changes. Because the projector is aimed towards the audience, it flashes light directly into the camera's field of vision, feeding information back to its own display. Any movement of light caught by the camera lens was concurrently projected nearly exactly where the camera pointed. This ‘nearly’ was the pivotal point that led the situation to produce a feedback loop that grows through both auditory and visual elements, retriggering both sounds and the visual content that initially triggers them. Depending on the intensity and contrast of the camera, as well as the room's physical parameters, the system might go beyond the constrained states by continually looping and feeding back information even on the absence of movement. As a result, those aspects had to be evaluated for the particular space and its light properties, so that they provide an interesting effect, while minimizing the possibility of their escaping into unmanageable states.

Even for those that were not in the room, but rather sat in the waiting area, the length of time that the performance lasted seemed that had some impact. The volume was fairly loud and took over a large amount of the auditory field, slowly and gradually immersing us through our senses. When no one was in the room, it restored serenity and tranquilly to the entire environment. A small group of individuals or a single person would frequently go inside and shake up the situation, maybe staying for a short time, perhaps longer, perhaps with a light touch, or with a range of frustrated gestures in search of turbulence and disintegration. This repetition of submersion and expression acted like a ’wave effect’ that loops through states of calmness and disorder, testing our tolerance and intriguing our anticipation. Very similar to the concept of drone, the exposition on a state that you repeatedly connect and disconnect, functions as a stairway that every stair represents the revisit of focus, and every step drowns you a little more. The longer the exposition, the greater the depth of immersion.

3.4 User Interface and Personalization

By clicking the presentation mode in the bottom-left corner of the Max/MSP window, you enter the UI of the application. It serves more like a display of all the important events of the patch, rather than an interface that interacts with the user, since the mediums that occupy this position are the mobile phone and the camera. This window is intended to exist in the background, so that the person that operates the application can observe what is happening, gain stage on the fly, chose different presets of specific variable amounts and have quick access on sample replacement. It also serves the purposes of a quick instruction

guide that demonstrates the important steps need to be done and tips on how to optimize and extend the system. The sub-patches are separated by lines, so that everything is displayed clear and the individual components are commented with informative names and descriptions.

Further modifications and personalization are more than possible and highly encouraged with the versatility and adaptivity of the tools that have been used. Future improvements that I would explore could be; the engagement of more effects and the mapping of medium variables to their parameters. The easiest would be to apply a camera variable to the plate reverb of the 'Crossfading Loops' and control the reverb of five different loops with one gesture. Different types of strong compressors and flangers would be ideal additives to the overall sound result, offering an organic feeling by revealing and disappearing as almost all the other components of the project. Another path of ideas on exploring the possibilities of extensions is focusing on the sensorial side of the project, by blending in more sensors. An encephalograph or a heart-beat counter would be really suitable for such purposes. Input stream of data that flow in unconscious levels, would lift off the complexity and unpredictability of the system. Max/MSP provides a ground where anything can be utilized since it got conceptualized. Aurora Machinery could be a conceived both as a ready application for audiovisual performance, or the foundation where other experimentations can be layered onto.

3.5 Conclusion

In this thesis, we approached Aurora Machinery from a theoretical standpoint, delving into the historical foundations, unraveling the musical aesthetics, and examining a variety of concerns embedded within. Societal and anthropological concerns came to the forefront as we examined the impact of music on culture, our everyday lives, and the first-person experience. Issues of aesthetics and the semantic significance they can carry, moral considerations, and broader societal implications were not incidental but integral to our understanding of Aurora Machinery's background. We analyzed the inspirational genres of ambient, noise, drone and microsound, and noticed that though they don't share much of aesthetical characteristics, they share fundamental notions of protesting against neoliberal values and conventional forms, since they expose the listener to their limits of endurance, something that could turn out to be beneficial and awakening. Then we demonstrated a chronology of associated technologies, compositional forms and mediums, with an emphasis on computer music and non-static compositions, witnessing how can technology aid creative explorations in unexpected ways. How machines are able to function as a transparent conduit that redefined the relationship between composers, performers, and audiences, but also how this transparency can become an opaque disorientation.

Since we gained understanding of our project's theoretical background, we were able to move to its technical aspects, explaining how it functions on a production and on a user level. We analyzed the project as a whole and then its five distinct but interconnected components. Afterwards we demonstrated how can somebody implement the system, how they could personalize it and what actually happened on a live setup. The majority of those

in attendance seemed to enjoy a lot that they could play music, without knowing a musical instrument, that they could affect the whole room's mood by the motion of their bodies. With time, they began to interact with one another and drive the system into increasingly severe states. The most satisfying thing to witness was when they eventually exited the room with a sense of gratitude for their experience.

Regarding customization, Aurora Machinery is built using the Max/MSP visual programming environment, which is by its very nature a versatile and adjustable instrument. That implies that the user has more control over the provided GUI and parameter adjustments. Based on the provided patches, they might replicate a fully updated system that modifies incoming data in an altered way. Suggested directions on the development of the application would be to focus more on the construction of new effects, new sound engines so that events provoke wider variety of textures, and the adaption of extra mediums that cause events. An example could be an encephalograph that is able capture sentimental resonance, even when outer bodies seem untouched, or the adaptation of more mobile phone devices, so that people can play always with an equal role to each other.

Apendix I - Software Photos

INSTRUCTIONS

1. Install the 'cv.jit' from within Max's 'Package Manager', found in File Menu

2. Download 'OscHook v2' application that allows the control of mobile sensors here:
https://apkcombo.com/oschook/com.hollyhook.oscHook/

3. Connect your mobile phone to the same wifi with the computer

4. In the preferences of the mobile app (Host IP/Port), insert the IP address of your wifi connection and set port to 5056 (You can change the port that Max listens to, in the 'OSC' sub patch)

5. Press the 'hook' button in your application, so that it works in background mode

6. Open 'motion-display' sub patch and click the message box 'open' to activate the motion detection camera

7. Click the 'ezdac' —speaker object to activate the system

TIPS

- For audiovisual results, full-size the 'live2' window

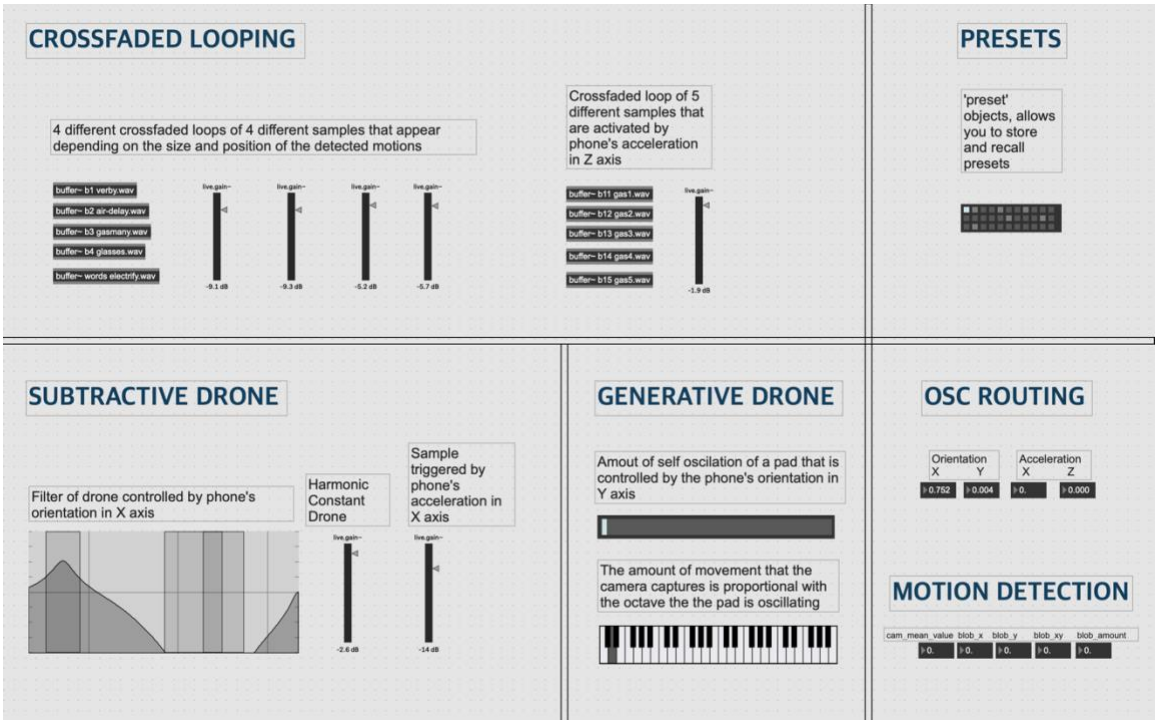
- You can personalize the system by changing the '.wav' names with the names of your own samples and move them into the same folder with the patch

- Further personalization can be done through changing the factors underneath the sensor outputs, highlighted with colors

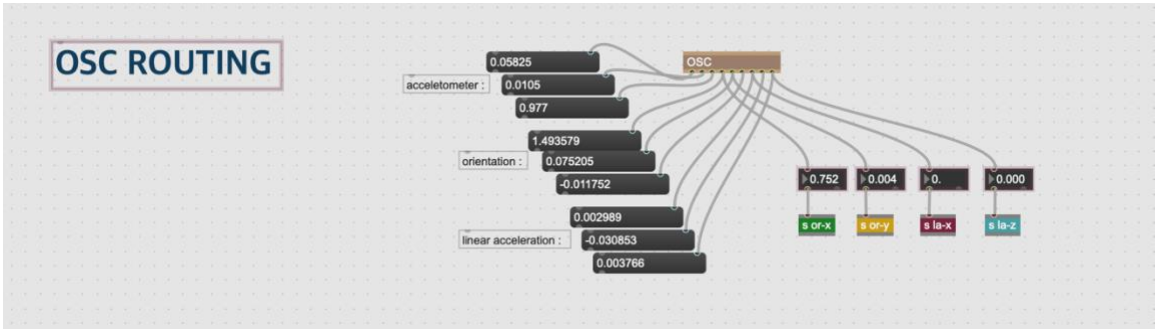
- When you decide the gain stage of each individual components, you can preset a box, by clicking while holding shift

- Turning top side of the phone inwards, yields maximum results

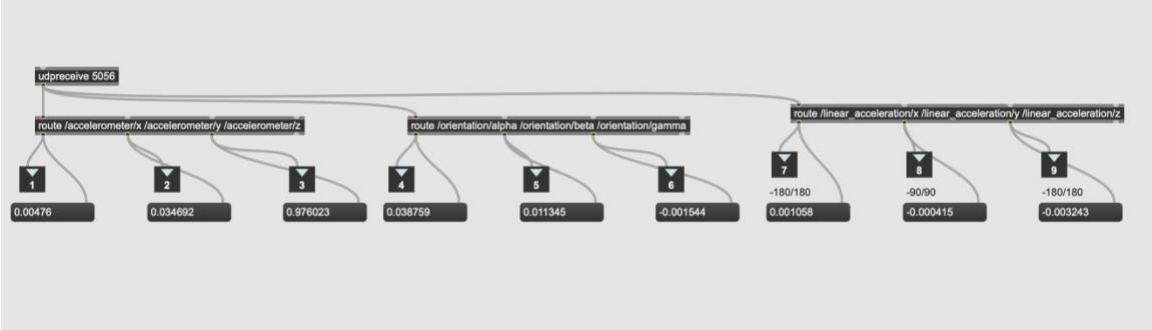
Graphical User Interface



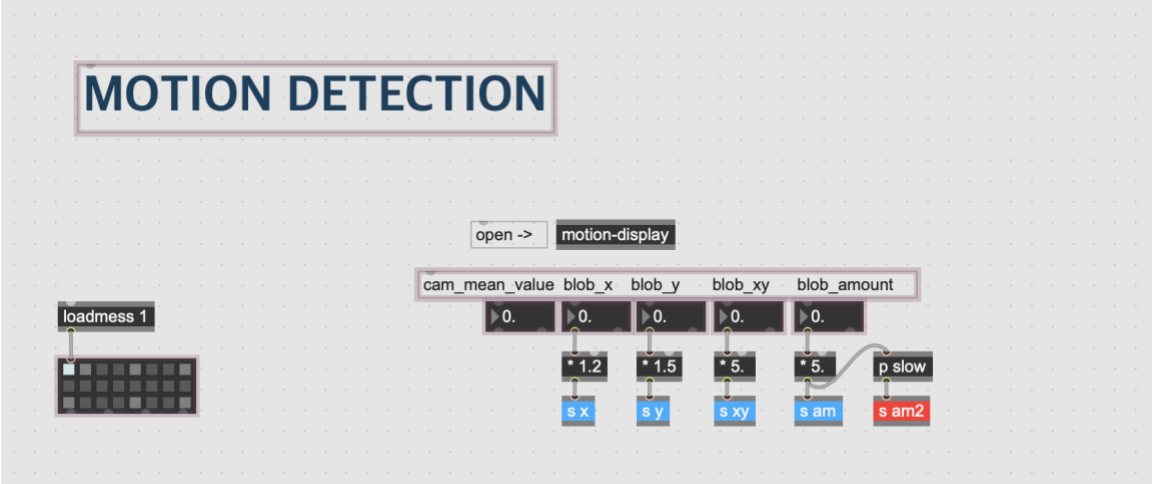
OSC Routing



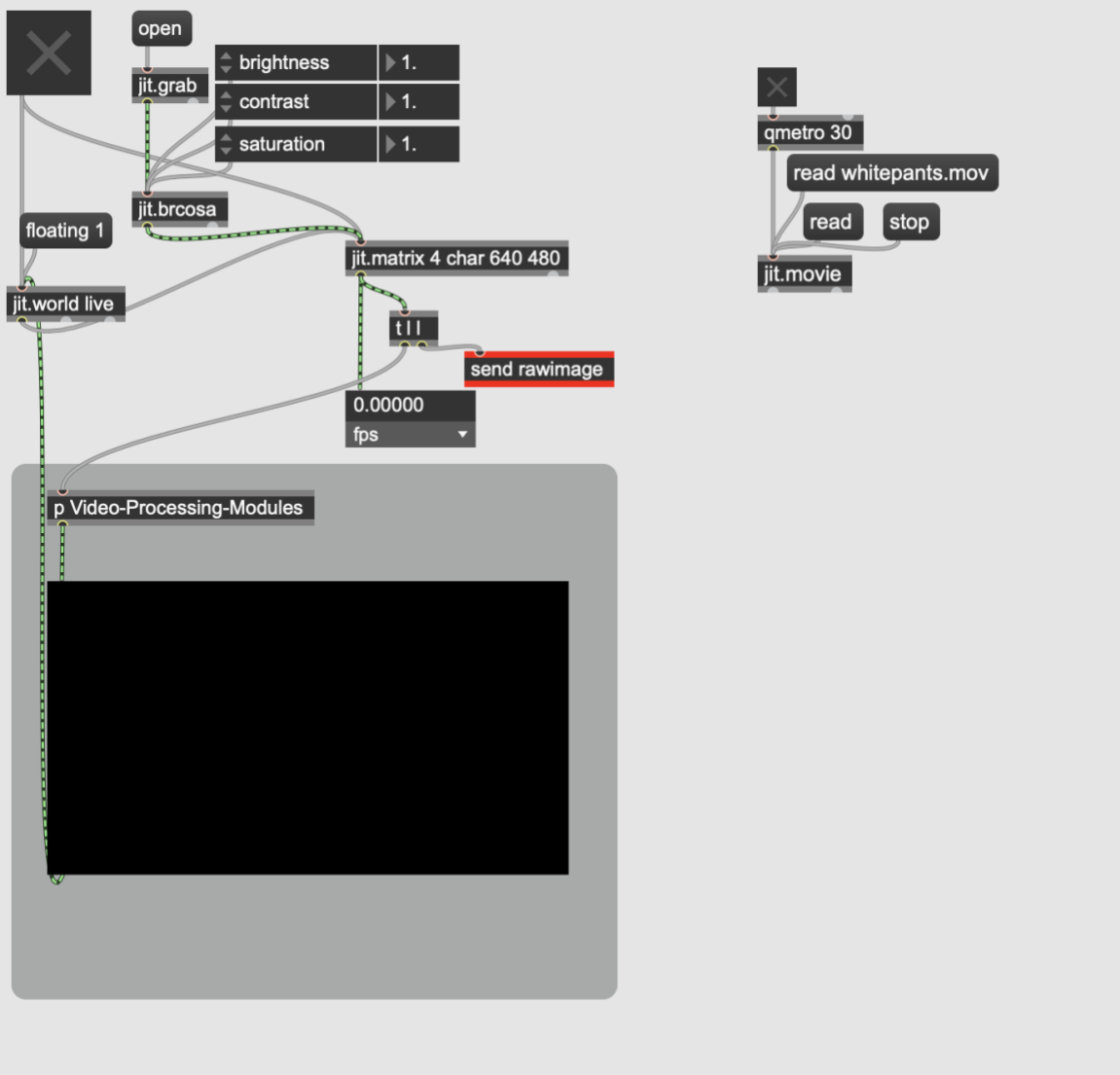
OSC (sub-patch)



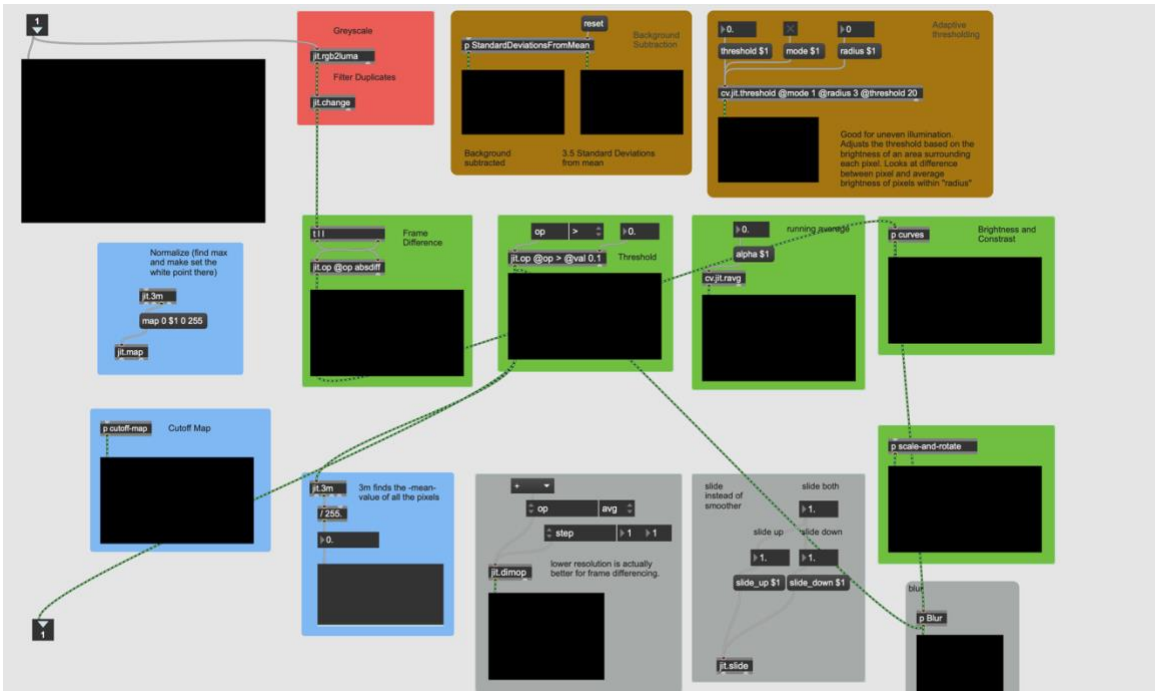
Motion Detection



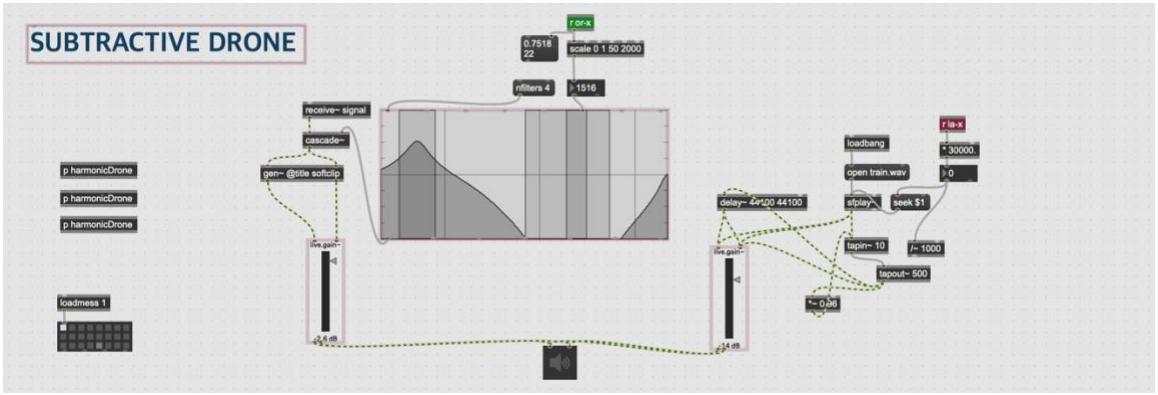
Motion Display (sub-patch)



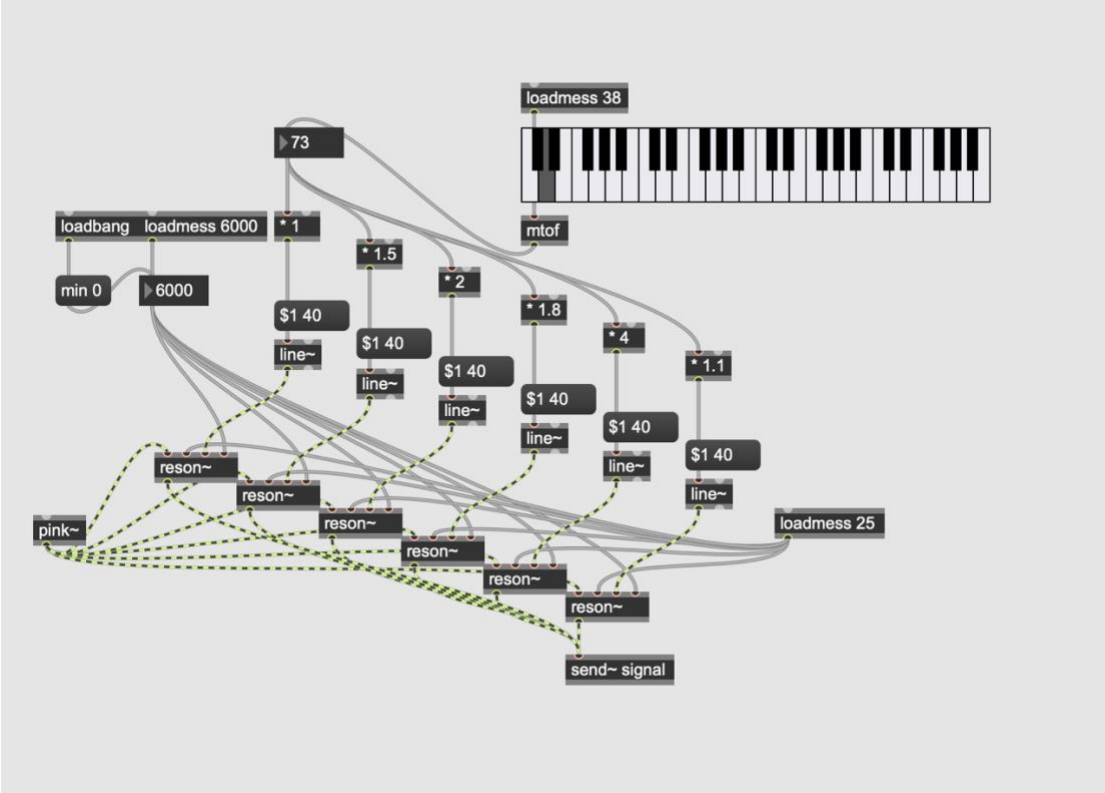
Video-Processing-Modules (sub-patch)



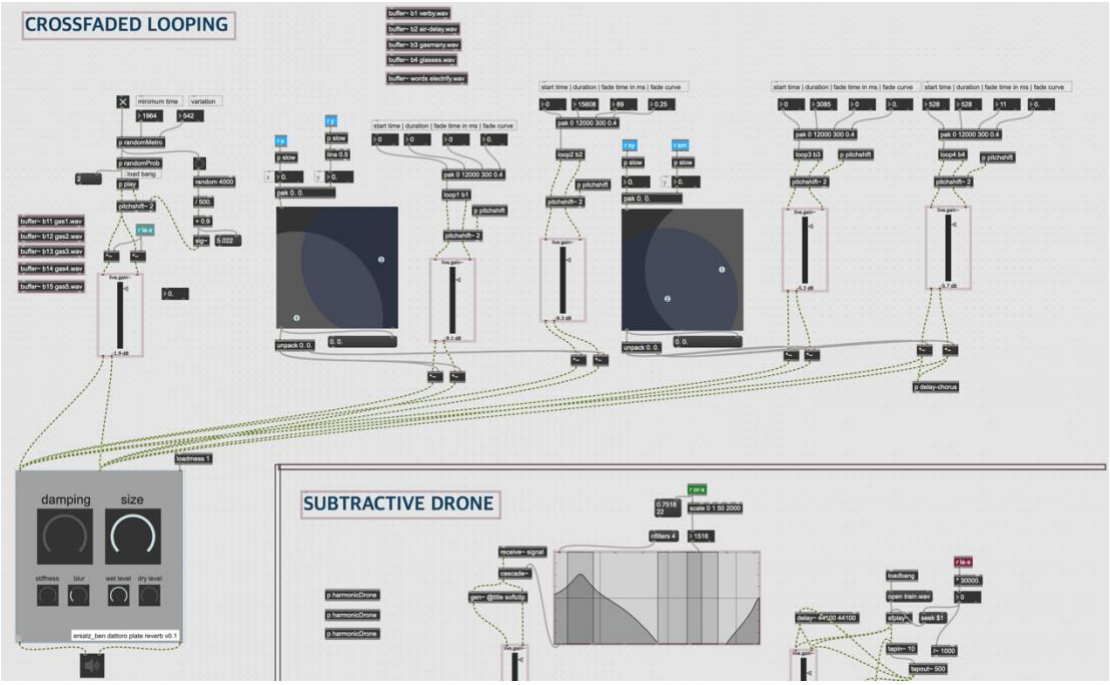
Subtractive Drone



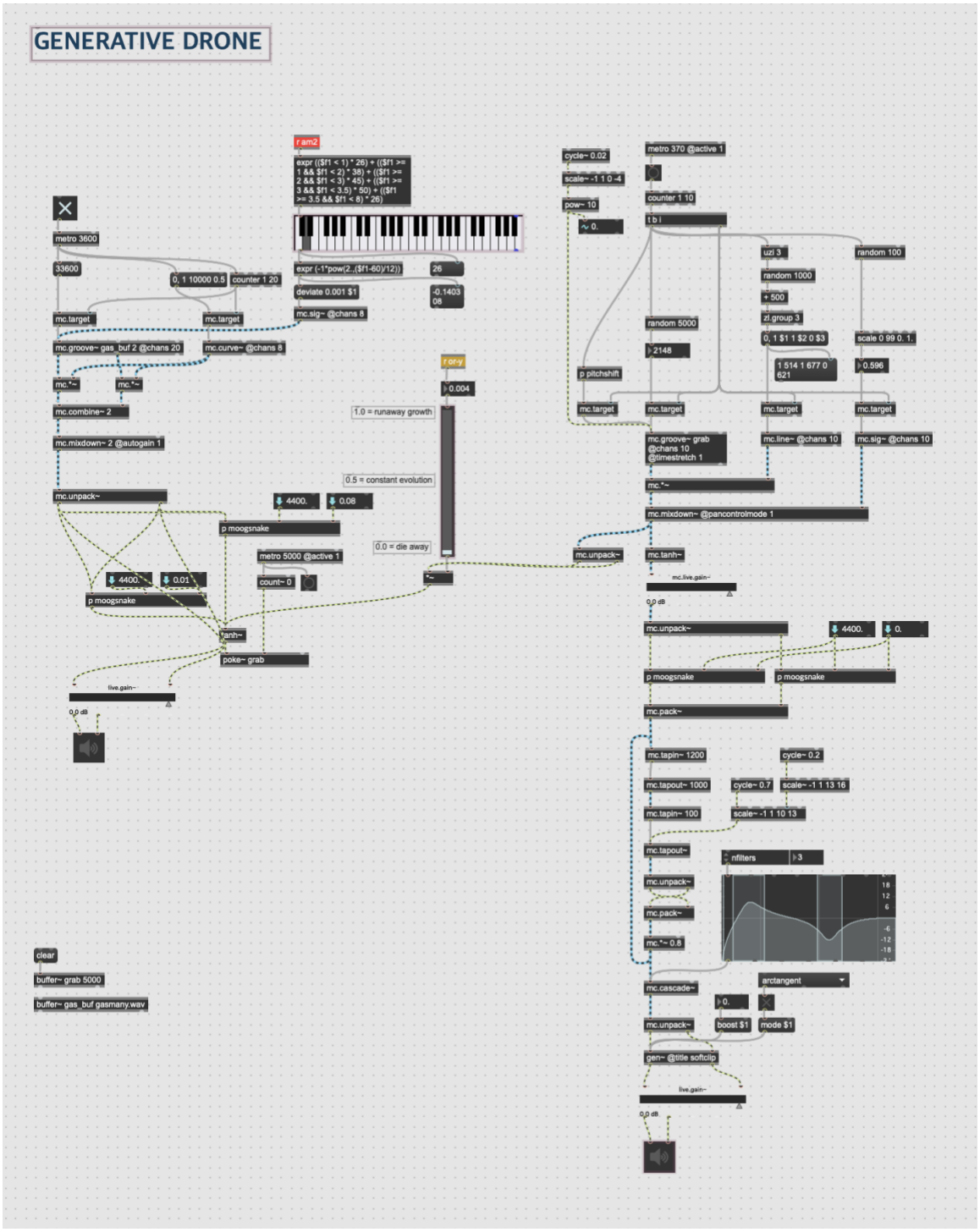
Harmonic Drone (sub-patch)



Crossfaded Looping



Generative Drone



Bibliography

Augoyard, J.-F. & Torgue, H. 2006, *Sonic Experience: A Guide to Everyday Sound*, McGill-Queen's University Press

Adkins, M. et al. 2019, *Music beyond Airports: Appraising Ambient Music*, University of Huddersfield Press

Adorno, T. 1996, *Aesthetic Theory*, G. Adorno (ed.),Theory and History of Literature Ser., vol. 88, University of Minnesota Press

Adorno, T. W. 1990, *Musik und Technik. In R. Tiedemann (ed.) Klangfiguren.* Musikalische Schriften I. [Gesammelte Schriften 16], Frankfurt am Main: Suhrkamp.

Bachelard, G. 1994, *The Poetics of Space*, Presses Universitaires de France

Bille, M. 2017, *Review of Gernot Böhme, The Aesthetics of Atmospheres*, ed. Jean-Paul Thibaud. London, Routledge, International Journal of Sensory Environment, Architecture, and Urban Space, https://journals.openedition.org/ambiances/1065

Böhme, G. 2016, *The Aesthetics of Atmospheres*, J.-P. Thibaud (ed.),Ambiances, Atmospheres and Sensory Experiences of Spaces Ser., Routledge.

Cascone, K. 2000, *The Aesthetics of Failure: Post-Digital Tendencies in Contemporary Computer Music*, The MIT Press

Cox, C. 2018, *Sonic Flux: Sound, Art, and Metaphysics*, The University of Chicago Press

Danto, A.C. 2014, *After the End of Art: Contemporary Art and the Pale of History - Updated Edition*, Princeton University Press

Deleuze, G. 2003, *Proust and Signs: The Complete Text, Theory Out of Bounds Ser.*, vol. 17, University of Minnesota Press

Demers, J. 2010, *Listening Through the Noise: The Aesthetics of Experimental Electronic Music*, Oxford University Press

Deupree, T. 2019, *Infinite Grain 13, Interview with Taylor Deupree*, https://sonicfield.org/infinite-grain-13-taylor-deupree/

Doyle, P. 2005, *Echo and Reverb: Fabricating Space in Popular Music Recording, 1900-1960*, Music-Culture Ser, Wesleyan University Press

Epstein, N. 2017, *Musical fragility: A phenomenological examination*, Cambridge University Press

Hegarty, P. 2007, *Noise Music: A History*, Bloomsbury Continuum

Hegel, F. G.W. & Knox, T.M. 1988, *Aesthetics: Lectures on Fine Art by G. W. F. HegelVolume I*, Oxford University Press

Heidegger, M. 1991, *The Question Concerning Technology: And Other Essays*, trans. W. Lovitt, Harper Torchbooks

Heidegger, M. 2004, *On the Essence of Language: The Metaphysics of Language and the Essencing of the Word Concerning Herder's Treatise on the Origin of Language*, trans. W.T. Gregory & trans. Y. Unna, SUNY Series in Contemporary Continental Philosophy Ser., Suny Press

Holmes, T. 2002, *Electronic and Experimental Music: Pioneers in Technology and Composition*, Media and Popular Culture Ser, Psychology Press

Kuhn, L. 2001, *quotes in The Scotsman*, executive director of the John Cage Trust, (August 24, 2001), www.festival.scotsman.com

Moles, A. 1966, *Information Theory and Esthetic Perception*, trans. J.E. Cohen, University of Illinois

Roads, C. 1996, *The Computer Music Tutorial*, The MIT Press

Richardson, D.M. 2010, *Revolving Lights*, Good Press

Sangild, T. 2002, *The Aesthetics of Noise*, Copenhagen, Datanom (also published online: www.datanom.com/noise and on UbuWeb www.ubu.com/papers/noise).

Sangild, T. 2004, *Noise – Three Musical Gestures – Expressionist, Introvert and Minimal Noise*, http://www.musicandmeaning.net/issues/pdf/JMMart_2_4.pdf, The Journal of Music and Meaning

Smalley, D. 2007, *Space-Form and the Acousmatic Image*, Organised Sound, Cambridge University Press