PORTFOLIO OF COMPOSITIONS

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A thesis submitted to

The University of Birmingham

for the degree of

DOCTOR OF PHILOSOPHY

Department of Music

College of Arts and Law

The University of Birmingham

ABSTRACT

This PhD portfolio comprises seven original compositions that crossover between experimental electronic music and electronic dance music, utilizing the overarching concept of technology as a driving force for composition. Emphasizing "performing to compose," this portfolio uses diverse hardware control in the composition process to capture subtle performance nuances. Adding to this, composition techniques coming from experimental electronic music and sound material coming from electronic dance music merge in distinct ways throughout the portfolio. Furthermore, spatialization techniques, from stereo to multichannel, enhance the creative exploration. The compositions serve as both technical experiments and artistic statements, revealing not only the potential of integrating technology with music-making, but also yielding compositions that portray artistic sensibility, a key part in the compositional process.

ACKNOWLEDGEMENTS

I would like to thank my advisor, Christopher Haworth, for his valuable feedback on my composition process, which allowed me to focus and successfully complete my portfolio, as well as Luis Manuel Garcia for sharing his expertise on electronic dance music. I would also like to thank Scott Wilson, Annie Mahtani, Simon Smith, and the BEAST team for the invaluable experiences provided during BEAST concerts at the University of Birmingham. Finally, I would like to thank Marx Corella for his collaboration video for *Sounds of Synthesizers,* and Reema Azar for her help in editing this written document.

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This is a supporting document to the contents of my PhD portfolio available to access in the following link:

bit.ly/3RLbkkg

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INTRODUCTION

As a musician, I have been active in the electronic dance music scene for twenty-five years, entering this world of music through previous musical instrument studies during my primary and secondary school years. My attraction to both music and computers led me to engage with electronic dance music as a composer and producer at a young age, and subsequently as a DJ, focusing on the aesthetic particularities of manipulating electronically produced sounds.

Throughout my musical career in electronic dance music, I have released a significant amount of music on smaller and larger independent record labels and continue to do so, always striving to establish myself as an electronic dance music artist. Equally, my interest in music and technology steered me towards an academic journey of music studies in my college and master's degrees, fostering a keen interest in the experimental side of music and computing. This interest primarily manifested through exploring sound design, alternative instrument design and use, and the overall appreciation of sound with its immense possibilities to create meaningful experiences.

Within this field, I have created acousmatic and live electronic performance pieces in academic settings, helping me synthesize learning outcomes into artistic conclusions. Furthermore, I have always gravitated towards the technical side of audio-related matters, exploring, learning, and trying to deeply understand technological tools to explore their sonic outcome possibilities. It has always been my interest to produce better electronic music. By "better," I mean music that

I, as an artistic person, am confident with. Combining my musical experience in the different fields I have explored has proved to be helpful in this regard. My composition portfolio for my PhD continues this exploration, leading to the creation of seven original compositions that crossover between experimental electronic music and electronic dance music through a focus of technology.

Throughout this document, I use the term *experimental electronic music* as a reference to music produced using electronic means that encompasses experimental and creative sound design with results that can be acousmatic or live performed electronic music in academic settings, and the term *electronic dance music* as a reference to popular music produced by electronic means that is intended for dance club settings.

The compositions explore the integration of an array of technological tools and concepts—such as MIDI and audio effects, hardware controllers, and sampling—to investigate their capacity to produce expressive, nuanced, and unexpected sound outcomes. Specific tools and concepts highlighted within this study include delay; arpeggiation; analog synthesizers; looping; sampling; and external hardware control. Each of these tools plays a crucial role in the compositions, making technology a driving force for the creative process, the main overarching concept in my compositional work. The tools first serve as inspiration for conceptualizing the pieces; I have used them previously in extensive ways, and this has sparked interest for further exploration of them. In my compositional process, once broader concepts influenced by the tools chosen for pieces are set, initial sonic ideas stemming from the tools themselves are created and act as jump start ideas. The compositional process involves permitting tool manipulation to drive and lead the process forward, making aesthetic choices in parallel. In this way, tools are explored, sound is produced, choices are made, and further exploration follows, leading to piece development.

A central theme of my compositional process is the concept of "performing to compose," where the composition process is approached as a live performance, allowing me to manipulate and interact with the music directly through hardware controllers. This approach is explored using the *MIDI Fighter Twister* knob and button controller, the *Wacom Intuos Pen Creative Tablet*, and the *Ultraleap Leap Motion Controller* infrared sensor device. The approach is scrutinized to determine if it aids in capturing nuances in sound that are difficult to achieve with traditional sound parameter automation in digital audio workstations (DAWs).

Spatialization is also a key aspect of the presented compositions. The pieces employ techniques ranging from stereo to multichannel spatialization, including ambisonics processing folded down to binaural spatialization.

The compositions serve both as a platform for technical exploration and as personal artistic statements, featuring aesthetic choices in the music production. They aim to engage the listener by providing an auditory experience that showcases the potential of combining technology with creative music-making.

The seven compositions in the portfolio are:

1. Sounds of Echoes - Explores the creative possibilities of the delay effect by utilizing software-based delay plugins and exploring their possibilities through parameter manipulation.
2. Sounds of Looping - Examines the concepts of looping and repetitive structures through various designed software systems that create pattern-based audio and MIDI.
3. Sounds of Arpeggiation: Explores the musical potential of arpeggiators by utilizing software-based arpeggiation audio and MIDI plugins to control pitches and multiple parameters within the composition.
4. Sounds of Motion - Utilizes the *Ultraleap Leap Motion Controller* external hardware device to manipulate sound and form a composition solely driven by this device.
5. Sounds of Analog - Focuses on sound characteristics of analog synthesizers to create a piece where the sound material mainly comes from sampling of true analog hardware synthesizers.
6. Sounds of Clubbing - Captures and transforms sounds from electronic dance music clubs through sampling, creating a resulting composition intended for the listener to feel inside a dance club environment yet expanding on this though creative exploration of the sound material.
7. Sounds of Synthesizers - Delves into sampling and manipulating mechanical sounds from eiight vintage hardware synthesizers to create a piece where the inherent sounds of each of these devices are featured to appreciate their particularities.

This document initially explores key concepts in composition to contextualize the composed pieces, and then proceeds to explore each piece individually in a more technical sense.

KEY CONCEPTS IN COMPOSITION

My PhD portfolio contains one main overarching axis—technology as a driving force for composition—and two sub-axes—performing to compose, and the crossover between experimental electronic music and electronic dance music.

Technology as a driving force for composition:

The main overarching axis of my PhD lies in using technology as a driving force for composition. From a broad historical perspective, one could argue that the advent of technology has always influenced the compositional process in various ways. We can begin by examining ancient instruments. In Warren D. Anderson's book, *Music and Musicians in Ancient Greece*, Anderson references the Neolithic period, focusing on the wall engraving of a shaman and his musical bow in the Trois Frères Cave in Dordogne, France. Anderson describes, "The player holds one end in his open mouth, which serves as a resonating chamber, strengthening the sound of the plucked bowstring and varying its pitch" (Anderson, 1994, p. 1). Anderson then investigates a "Cycladic marble statuette from Keros of a seated harper" dated to 2700 BC, where the harp portrayed in this artwork bears similarities to a modern harp. Reflecting on these early instruments, one could argue that their physical constraints necessitated that musicians focus on their technical abilities to produce sound. Consequently, music inherently possessed a technical dimension. Additionally, the creation of these instruments reflects the technological advancements of the time, demonstrating the interplay between music and technology in the ancient world. Noehren, in his article *Notes on Bach and the Organ of His Time*, reflects on the influence of the organ on Bach:

> We are able to see the reflection of these organs in the organ music of Bach, whose conception of the imperishable *Toccata and Fugue in D Minor* was certainly inspired by the atmosphere of the great medieval cathedrals and their magnificent organs with 32' registers standing under those crashing chords. (Noehren, 1995, p. 74)

Noehren further emphasizes how composers tailor their work to the capabilities of known instruments, asserting, "It is for the instrument he knows and about which he dreams that a composer writes" (Noehren, 1995, p. 73). The organ, in this example, underwent various technological advances, which led to the creation of superior instruments and, consequently, new compositions. Would Bach have written the same *Toccata and Fugue in D Minor* if the organ had not existed? Questions like this help us conceptualize how technology can directly influence the compositional process.

Fast forward to the 21st century, and we observe a vast array of technological advancements, many focused on the field of music. Consider Leon Theremin and his *Theremin* instrument, a marvelous piece of technology that resulted in composers writing specifically for its unique means of performance and sound capabilities. Derek G. Fleck references this instrument in his thesis, *The Theremin* (2009). Fleck writes, “The Theremin became a huge hit by becoming popularized as the scary sounds in the classic movie *The Day the Earth Stood Still*...” (Fleck, 2009, p. 1). Bernard Herrmann (1951), composer for this movie, was influenced by the

Theremin's instrument sound and capabilities. In the article *The Story Behind That Really Creepy Sound In The Film Score from The Day The Earth Stood Still*, Kevin Gordon further writes on this idea:

> It was precisely that sound that gave *The Day the Earth Stood Still* score its signature creepiness. Herrmann's use of the Theremin was copied by other film composers, and the instrument has been associated with science-fiction and thriller movies ever since. (Gordon, 2020)

We can extend this idea beyond individual instruments to broader technological advances in music. The tape machine, originally designed to capture audio recordings, was used in the Musique Concrete movement as an instrument and sound medium, influencing music styles and compositions. As Daniel Teruggi states in his article *Technology and Musique Concrète: The Technical Developments of the Groupe de Recherches Musicales and Their Implication in Musical Composition*:

> The arrival of the first tape recorder, when it finally functioned in 1950, enlarged the techniques of musique concrete. New actions were possible on sound: the main improvement being to facilitate the manipulation of the media, and simplify operations such as speed variation. (Teruggi, 2007, p. 217)

He furthermore expands on this idea by stating:

> It is not surprising that Pierre Schaeffer, with the assistance of a very skilled technician, Jacques Poullin, started conceiving and constructing new machines derived from the tape recorder. Schaeffer had foreseen in speed variation an effective technique to modify the causality of sounds, while keeping their essential physical character. (Teruggi, 2007, p. 214)

The tape machine became an instrument that was explored and repurposed for composition, yielding expanded possibilities in sound material for composition.

In the current era, technology surrounds us, changing the way we work, perceive our surroundings, and interact with others, among countless other factors. Although physical hardware sound-producing devices, both digital and analog, remain common in the music production process by each intending to offer their own signature sound or characteristics, many compositions now begin with the composer opening a laptop, launching a digital audio workstation (DAW), and choosing a sound to start with, which sets off a chain reaction of choices influenced by technological aspects existing in the DAW digital medium.

Tanev and Božinovski (2014) reflect on the evolution of music technology in their paper *Virtual Studio Technology inside Music Production*:

> About two decades ago, musicians would have laughed if they were told that classic synthesizers would be successfully re-created in software form and sold at a fraction of their original price. They would have been even less likely to believe that they might

> have half a dozen or more of them, neatly integrated into their favorite MIDI (short for Musical Instrument Digital Interface) and audio sequencer to be summoned at will...” (Tanev and Božinovski, 2014, p. 231)

This prediction has not only come true but has also revolutionized the way music is produced and composed. The landscape of current music technology is vast, encompassing numerous DAW programs, each with its own collection of MIDI and audio-based effects and processors, as well as sound-generating virtual instruments and samplers. This technological ecosystem allows musicians to experiment with a wide array of sounds and effects, making the composition process more dynamic and fast paced. Artificial Intelligence (AI) is also in an expanding sphere where sound synthesis and processing are being explored. Examples include tools such as *iZotope’s Ozone* mastering plugin processor that utilizes AI processes to help the user speed up workflow by taking care of “grunt work” (Stewart, 2023), *Synth GPT* that has the capability to create synthesized sound from a text-based prompt (Pebble Dev Studio, no date), and *DataMind Audio’s Combobulator* that has the capacity to “style transfer” timbre of your entering audio into the style of trained data-sets (DataMind Audio, 2024).

Adding to this, numerous hardware control devices are designed to enhance parameter control through physical interaction, such as piano-style keyboard controllers and devices with knobs, buttons, pads, and faders. Examples include modern grid-style controllers.

> A variety of popular tessellating square keyboard designs exist on the market for digital musicians. There are clear creative, theoretical, and performance advantages to using

> these devices, especially when it comes to creating live electronic music. These include MPC controllers like the *MPC500* and *Native Instruments' Maschine*, and other advanced MIDI controllers like the *Ableton Push*, *Push 2*, and the *Novation LaunchPad*. The square grid makes simultaneous drum sequencing and clip triggering a possibility. (Earnest, 2013, p. 8)

We find such hardware control devices in multiple situations in the present, from studio to live shows, as means to drive away from the keyboard and mouse.

An interesting critique on this expanding sphere of technology can be found in composer Alessandro Cipriani's words quoted in Mark Fell's book *Structure and Synthesis: The Anatomy of Practice.* Cipriani criticizes modern audio software by claiming "people are subjected to the dictatorship of the software [that] has a lot of very nice sounds and very nice possibilities, but you end up making music following the way that these softwares are built" (Fell, 2022, p. 52). The point is valid, yet looking at modern music composition within the DAW in the present is not simple at all. Technology is heavily intertwined with the process of music performance and composition, and how technology influences and drives the creative process becomes a compositional matter in itself: you cannot simply break away and put technology to the side.

This technology backdrop acts as a starting point for the seven compositions of my portfolio, all encapsulated by the main idea of technology as a driving force for composition in the following ways.

First, by zooming into very specific technological music tools, and using these tools as a means for composition, exploring them in various ways, looking at them from different angles, and accepting their influence in the compositional process. This idea is not new (the tape machine in Musique Concrete as previously mentioned, for example), as countless electronic music productions are inherently influenced by the devices used to produce them, bound by their limitations in hardware or software. A question I want to address in my composition process is: How can I use a tool and explore it beyond its intended purpose? Most, if not all, digital or hardware-based synthesizers and signal processors come with manuals that explain the general and in-depth functions of the devices and provide examples of their use. For instance, a reverb plugin manual explains how reverb can be used to add depth to an audio mix, while an equalizer plugin manual details how this processor can help clean up the audio frequency spectrum and balance it according to other instruments in a mix. Additionally, a simple web search can yield numerous practical tutorials on using audio devices, connecting them to techniques for creating music in various commercial genres. A look at Rick Snoman's book *The Dance Music Manual: Tools, Toys, and Techniques* exemplifies this. Turn to any chapter and concise detail of tool use is explained, as in "to get this sound you must do this with these tools..." (Snoman, 2019).

The mentioned question resurfaces and expands: How can I use tools and explore them beyond their intended purpose? Can different concepts for their use be devised to enhance creativity?

A good example is electronic musician Brian Transeau (BT) and his use of editing tools and custom created software to create extremely distinctive and elaborate glitching sonic outcomes:

> So my first rudimentary stutter edits were using tape. Then I started cooking up all these mathematical schemes for what happens if you interpolate exponentially over a dada quad note to 1024 and cluster down to 8th and triplets, I mean just these crazy ideas in my teens and early 20's. I had to execute these things, find a way to do so on the first digital audio workstations, which weren't even what you would think of as workstations but things like *Sound Tools* and *Peak* to do some of the early edits, and I reached a point where it was reason enough to start *Sonik Architects* where I would be able to automate this process and not do it by hand. (Transeau, 2016)

In this example, Transeau is finding ways to use two-track editing digital software such as *Peak* creatively to transfer the concept of tape edits into the digital realm. By taking advantage of digital resolution, he is able to expand on simple tape edits and go into very precise micro-timing edits that would not be possible otherwise.

Another good example is Richard D. James, aka Aphex Twin. In an interview conducted by Phil Ward for *Lanner Chronicle*, James states:

> I remember reading in *Music Technology* about DAT [Digital Audio Tape] machines, before I had one, and it said turning the recording level up too high gives you a digital

> distortion which is horrible and unusable. And I thought, that's a terrible thing to say, like you can't use that medium in that way… I took it as a challenge, to use that horrible and unusable effect in some way. Everything has got a good sound. (James, 1993)

Such use of distorting a DAT machine exemplifies how a technology can be looked at from a distinct perspective and used as a musical compositional tool. James makes the tool malfunction by distorting it on purpose to reach a creative outcome. Mark Fell explores this concept in his book *Structure and Synthesis: The Anatomy of Practice*. In the section *Notes on Malfunction* (Fell, 2022), Fell explores the concept of technological malfunction through distinct critical lenses. One reference he uses is his experience with composer Yasunao Tone and his use of skipping CD samples in his works. Fell questions the definition of a malfunction throughout this section, leading to the following statement:

> In this case, the CD player fulfills Tone's intended aim, yet the machine still malfunctions: the sound we hear is still the sound of errors produced by a malfunctioning piece of equipment, not a CD being played "properly." But on another level the machine is doing what the artist intends; the artistic practice is not failing. So is the artifact also functioning correctly? (Fell, 2022, p. 179)

Tone's and James' uses of these devices in a "malfunctioning" way are analogous, as both expand their creative process by this practice.

Fell further examines the creative use of malfunction in technological devices, leading momentarily to the subject of technology being used "contrary to their design-intended functions" (Fell, 2022, p. 173). Fell exemplifies this by stating, "These might include quirky one-off uses of a certain technology negotiated by the user in specific contexts" (Fell, 2022, p. 173). He further argues that technologies often get repurposed for uses different from their original design, reflecting cultural shifts and new situational needs, illustrating that a technology's primary function can change over time. In this example Fell references technology in a broad sense, yet I find that the concept of utilizing tools not for their primary intended function ties into my compositions. Fell discusses an example of a DJ:

> [The DJ] has developed a new set of uses, goals, and intended functions for record players designed and primarily used for the linear playback of vinyl. ... By pushing and pulling the vinyl backwards and forwards, it produces aesthetically pleasing variations in playback speed and direction. (Fell, 2022, p. 175)

This statement resonates directly with how I treat certain technological tools within my compositions. Controls over technology can be repurposed to achieve new creative outcomes.

As a summary, the above mentioned examples are meant to exemplify how technology is inherent in the music composition process, be it to a lesser or greater degree. The composition process for my portfolio pieces all try to expand on this idea to a greater degree, leading to the final seven composed and produced pieces.

Performing to compose:

When utilizing technological tools to drive compositions, numerous factors must be considered as these tools can become very complex in achieving desired outcomes. This complexity arises from allowing the user to finely tune parameters to hone in on specific sonic results. In DAW usage for composition, the numeric keyboard and mouse are increasingly becoming the primary means of data input. One can draw in MIDI notes and chords and manipulate them over time, gradually creating sonic progressions. Users choose a software instrument to render these inputs, browse through presets with the mouse until an acceptable sound is found, and adjust parameters to fine-tune the sound further. Furthermore, a chain of effects is commonly employed to add "color" or identity to the sounds, each containing a vast array of parameters to explore (Fajar and Sukmayadi, 2021; Marrington, 2017). Automation, the practice of modulating parameters in a DAW with a pencil-style approach, is used to delineate how these parameters change throughout a piece. While effective, this process of composition can often be static and rigid. This is where the first sub-axis of my portfolio, the concept of performing to compose, plays a pivotal role in my compositions.

Through my experience producing electronic music throughout my career, I have observed that integrating performance elements can yield more dynamic, nuanced, and exploratory results beyond the traditional use of a keyboard and mouse.

Consider an acoustic instrument, like a violin, and ponder the physical factors involved in its performance. A thorough analysis reveals nearly infinite parameters: the construction of the instrument, its resonance, the strings, the bow, and how the performer, through years of practice, interacts with these elements to produce dynamics, vibratos, and movement while playing. Additionally, the acoustics of the space where the instrument is played significantly affect the sound, showcasing the myriad factors that contribute to a nuanced and highly expressive outcome. All these possibilities are controlled and interconnected in real-time by the performance. Dobrian (2003) states:

> Much of our appreciation of music is in its performance: the contributions the interpreter makes in terms of dynamics, rubato, timbre, ornamentation, in some cases even improvisational decision making, and notably in this context, the performer's virtuosity and mastery of the instrument." (p. 1)

This is particularly evident in the performance of complex pieces like the Bach Chaconne, where witnessing the violinist's technical prowess and ability to navigate the piece's challenges enhances our appreciation.

> Indeed it can be said that a major part of the drama of, for example, the Bach Chaconne is witnessing the violinist's mastery of the technical challenges that the written music presents. We are aware of the skills and maneuvering required, and when the music flows elegantly from the instrument we are impressed and enthralled by the technical success of the performer. Our knowledge of the instrument also contributes to our appreciation of the timbres, intonation, and effects the player produces. (Dobrian, 2003, p. 1)

For example, if the performer is excited and shifts the violin downward, this movement affects how the bow interacts with the strings and consequently alters the sound. The interplay of physical and emotional factors in real-time performance underscores the complex and dynamic nature of musical expression, where every nuance and gesture contributes to the overall experience.

The concept of performing to compose is not new. Consider Stockhausen's piece Studie II, with a detailed score set to be interpreted by a technician. Even though the set of instructions are clear, the actual interpretation of the recording acts as a means of performing the piece to tape. In his study *Interpretation and Performance Practice in Realizing Stockhausen's Studie II*, Sean Williams argues that the actual recording to tape is an influence on the end resulting recording. As mentioned by Williams, "The performance practice and, by association, the instruments used clearly exert a significant influence over the way that these realizations sound, and therefore over how they are perceived." (Williams, 2016, p. 446).

We can further consider this theme as analogous to the engineering practices of musical productions pre-DAW. Records that were recorded to multi-track tape machines involved live performances of the mix by the engineer, producer, and even musicians in order to successfully transfer the mix to the two-track tape machine. Parameter manipulation, such as volume rides, had to be performed using the mixing console to complete the final take. (Owsinski, no date)

Current electronic dance music producer Hannes Bieger also approaches music composition in a performative way. In his interview *Fifteen Questions Interview with Hannes Bieger*, the artist states:

> Often times I would just jam with my machines, and I'd like to think that I am quite good by now detecting the moments when I'm on to something. I would then start recording immediately, and I usually record larger passages. (Bieger, no date, para. 12)

Referencing back to ***Structure and Synthesis: The Anatomy of Practice,*** Fell (2022) discusses the use of the Roland 303 bass synthesizer in Phuture's track "Acid Tracks." In an interview cited by Fell, Nathaniel Pierre Jones, one of the track's producers, explains that the distinctive sound of the track, often credited as the birth of acid house, emerged from randomly turning knobs on the machine because the producers did not know how to program or use it. Fell examines this through different lenses, finding a "personal resonance" with Phuture's "encounter with the TB 303" (Fell, 2022). Fell states:

> I see many parallels between that specific recording session and how I work. Although the process of producing work involves a great deal of detached theoretical analysis, at its core I feel my work is derived from "hands-on" explorations of the tools that I encounter or make. (Fell, 2022, p. 66)

My work on this portfolio embraces this idea of knob turning and interacting with technology to explore sonic possibilities, and I execute this by incorporating performance into the compositional process which is a central theme in my work. By including hardware control over multiple parameters within my compositions, I can engage with these controls and "play around" with them, analogous to Phuture's interaction with the *Roland TB-303.* Through this, strengths and limitations become apparent, gradually shaping the decision process leading to the final composition. This reveals the concept of performing to compose: multiple practice sessions yield results, and various performances are executed, listened to, and analyzed, leading to subsequent performances until a final one is recorded and becomes part of the composition.

Experimental Electronic Music and Electronic Dance Music:

The sound design and composition techniques used in the pieces within my portfolio stem from a crossover of concepts and elements from experimental electronic music and electronic dance music. Each piece explores distinct compositional concepts, resulting in works that help bridge these two musical concepts.

Experimental Electronic Music:

Throughout my academic music career, I have explored a variety of sound design tools and compositional techniques. When composing acousmatic pieces, I have found that a productive approach involves moving away from traditional DAW-based composition, where one uses a left-to-right timeline. Instead, I program sound-generating and manipulation systems in distinct software. I visualize these systems as objects that are constantly producing sound with no defined endpoint, and within the programming, I can tap into them to modulate and manipulate sound through different control mechanisms.

Mark Fell touches on this subject in his *DAWs of Perception* chapter in *Structure and Synthesis: The Anatomy of Practice* (2022), where he questions modern DAWs and criticizes them for being digital representations of analog tape machines used in pre-DAW studios that emphasized individual track channels. Fell proposes a system that "removes the parallel track model," where time is still left to right, but users can move sound "clips" vertically and organize them in the desired way (Fell, 2022). For my portfolio, I extensively use *Symbolic Sound Kyma* software, which closely resonates with Fell's idea. *Kyma* uses the term *sounds* as self-contained programs that generate or process sound, or programs that merely set instructions. *Sounds* in *Kyma* range from simple looping samples to complex sound synthesis and/or manipulation programs, and these can be placed as desired within the *Kyma* timeline tracks, fitting the composer's needs. *Kyma* offers great affordances here, specifically when understanding the meaning of tracks in the program. Any *sound* can be placed on any track; the track is simply a place to set it. As an example, one track can have various *sounds* placed from left to right, and multiple tracks can be created in this manner. When the play button is pressed, *Kyma* will play sounds arranged vertically on tracks and will do so continuously until instructed by programming (which is a *sound* within itself) to move on to the next set of sounds. It is important to note as well that *sounds* in *Kyma* do not adhere to a main tempo, reducing constraints. To visualize this process, imagine a set of distinct color spherical objects floating in dark space in front of you. Each spherical object contains a sound program within itself that you, the composer, programmed. You walk forward (as the composer) and hear the sound produced by the spheres that surround you. You can also touch the spheres and control sound through interaction. Once you have explored the surrounding spheres, you move forward to the next set that can be a duplicate of the previous ones, edited versions, or new ones. In that sense, you move along (the *Kyma* timeline), exploring the sounds that you have programmed yourself, arranging your movement into a piece. I further translate this sound-oriented approach into my main DAW, *Ableton Live*, which resonates as well with Fell's words but in a lesser way than *Kyma*. In the *Ableton Live* session view, a track contains multiple MIDI or audio clips, that are arranged vertically. Clips in *Ableton* can only be MIDI or audio. In MIDI tracks, clips trigger the software instrument loaded onto the track. In audio tracks, clips playback audio files. Tracks are arranged from left to right, and clips from distinct tracks can be played simultaneously in continuous loops, following the main tempo. In this manner, *Ableton* adheres to properties of a traditional DAW, such as following tempo as mentioned, and limiting clips to MIDI or audio information. Nevertheless, the session view in *Ableton* is tailored toward live performance, therefore, as within *Kyma,* I create systems in *Ableton Live* as well, and expand these by using the aid of *Max for Live*, an instance of the *Cycling '74 Max* software integrated into *Ableton*. Consequently, the composition process for my portfolio pieces mainly relies on the programming of these systems through various manners, interacting with and arranging them.

To make the discussed systems expressive, external hardware control devices for parameter manipulation are used. This approach aligns with the concept of performing to compose, as it allows for sound manipulation through tactile-driven devices, thereby enabling the performance of the sound systems. My academic experience with experimental music has led me to experiment with different control devices, and a key one in my compositions has been the *Wacom Intuos Creative Pen Tablet*. Through the touch of a digital pen on a rectangular tablet, sound can be manipulated through X and Y movement. In the article *Ten Years of Tablet Musical Interfaces at CNMAT*, this tablet is described with the following words:

> Another promising aspect of the tablet, with respect to potential virtuosic performance, is its combination of tactile reference (i.e., the user touches it, and the spatial coordinates are absolute) with a gestural language that leverages human fine motor control, and years of writing experience. (Zbyszynski *et al.*, 2007, p. 100)

I have used this device continuously through the last ten years, and I find the description provided to be accurate. The feeling of using a pen as a control device resonates with writing, and this permits for fine movement leading to more nuanced parameter control.

Furthermore, in one of my compositions, I use the *Leap Motion Controller* hand gesture device, which allows left and right hand and finger movements to control sound parameters (this is discussed further in the piece descriptions).

Another way to visualize these systems I describe is as electronically driven instruments within themselves. A system created with the ability to have external control of sound parameters by a hardware controller becomes an instrument that you, as a composer, must learn to play. Each piece in my portfolio involves creating multiple systems that act individually, where I, as the composer, interact with and learn the system, and then find ways to integrate the systems together to realize the compositions in a performative manner.

In the creation of these systems lies a significant amount of compositional work, as they are meticulously treated to output sounds that fit the desired aesthetics of each piece. Sound granulation techniques are prevalent in my work and form part of these aesthetics. In *Listening through the Noise: The Aesthetics of Experimental Electronic Music*, Joanna Demers discusses the concept of microsound, comparing it to granular synthesis: "Microsound describes recent electronic music that treats sound as collections of infinitesimally small particles" (Demers, 2010, p. 70). This is essentially granular synthesis, where "a sound is split apart into particles ... when combined, grains can construct previously unimaginable textures and sounds" (Demers, 2010, p. 71). I find that this synthesis technique permits diverse results, leading to the “unimaginable textures and sounds” mentioned, by the distorting of the original sound material. For my portfolio, I treat the idea of “Microsound” in various manners, including it in the systems created for each piece.

Electronic Dance Music:

Electronic dance music is vast, encompassing countless genres and sub-genres. The term genre, as defined by Demers in *Listening through the Noise: The Aesthetics of Experimental Electronic Music* (2010), is "a collection of works sharing a common set of conventions" where repeated attributes create "listening expectations." Interestingly, Demers adds, "The most striking moments, however, occur when genre rules are broken or when a work seems to belong to more than one genre" (Demers, 2010, p. 168). This resonates with the concept of sub-genres in electronic dance music, where a mixture of two or more genres produces a new sonic staple, defined by enough artists using this in order to become a sub-genre itself.

In electronic dance music, defining genres and sub-genres is not easy due to the fast-changing pace of music. In *Genres, Subgenres, Sub-Subgenres and More: Musical and Social Differentiation Within Electronic/Dance Music Communities*, Kembrew McLeod explores the fast-evolving nature of genres and sub-genres in electronic dance music. McLeod states:

> Within the electronic dance music communities, the somewhat cryptic adjectives and nouns that appeared in the review reprinted above function as subgenre names that describe a multitude of musical styles that are invented, quite literally, on a monthly basis. Without lapsing into hyperbole, I can confidently claim that the continuous and rapid introduction of new subgenre names into electronic/dance music communities is equaled by no other type of music. (McLeod, 2006, p. 59)

When looking into literature on electronic dance music genres, such as McLeod's mentioned article or Brewster and Broughton's book *Last Night a DJ Saved My Life: The History of the Disc Jockey*, there is agreement on the birth of genres such as House and Techno. House music began in Chicago's Warehouse Club with resident DJ Frankie Knuckles, while Techno emerged in the Detroit scene, pushed by Derrick May and Juan Atkins. Also, a general review of the literature suggests that the naming and placing of these genres are partly defined by historical and cultural aspects. Brewster and Broughton shed light on this by stating that initially, "The word 'house' referred not to a particular style of music, so much as to an attitude. If a song was 'house' it was music from a cool club, it was underground" (Brewster and Broughton, 1999, p. 314). They further explain how the genre specific term “house” originated from the music played at the Warehouse by Frankie Knuckles and "the underground vibe the club engendered" (Brewster and Broughton, 1999, p. 315). The authors also coin the term "house-aesthetics," born from Knuckles' reaction to the death of disco, repurposing tracks by creating "complex remixes, as he ran completely new rhythms, basslines, and drum tracks underneath familiar songs" (Brewster and Broughton, 1999, p. 317).

McLeod references Acid House, later becoming Techno, as a British “cooptation and transformation of Chicago House music that helped give birth to the rave culture in Great Britain" (McLeod, 2006, p. 63). This music was "characterized by an even faster beat and an instrumental style that emphasized synthesized sounds even more than previous electronic/dance music" (McLeod, 2006).

These concepts of genre in electronic dance music lead me to argue that genre is heavily influenced by history and culture, yet specific moments in time transform the music and give it certain sonic aspects that resonate within electronic dance music communities. I aim to move away from focusing on genre as a whole and instead concentrate on the sound aspect of electronic dance music. I consider sound in electronic dance music to be generally divided into the drum/rhythmic elements, bassline elements, harmonic elements, and melodic elements. House, for example, relies heavily on vocal melodies, whereas Techno strays away from this and focuses more on drum and bass patterns. Leap to the present, and you find a long list of genres and sub-genres, each with certain sonic characteristics that are part of their identification. Nevertheless, I have found that certain aspects of sound in electronic dance music can cross genres and sub-genres, and my experience and lean-to aesthetics in this manner lie in the sound coined *progressive*. Searching for literature on this term yields results in the sub-genres of electronic dance music such as *progressive-house* or *progressive-trance*, yet it is difficult to find results that treat the term *progressive* as singular. A review of the term *progressive* yields certain common aspects to its base definition, yet information is scarce. Blogger *Assistant* answers the question about what progressive means in the following way: "The term 'progressive' in progressive house refers to the progression and development of the music over time. In progressive house tracks, you often find long, evolving compositions that build gradually, introducing new elements and variations as the track progresses" (Assistant, 2024).

In her thesis *Progressive House: From Underground To The Big Room*, Sonja Hamhuis references Simon Reynolds' (1998) book *Generation Ecstasy: Into the World of Techno and Rave Culture*, and describes progressive as "a dance track that develops in stages, proceeding step by step while adding and subtracting layers. Reynolds describes the subgenre as trippy and trancey, distinguished by long tracks, big riffs, mild dub inflections, and multitiered percussion" (Hamhuis, 2017, p. 7).

As previously mentioned, most literature searches on *progressive* lead to the *Progressive House* genre in electronic dance music, where the base definition of *progressive* fuses together with *House* music. James Todoroski's article on Cultr website delves into the history of *progressive house*, stating:

> Having been influenced by the sounds of house & techno, both of which were founded in the United States, progressive house emerged in the UK underground scene in the early 90s. While the UK had its own boisterous rave scene in the 80s & 90s with hardcore, garage, and jungle, progressive house’s emergence essentially established itself as a UK-created sound. It served as an alternative rave scene to that of the harder styles of electronic music that emerged prior. (Todoroski, 2020)

As an active member in the electronic music scene both as a DJ and a producer, I have witnessed the genre of *progressive house* evolve over the past twenty years. Personally, I prefer the single term *progressive,* refencing this initial UK sound. *Progressive house* has passed through various sonic stages throughout the last twenty years, even reaching a point where it referred to commercial electronic dance music bangers, with artists such as Swedish House Mafia producing tracks within the genre. *Progressive* in turn has consistently defined a certain sound aesthetic akin to the original *Progressive house*. With this as a backdrop, I define *progressive* as heavily harmonic structure based in minor scale tonalities, utilizing lush pads accompanied by simple rhythmic bass lines and arpeggio-style melodic structures as melodies. These sonics can be heard clearly in tracks produced or remixed by influential producers Sasha and John Digweed, artists often referenced as the original creators of the *progressive* sound. A DigTokyo.jp article on *progressive* refers to Sasha and Digweed:

> The pair's back-to-back chemistry became so great that Renaissance asked them to mix a compilation album, *Renaissance: The Mix Collection*, which was released in October 1994 to promote the club's sound as well as kick-start its new label. The three-disc masterpiece is said to be the first DJ mix released for commercial purposes, and would establish the format as key to spreading the progressive house sound. (Mickey K., 2022, para. 13)

Many examples of the *progressive* feel can be found in the present, as it is a style that is currently experiencing great popularity. For example, Brian Cid's (2020) track "Fill the Void" embodies this progressive sound.

Pavel Khvaleev, formerly known as Moonbeam, also exemplifies this style in his track "Everything" (2020).

Tying this discussion to my portfolio, through my experience as a music producer and DJ with aesthetics leaning towards the mentioned *progressive* sound, most of the sound material used for my compositions reflects upon this sound. The feeling of *progressive* lies within all compositions in some manner, sometimes in a raw form, sometimes in a deconstructed and processed manner. Comparison of my compositions to tracks labeled as *progressive* is clear when listened to side by side. A good way to find current tracks in this style is by visiting the electronic dance music web store Beatport (2024) and navigating to the *progressive house* genre.

Moving into more detail, and in order to achieve the progressive sound mentioned, the sound material for the seven compositions in this portfolio all incorporate combinations of sounds from hardware and software synthesizers, virtual samplers, and samples known for their use in electronic dance music productions in the present. It is challenging to pinpoint the most commonly used tools for sound generation in electronic dance music today, given the vast array of available hardware and software devices. Websites like KVR Audio (2024a) highlight this diversity, acting as a central hub for information on the numerous digital software options currently on the market, with constant updates on new releases. A simple web search on the best virtual instruments for electronic dance music production yields hundreds of websites and forums with varying opinions. From my perspective, the best tools to use are the ones you are familiar with, especially since modern digital virtual instruments and samplers can produce a wide variety of sounds. In a 2009 interview with *Sound on Sound* magazine, trance producer Armin van Buuren stated, "One of my biggest tips would be to restrict your gear choice, because there's so much out there; restriction is good! The technological possibilities available are humongous, and they're actually too big for your own good" (Van Buuren, 2009, para. 10).

Although this interview dates 15 years, the concept of an overwhelming variety of available tools was relevant then and remains pertinent today.

In this manner for my portfolio, I have chosen tools that I have experience with. These include the virtual synthesizers and/or samplers *Reveal Sound Spire; XFer Records Serum; Spectrasonics Trilian; Native Instruments Battery; Ableton Drum Rack; VCV Rack modular software;* the hardware devices *Dave Smith Prophet Rev 2* analog synthesizer and *Moog Poly D* analog synthesizer; and drum samples from the widely used *Vengeance* sample packs. I am also using vocal recordings stemming from original electronic dance music tracks, and field recordings from electronic dance music club events. Additionally, *Ableton Live*, a prevalent DAW in electronic dance music production and my DAW of choice, is central to the compositional process, integrating all the ideas for the compositions.

As a bridge to proceed to the next sections of this document that delve into the specificities of each composition in my portfolio, I would like to summarize the key concepts in composition in a clear statement of understanding. All compositions in my portfolio follow the concept of technology as a driving force for composition. Pieces are conceptualized through the use of certain digital tools and how these can be pushed in creative ways. These tools are explored by putting them together into sound-outputting systems influenced by experimental electronic music techniques that rely on external hardware control for performance of the systems, yielding the concept of performing to compose, that results in organic and nuanced sonic outcomes. The aesthetics of my compositions come from sound sources common to electronic dance music, fitting into the *progressive* sound palette, which are heavily processed within the mentioned systems, and undergo granular style processing in various ways. With all this as a backdrop, following is a detailed explanation of each piece of my portfolio and its unique particularities.

SOUNDS OF ECHOES (Stereo)

CONCEPT AND SYNOPSIS

Sounds of Echoes is a composition that delves into the tape delay effect, a staple in popular music production originating from analog tape machines. This effect, initially known as tape echo, involves recording an audio signal and playing it back with a slight delay. When combined with the primary signal, it produces an echo effect, and by panning this effect to the left speaker and repeating the process to the right speaker, a ping-pong delay effect is produced. By integrating a feedback mechanism to this—where the delayed signal is rerouted back to the input—and applying modulated effects like equalization, a variety of sonic outcomes can be achieved.

My fascination with the tape delay effect began during my career in music production, using a two-track tape machine and processing signals within the analog domain. My interest deepened as I started to experiment with increasing the feedback and adjusting the equalization settings, exploring the extensive sonic possibilities offered by this method. The concept for *Sounds of Echoes* was born from these experiments. The composition aims to explore the tape delay effect from its purest form and extend it into a comprehensive composition where delay is the focal point. *Sounds of Echoes* transposes this described analog signal flow into the digital realm, meticulously reproducing each technical aspect step by step. Through various forms of sound manipulation techniques, *Sounds of Echoes* engages in a deep exploration of the delay effect.

SOUND SOURCES AND MATERIAL

Synthesizer Growl: A sample of a *Dave Smith Prophet Rev 2* Synthesizer was selected for its harmonic-rich oscillator waves, coupled with low-pass filter modulation, creating a distinctive "growl" character. The sample underwent editing and subsequent transposition into fifths and octaves to maintain a consistent tonal center. Fifteen instances of this sample were loaded into an *Ableton Live Drum Rack* device, acting as a multi-sample instrument.

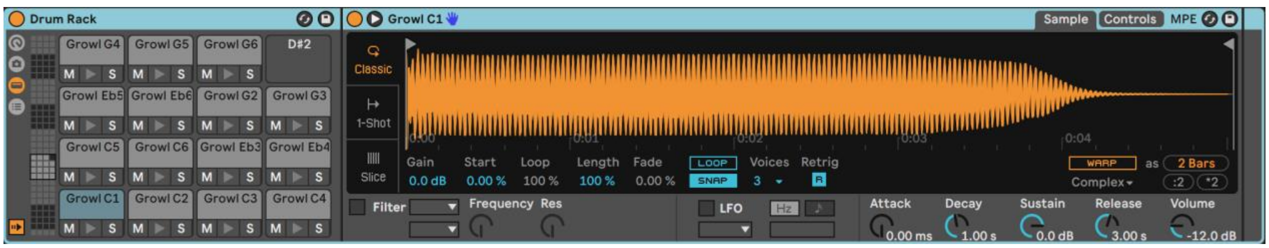


Figure 1 - Ableton's Drum Rack device loaded with fifteen "growl" samples from the Dave Smith Prophet Rev 2 analog synthesizer for *Sounds of Echoes.*

Voice: An acapella voice track featuring a female vocalist was extracted from a previous original electronic dance music production. The voice was professionally recorded in a studio, using an appropriate condenser microphone to capture a broad frequency response. Eight copies of this sample were loaded into an *Ableton Live Drum Rack* device, acting as a multi-sample instrument. Specific time instances were chosen for each of the eight copies based on varying timbre of the sample.

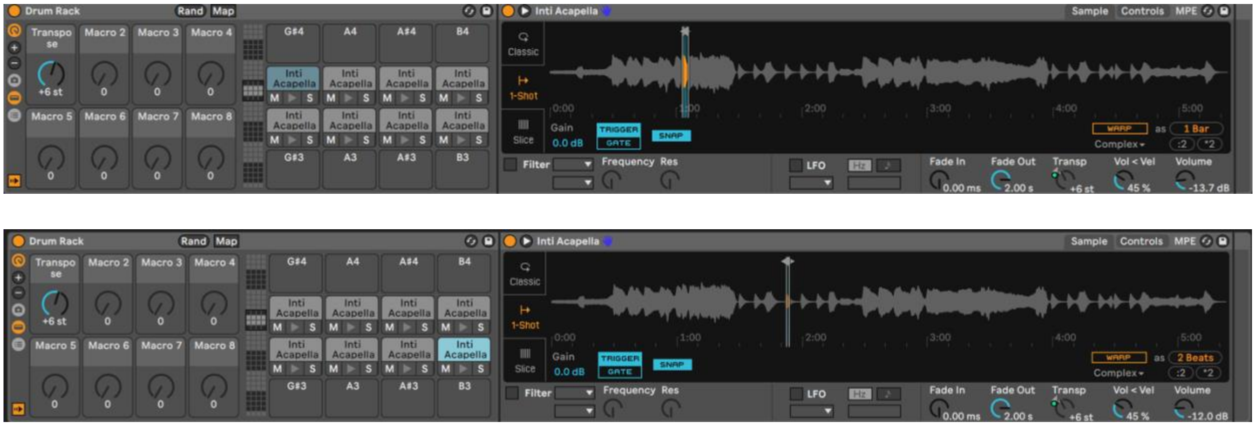


Figure 2 - Two instances of the voice sample within Ableton's Drum Rack device for *Sounds of Echoes*.

Drum Samples: An *Ableton Live Drum Rack* device was loaded with twelve synthesized drum samples from the *Vengeance* sample pack. These include kick drum samples, snare samples, clap samples, hi-hat samples, and tom samples.

Figure 3 - Ableton's Drum Rack device loaded with twelve drum samples for *Sounds of Echoes.*

SOFTWARE SYSTEMS

Sounds of Echoes uses programmed systems within *Ableton Live* and *Kyma* for the performance/composition process of the piece. Sound is generated and processed in various ways within each system or through various of the programmed systems.

Ableton Live Delay System: The central system for composing this piece lies in the *Ableton Live* software. *Live* acts as the main mix platform where all source audio material originates and eventually returns for the final stereo result. Adding to this, *Live* also acts as a means of audio processing and manipulation platform. For *Sounds of Echoes*, I developed a ping-pong delay sound processing system setup. Through this framework, various forms of sound source manipulation become achievable. This is realized as follows:

1. Creating an audio or MIDI track, *Track 1*, which triggers the source audio material.
2. Creating an auxiliary track, *Aux A*, loaded with *Ableton's Delay* plugin, mix set at 100%, feedback set at 0%.
3. Routing the output of the auxiliary track, *Aux A*, to a new audio track, *Track 2*, set in monitor mode, panned hard left.
4. Creating a new auxiliary track, *Aux B*, loaded with *Ableton's Delay* plugin, mix set at 100%, feedback set at 0%.
5. Routing the output of *Track 2,* to *Aux B.*
6. Routing the output of the auxiliary track, *Aux B*, to a new audio track, *Track 3*, set in monitor mode, panned hard right.

7. Routing the outputs of *Track 1, Track 2* and *Track 3* to a master track.

With this system configuration, you can send an audio signal from the source audio track, *Track 1*, to *Aux A* through the corresponding send rotary fader. This action sends audio to the *Delay* plugin, which delays the sound by the set time in the *Delay* plugin. After the audio is delayed, it travels to *Track 2*, where the delayed sound is heard in the left speaker due to hard-left panning. This delayed sound is then further directed to *Aux B* through the corresponding rotary send fader, which, in turn, delays the audio once again for the desired adjusted time. This delayed audio is then sent to *Track 3*, which is panned hard right. The audible result of this system is the original sound heard through both speakers, the delayed sound heard a moment later through the left speaker, and the delay of the delayed sound heard subsequently through the right speaker.

Building upon this system as a foundation, parameter manipulation and the incorporation of additional audio FX have the potential to create intricate sonorities in the following ways:

- By sending *Track 3* back to *Aux A*, a feedback loop is created, extending the delay to the desired result, which can be an infinite ping-pong delay loop or even a growing delay loop.
- By adding a static or modulated equalizer boost in *Track 3* and sending this back to *Aux A*, the timbre of the sound evolves in different manners depending on the frequency of the equalizer boost and how it modulates.

- By manipulating the delay time in one or both delay plugins, the left-right ping pong effect modulates, and if manipulated in real time, pitch modulation effects are achieved.

Two of these ping-pong delay systems were set up in *Ableton Live* for *Sounds of Echoes.* (An audio and video example screen recording of this system can be found here: https://bit.ly/4gpRllH.)

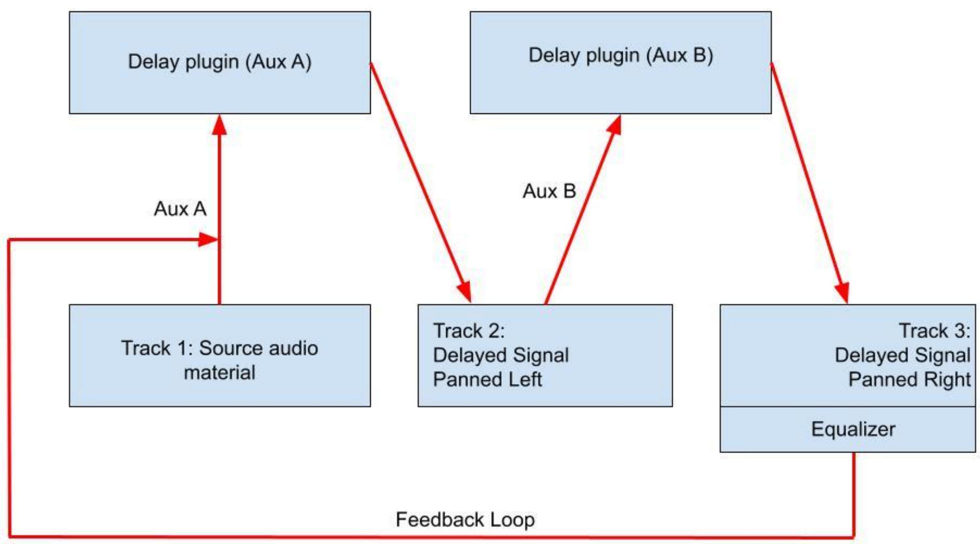


Figure 4 - Tape delay signal flow diagram for *Sounds of Echoes.*

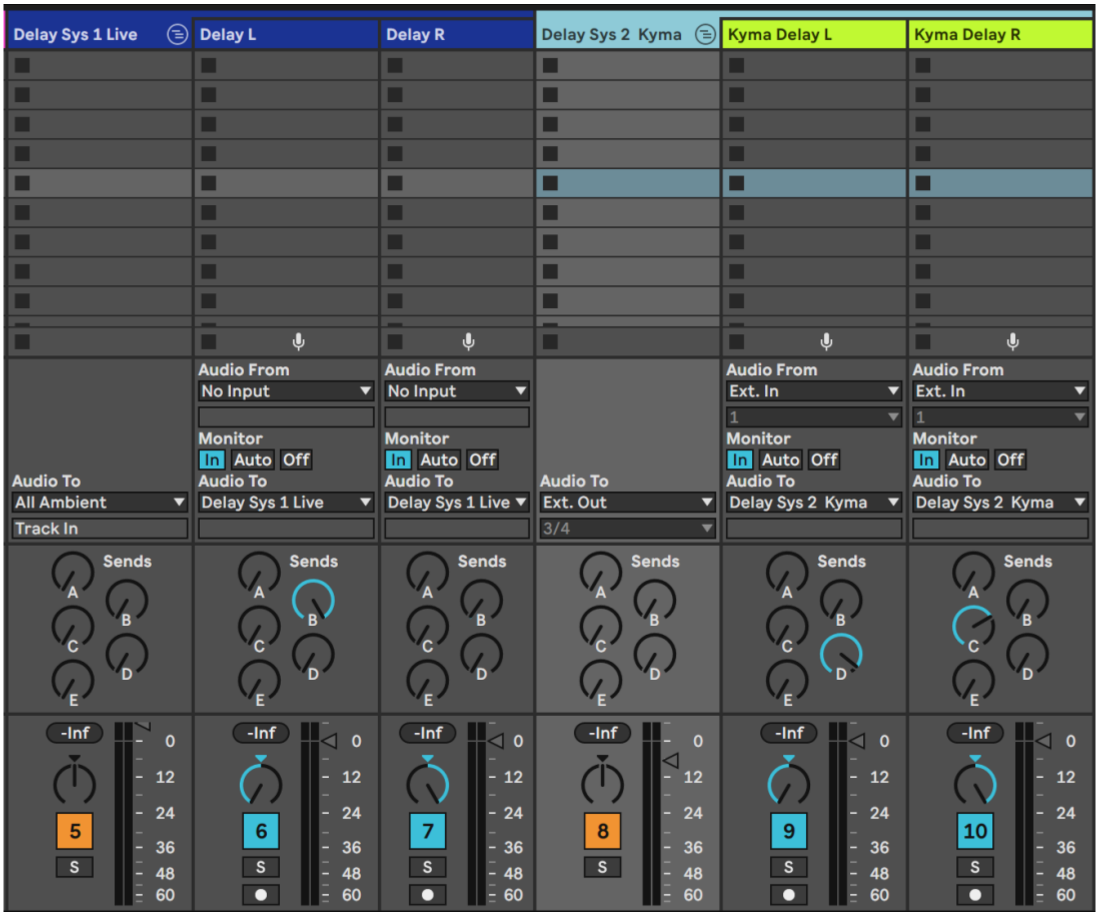


Figure 5 - The delay system setup within Ableton Live for *Sounds of Echoes.*

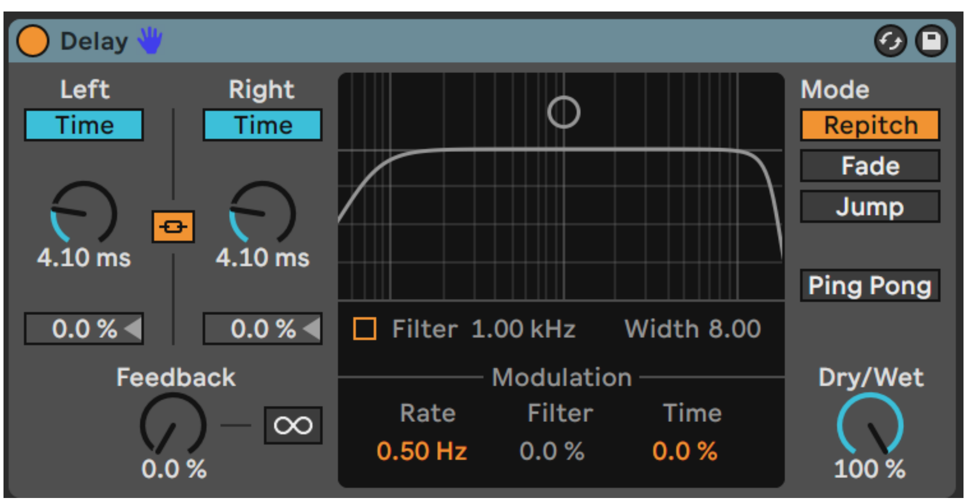


Figure 6 - Ableton's Delay plugin in for *Sounds of Echoes.*

Symbolic Sound Kyma System: For *Sounds of Echoes*, I designed a *Kyma* sound with the purpose of manipulating live incoming sound through a granulator *Sample Cloud* device, and then through a *Resonator* device. The *Sample Cloud* device allows for real-time granulation of the sound through various parameters, including frequency jitter, time jitter, grain density, grain duration jitter, and pan jitter (the term jitter in *Kyma* is used as a way of describing modulation of the parameter). The *Resonator* device allows for real time resonance manipulation of different frequencies. The *Kyma* patch for the piece yields sonic results from very sparse grain ambiences to intense, almost noise-like atmospheres.

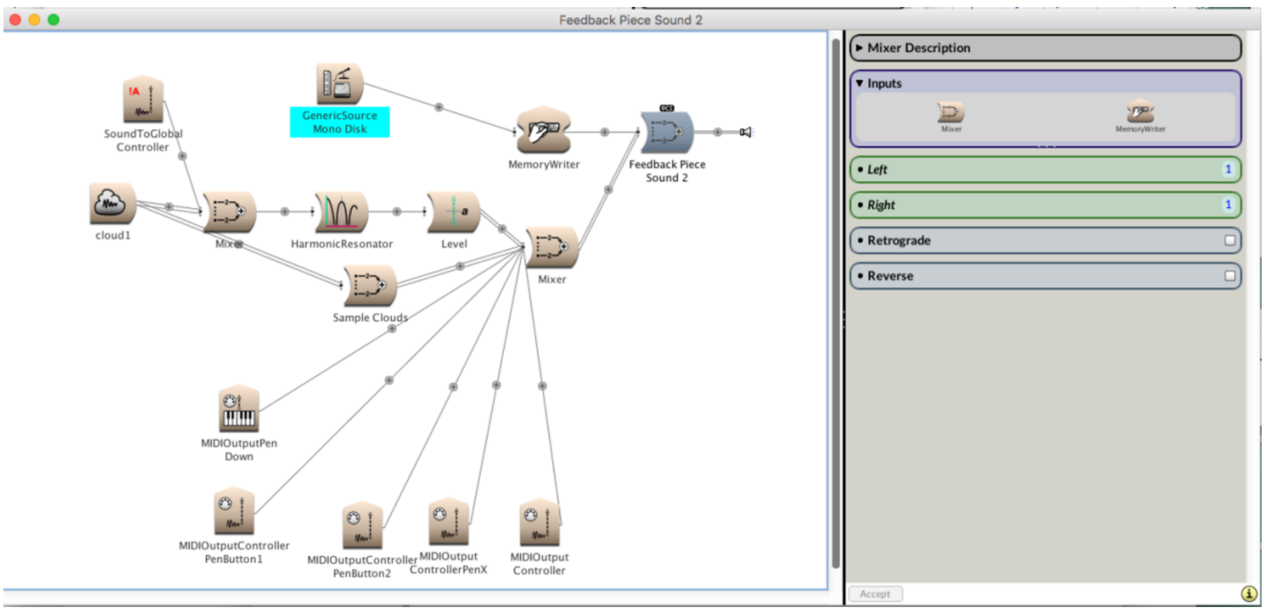


Figure 7 - The Kyma patch designed for *Sounds of Echoes*.

Max for Live: *Sounds of Echoes* uses a custom created delay effect that I programmed in *Max for Live*. This delay effect takes an original audio input and sends eight copies to eight different mono delay lines. Each copy is then delayed by a random delay time, from milliseconds to a maximum of one second. The delay time randomly changes every musical measure. Each copy also has a random panning algorithm that smoothly modulates the panning control of the sound. Finally, there is a main feedback control for all delay lines. With this device, very interesting modulating granular effects can be achieved, especially when using short delay times.

Figure 8 - Custom designed multiple delay line effect in Max for Live for *Sounds of Echoes.*

THE PERFORMANCE SYSTEM

Sounds of Echoes utilizes the previously described software systems with the chosen sound source material, incorporating hardware/software integration as a means of real-time performance control to execute a performance and subsequently the composition process of the piece. The hardware and software systems used include the *MIDI Fighter Twister, Wacom*

Intuos Creative Pen Tablet, and *Cycling '74 Max.* A combination of these devices with software were used in the piece to create systems for performance and composition, outlined as follows:

MIDI fighter Twister and Cycling '74 Max

The synthesizer growl system: For *Sounds of Echoes*, I programmed the *MIDI Fighter Twister* through an original *Max* patch to control key parameters in *Ableton Live*, including sound source launching and parameter manipulation of the ping pong delay setup. The initial program, which I call *the synthesizer growl system*, involves receiving button press messages from the *MIDI Fighter Twister* device that randomly outputs one of eight possible MIDI note-on messages. These messages are directed to the *Ableton Drum Rack* device loaded with the eight synthesizer growl samples. Consequently, each press of the programmed knob on the hardware device launches one of eight samples randomly. Rapidly pressing the button results in the simultaneous launch of various sounds. The *MIDI Fighter Twister* was further used to control parameters within the *ping pong delay system* in *Ableton Live* for this piece. The programmed parameters include:

- Delay time of both *delay* plugins.
- *Aux A* send of *Track 3* as feedback control for the *ping pong delay system*.
- Equalizer frequency for conducting frequency sweeps.
- Equalizer frequency gain to manage the intensity of the EQ sweep.

With control over these four parameters, a remarkable array of sonic outcomes can be achieved. A simple launch of one sample and a gradual increase of the feedback control generates a sustained sound that can be morphed by performing an equalizer sweep, emphasizing specific frequency content. Additionally, a real-time adjustment of the delay time parameter in one or both delay settings serves as a pitch control, with slower delay times producing very low pitches and higher delay times resulting in very high pitches.

Wacom Intuos Creative Tablet and Pen, MIDI Fighter Twister, and Cycling '74 Max:

The drum system: In *Sounds of Echoes,* I used the *Wacom Tablet and Pen* to control various simultaneous parameters in *Ableton Live* and in *Kyma*. To begin, I programmed *Kyma* to receive data when the *Wacom Pen* touches the tablet. Every time this happens, a MIDI note-on message is sent to *Ableton Live*, and one of the 12 drum samples is launched randomly. Furthermore, I programmed the horizontal placement of the pen to alter the frequency of the drum samples; touching the tablet with the pen transposes the drum samples gradually from left to right. In this way, a pitch control is created. The drum samples are then sent to the second ping pong delay system within *Ableton Live*. The parameters of this second delay system are controlled by a second set of knobs using the *MIDI Fighter Twister*, in the exact way as the *synthesizer growl system*. Once the samples pass through this system and parameters are modified, the sound is sent to a *Kyma* input, where it passes through *Kyma's Sample Cloud* granulator and *Resonator* devices. To complete the system, I programmed vertical movement of the pen through the tablet to control the overall resonance of the grains and the grain size, and horizontal movement through the tablet to control grain density. Altogether, this complex system yields percussive rain-like sustained sounds in low and high frequencies, and the interaction of the *Pen* with the *Tablet* morphs the sound in very interesting ways.

Wacom Intuos Creative Tablet and Pen, MIDI Fighter Twister, Max for Live, and Cycling '74 Max:

The vocal system: Functioning simultaneously with the *drum system,* the *vocal system* in *Sounds of Echoes* uses the acapella vocal sample loaded into the *Ableton Drum Rack* multi-sampler device. Like the *drum system*, one of the eight vocal instances is triggered randomly every time the pen touches the *Wacom Tablet*, with the distinction that the *Pen button 1* must be pressed. Once triggered, the sample is processed using the delay effect that I programmed in *Max for Live*. Furthermore, I programmed vertical movement through the tablet to control the pitch of the voice sample, and horizontal movement through the tablet to control the delay feedback. Finally, the triggered voice samples are also sent to the second ping pong delay system, passing through all instances of *Kyma* granulation and resonance effects.

STRUCTURE

Sounds of Echoes is divided into two sections that are outlined as follows:

0:00 – 7:00: This first section explores the *synthesizer growl system.* Sparse tonally centered moments morph into atonal content in multiple occasions, with varying pitch control and delay time/pitch modulation. The ping-pong delay effect and the use of the feedback parameter to sustain tones are appreciated in this section.

7:00 – 13:04: This section explores the *drum system* together with the *vocal system* simultaneously. Mostly manipulated by the *Wacom Tablet and Pen*, granular and tonal ambiences can be appreciated, with modulating left right delay effects. Sound morphs from sparse to full grains and low- to high-frequency content. By the second half of this section, the *synthesizer growl system* is gradually incorporated to tie both systems together. A short video example of this section can be found in the following link: https://bit.ly/3CXFCLZ.

PIECE SUCCESSES AND SHORTCOMINGS

As mentioned in the concept and synopsis, having previously explored the sonic possibilities of the tape delay effect, I find that *Sounds of Echoes* achieves various successes. From a technical standpoint, the tape delay system recreated within the DAW closely mimics its analog counterpart, which is crucial for the success of the piece. Understanding a tape delay system is neither easy nor straightforward. Having to set it up multiple times and using it in various instances makes it like an instrument; you practice its possibilities and learn to find the nuances, leading to better and more controlled results each time. With this technical aspect deemed a success, the piece itself successfully explored the effect. As expected, the system allowed for a thorough exploration of sound, and repeated practice along with the control devices led to a deep understanding of possible sonic outcomes that ultimately became part of the piece. As the composition progressed, the need for variation arose, leading to the creation of the other mentioned systems, all to create an engaging piece that transports the listener through different sonic landscapes. Together, the piece fulfills the purpose of showcasing the possibilities of the effect, moving through various sections and yielding sonic variation. The piece also has its shortcomings. I believe the sound material used could have been more varied, which might have led to a richer array of sonic outcomes. This is a challenging balance to strike, as too much variety in the samples can lead to a less coherent piece, while too little variety might make the piece sound repetitive. For this iteration, the result may be on the safer side; originally, I probably should have used more varied original sound sources. Nevertheless, the idea of iterations—of the piece having different outcomes depending on the source material—keeps it interesting, as a simple sample swap can lead to a completely new piece each time it is played.

SOUNDS OF LOOPING (Binaural)

CONCEPT AND SYNOPSIS

Sounds of Looping is a composition that incorporates electronic dance music sound material, processed through various looping techniques. Synthesizers, drums, and vocals are subjected to numerous looping methods to create an original piece. The intended effect is for the loops to be noticeable and distinctive, yet acoustically stimulating and diverse. The composition showcases a range of patterns from tonal to dissonant and incorporates movement within a binaural field. It is enhanced by electronic drum samples and a bass synthesizer, adding a club remix vibe to the piece.

The concept of *Sounds of Looping* originated from the intrigue I have of the practice of looping within electronic dance music, a technique prevalent across its genres and subgenres, from rhythmic to pitched loops encompassing drums, bass, melodies, pads, and more. In his book *Playing on Something that Runs*, Mark Butler explores the concept of looping in the chapter "Looking for the Perfect Loop." Butler states, "Repetition is evident in all musical cultures; in fact, it is a necessary component of human expression. Music without some degree of repetition is extremely scarce, almost to the point of nonexistence" (Butler, 2014, p. 13).

Electronic dance music has a strong focus on looping, a term that can be aligned with repetition in this particular case. Butler further explains:

> Thus, even though [electronic dance music] is hardly the only "repetitive" musical style, it does display a distinctive orientation toward repetition, which listeners respond to when they describe it in this way. Its repetitions are meant to stand out; they insistently and repeatedly proclaim their presence. (Butler, 2014, p. 15)

In his chapter, Butler discusses looping as clear audibly recognizable elements within electronic dance music. A looping beat or a looping vocal are clear, distinguishable elements that define the genre. This focus on repetition and looping creates a hypnotic effect, essential to the immersive experience of electronic dance music.

As a producer of this music style, I was inspired to create a piece centered around looping. Through this intrigue questions arose.

How can the fundamental concept of looping be explored and exemplified through various means?

How can this concept be presented in a way that makes its repetitive nature obvious yet creatively evolves to avoid sounding monotonous?

How can the concept expand further to less obvious audible elements?

In developing this piece, I envisioned elements that could loop in a straightforward manner, such as repeating audio patterns. However, I also envisioned these loops existing in deeper forms, such as binaural panning repetitive patterns or modulating audio loops with repeating yet evolving aspects. Furthermore, I contemplated the possibility of multiple loops occurring simultaneously across various frequency ranges and tempos, creating a dynamic effect of synchronization. This thoughtful approach to exploring multiple possibilities of looping led to the composition's emergence, where various looping systems were programmed as a means for the piece composition. External hardware real-time parameter manipulation control was utilized to yield a more organic compositional process, creating small nuances in the repeating loops that resulted in variation. Moreover, the piece features a remix section where typical electronic dance music elements blend with the initial loops to showcase the versatility of looping in this music style.

SOUND SOURCES AND MATERIALS

***Synthesizer pad*:** A sample made from various software synthesizers was produced for the piece. These included the software instruments *Spire* and *Serum*. This sample was consequently loaded into an *Ableton Drum Rack* device. The original sample lacked clear tonality; therefore, resonators were used to establish a tonal center that served as a base to accommodate other elements of the composition.

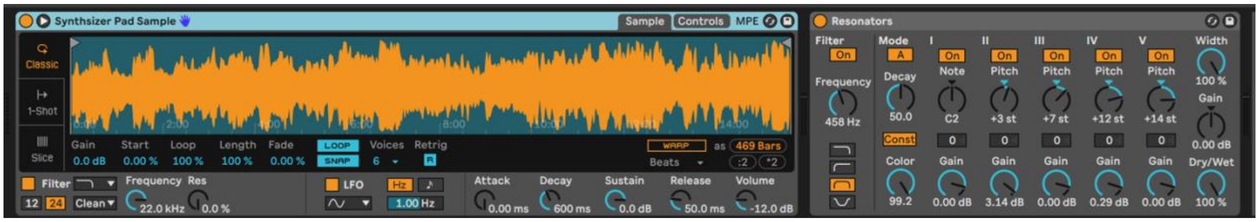


Figure 9 - Ableton's Drum Rack device together with a Resonator device to create a tonal center for *Sounds of Looping*.

Drum loop sample: A rhythmic drum loop sample was produced using MIDI in *Ableton Live* utilizing various drum samples from *Native Instruments Battery* drum sampler.

Female voice sample: A female voice sample of an original recording of an electronic dance music piece I composed in the past was used for this piece. The voice was professionally recorded in a studio, using an appropriate condenser microphone to capture a broad frequency response.

Tonal – rhythmic samples: Fourteen tonal-based rhythmic patterns were produced in *Ableton* for the composition. These patterns stemmed from the previous two samples, the *drum loop sample* and the *female voice sample.* These samples were produced through an original *Max for Live* device named *Beat Machine*. This custom-made device has the ability to create real-time MIDI note patterns in a set tempo, with controls that allow from simple to complicated patterns. To produce the *tonal-rhythmic samples*, the *Beat Machine* pattern output was set to trigger and set start points and durations for the *drum loop* and *female voice* samples within an *Ableton Drum Rack*. With the click of a button, the control mechanism created new patterns, allowing for the exploration of instantly generated loops. Through these means, the fourteen mentioned loops were created for the piece.

Figure 10 - The custom-made Beat Machine device controlling the drum loop sample in *Sounds of Looping.*

Electronic drum elements: Kick, snare, and hi-hat samples from the *Native Instruments Battery* virtual instrument were utilized for the rhythmic foundation of the composition.

Bass synthesizer: A sample library of the vintage *Arp 2600* synthesizer was used within the *Spectrasonics Trilian* virtual instrument and was employed as the bass instrument for the piece.

SOFTWARE SYSTEMS

Sounds of Looping utilizes a mix of different systems programmed in *Ableton Live* and *Symbolic Sound Kyma* as means to process the sound source material and create the resulting composition. *Ableton Live* acts as the main mixer platform as well.

The synthesizer pad system: The *synthesizer pad system* employs four copies of the synthesizer pad sound, meant to serve as a tonal bed for the composition. Each copy of the sample was placed in an *Ableton Sampler* device and triggered by a clip, and further processed with *Resonator* devices in order to keep a tonal center, as well as the addition of reverb to add space. All instances of the pad loop continuously. Each instance is then sent to its own binaural panner, which follows a 32-measure looping pattern. The result is four pads swirling around the listener in a recognizable loop.

Figure 11 - Four tracks containing the synthesizer pad triggering clips for *Sounds of Looping* which are later spatialized using a binaural panner.

The granular rhythmic system: For the piece, the drum loop sample is processed inside *Symbolic Sound Kyma* to create a large array of granular loop-based patterns. *Kyma's Sample* object is used to control loop time and pitch. Through real-time manipulation of the *Sample* object parameters, very short granular sounding results can be achieved as well as longer rhythmic patterns. Reverb in *Kyma* is also used for depth purposes.

The tonal – rhythmic pattern system: This system programmed in *Ableton Live* uses the fourteen *tonal-rhythmic loops* as sound source material. Two audio tracks are created, each containing the mentioned fourteen loops, that are triggered in pairs randomly through

Ableton's native random clip triggering mechanism. Track 1 is panned hard left and track 2 is panned right within the binaural field.

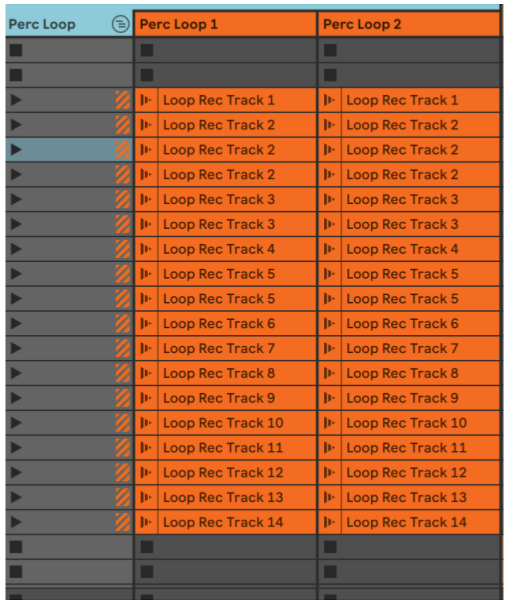


Figure 12 - Fourteen pattern-based loops, each placed in two audio tracks for *Sounds of Looping.*

The Vocal System: The vocal system employs the *female voice sample* as sound source material. It is processed in *Kyma* in the exact same manner as the *granular rhythmic system*.

The Beat and Bass: For this system, the *electronic drum* and *bass synthesizer* elements of the piece are programmed as MIDI clips within *Ableton Live*. These are triggered for the remix/club section of the piece.

THE PERFORMANCE SYSTEMS

Sounds of Looping utilizes the *Wacom Intuos Creative Pen Tablet* as a means for scene triggering within *Ableton Live*, timeline triggering within *Kyma*, and sound exploration within *Kyma*. Both *Ableton* and *Kyma* produce and process sound in real-time, creating a performance system comprised of multiple software elements running simultaneously.

Ableton Live scenes: *Sounds of Looping* is partly arranged using scenes in *Ableton Live*. Scenes are defined as a group of clips containing sounds that can be triggered simultaneously. For the piece, these scenes are triggered using the *Wacom Pen's* erase button. When the erase button of the pen touches the surface of the tablet, an *Ableton* scene is triggered. Moreover, each touch of the pen eraser with the tablet triggers the following scene. This allows for the piece's arrangement to be performed. *Sounds of Looping* contains various scenes, each of which activates the different performance systems created for the piece.

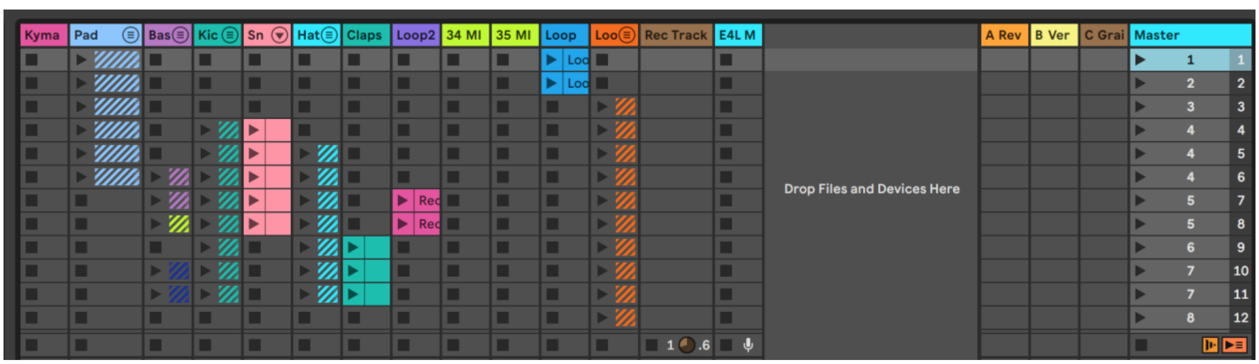


Figure 13 - A view of the clips and scenes within Ableton Live for *Sounds of Looping*.

Kyma: Sounds within *Kyma*, including the *granular rhythmic system* and the *vocal system*, are programmed to be controlled with the *Pen* of the *Wacom Tablet* and behave as follows. By placing the *Pen* on the tablet, sound is triggered. Whenever the *Pen* is released, the sound stops. When triggered, *Pen* movement on the x-axis of the tablet sets the loop starting point of the sample used, and pen movement on the y-axis sets the loop endpoint. Through this control, x-axis movement is used to scrub through the sample start point, and y-axis movement permits the control of loop length. This leads to a performance/composition system, where the audio sample can be explored by scrubbing through the *Wacom Tablet*. Very interesting sounds are achieved as the loop becomes very short, with granular-type sounds appearing. Finding interesting spots through the exploration of the *Pen* within the *Wacom Tablet* and freezing on those spots yields recognizable momentary looping patterns, only then to move on to exploring to find the next one.

Figure 14 - Wacom Tablet and Pen used for *Sounds of Looping.*

Furthermore, the *Wacom Tablet Pen Button 1* (located on the side of the device) triggers sections within the *Kyma* timeline. A *Kyma* timeline is similar to a track timeline in common digital audio workstations. For *Sounds of Looping*, the *Kyma* timeline is a mode of arrangement that triggers sections containing different programmed elements created to perform the piece. Therefore, the pressing of *Pen Button 1* runs through different combinations of sound produced within *Kyma*.

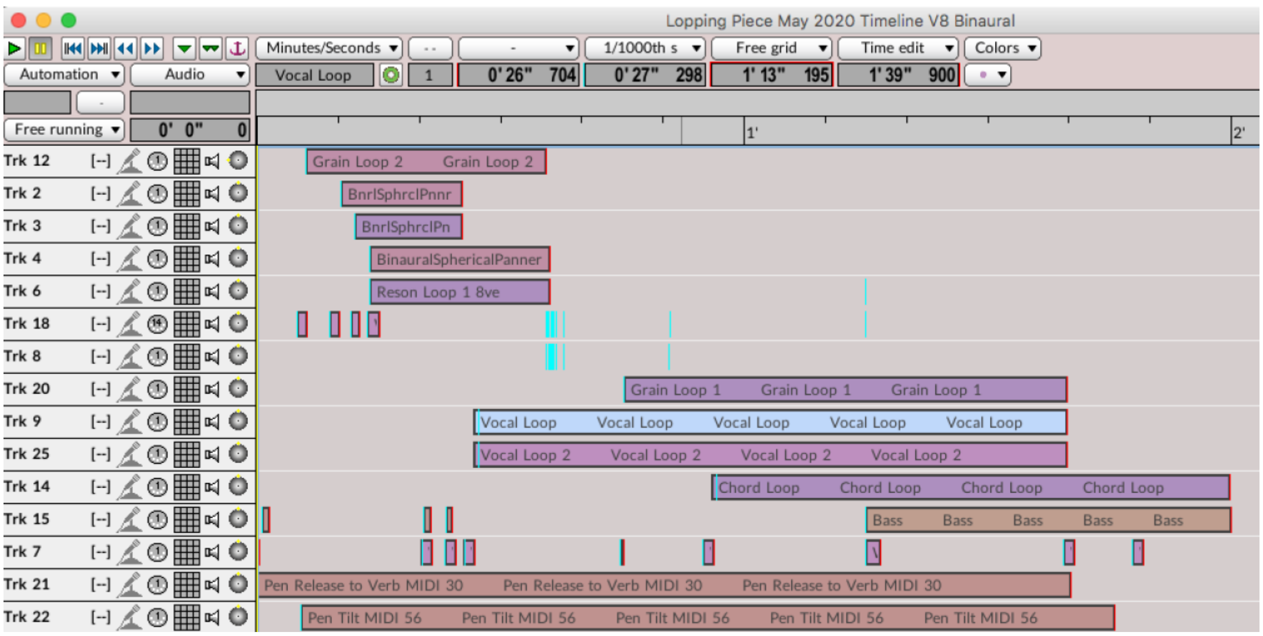


Figure 15 - The Kyma timeline for *Sounds of Looping*.

STRUCTURE

0:00 – 4:35: This first section sets the tone for the piece. The synthesizer pad serves as a pad sound, and the *granular rhythmic system* is explored/performed by means of the *Wacom Tablet* *and Pen*. Granulated patterns can be appreciated, varying in pitch and time segments. The section evolves to an exploration of the resonance of the synthesizer pad, where tonal rhythmic patterns appear. By the end of the section, elements start to dissipate to create a sparse moment. Constant binaural movement of the elements can be appreciated.

4:35 – 6:05: Section 2 features the *tonal–rhythmic pattern system* together with the *vocal system*. The section is more time-based as a clear tempo can be appreciated. Vocal transformation and pattern exploration by means of the *Wacom Tablet* are the main element in this section, creating a timbre change from section 1.

6:05 – 9:24: Section 3 can be thought of as the club or remix section of the piece, as it features a gradual entrance of the drumbeat and bass synthesizer. On top of this, the *vocal* and *granular rhythmic systems* are explored together by the *Wacom Tablet and Pen*. At 8:04, a four-beat kick drum pattern emerges, transitioning into a club-style track, while the rest of the elements are still being explored. This whole section can be thought of as a remix of sections 1 and 2.

9:24 – 11:20: Section 4, or the outro, gradually decreases density to achieve a slow finish to the piece.

PIECE SUCCESSES AND SHORTCOMINGS

I consider *Sounds of Looping* a success because it effectively presents the concept of looping in various forms throughout the piece, allowing listeners to clearly appreciate this technique. The focus and goal were to demonstrate looping in a discernible way, and through various systems created with this central idea, it translates well into the final audible result. Achieving this was challenging because, as a composer, I strive to explore variation and evolving sounds to maintain the listener's interest. Thus, I had to find sonic outcomes that embodied both these concepts, looping and variation. The performance aspect of the piece was crucial in this regard. Instead of using a classical DAW arrangement, where I would normally copy, paste, and use automation, programming the systems to be controlled externally added the nuances and variation needed to avoid a straightforward copy-paste approach. Creating these systems involved considerable time and trial and error, but once they functioned as intended, many potential issues were resolved, leading to a smoother arrangement process. A shortcoming of the piece lies within the broad arrangement. The piece features three sections and an outro, each exploring different sound elements and yielding broad variation in timbre and style. Sections one and two are very different, which succeed in portraying variation but fall short in maintaining a cohesive main idea. Section three was intended to tie the two previous sections together, and it does, yet it could stand as a piece on its own. Reflecting on these points, I feel that the piece comprises three different pieces put together with an outro, where each idea could have evolved into a distinct piece. Fortunately, for future iterations of the piece, the performance systems are established, and each section could quickly become a separate piece.

SOUNDS OF ARPEGGIATION (Binaural)

CONCEPT AND SYNOPSIS

The concept for *Sounds of Arpeggiation* emerged from an interest in exploring arpeggiation, a compositional tool that is very common in electronic dance music. In general, an arpeggiator is a straightforward device that outputs MIDI in various possible patterns. Normally, this MIDI information triggers MIDI notes. Arpeggiating a sound can quickly generate interesting rhythmic elements that enhance electronic dance music tracks, making it a widely used technique in this genre (Snoman, 2019).

Martino Lozej explores arpeggiation in depth in his thesis *THE ARPEGGIATOR: A COMPOSITIONAL TOOL FOR PERFORMANCE AND PRODUCTION*. Within his writing, Lozej quotes Guy E. Garnett in "The Aesthetics of Interactive Computer Music," stating:

> The appeal of the arpeggiator, and one of the reasons it is part of [electronic dance music's] lexicon, lies in how the arpeggiator re-contextualizes sound by expressing machine aesthetics, or "aesthetics of the Machine" (Garnett, 2001), by injecting sonic events that are blatantly machine-made, automated, acknowledging or inspired by technology, industrialization, or mass production—a notion that ties into futurism and science fiction. (Lozej, 2016, p. 13)

Lozej draws comparisons between the technology of arpeggiation in synthesizers and futuristic and industrial changes throughout history. The effect can resemble these ideas by sounding robotic and mechanical. My approach to using arpeggiation in my compositions seeks to balance the mechanical nature of the effect with a more nuanced and varied version. I aim to render it as an otherworldly effect, yet less machine-like and more subtle and nuanced.

As I conceptualized this piece, several questions arose.

What results would come by using arpeggiators to trigger parameters of software devices and not just used to create pitch patterns?

What different types of arpeggiator devices exist in software, how do they differ, and how can they be integrated?

Can I create my own arpeggiator devices that have specific fuctions and add to the composition?

These questions opened a myriad of possibilities, as there are numerous avenues to explore and test. *Sounds of Arpeggiation* delves into the creative potential of arpeggiators, utilizing diverse techniques and systems to center the piece around arpeggiation. The composition taps into the digital domain of *VCV Rack*, a software emulation of modular synthesizer systems that includes digital representations of many hardware arpeggiator devices, as well as originally programmed arpeggiation devices. For the piece, I built a customized modular system incorporating various arpeggiators, offering a versatile palette of arpeggiated melodies and rhythmic patterns. Alongside *VCV Rack*, I integrated my custom *Max for Live* device, *Beat Machine*, into the creative process. This tool enables the generation of randomized patterns with a simple click, acting like a personalized arpeggiator. Multiple instances of this device are used within *Ableton Live*, each triggering unique sonic elements and textures. Furthermore, the native *Arpeggiator* within *Ableton Live* was utilized to explore additional possibilities, as well as *Max for Live's* arpeggiator device.

SOUND SOURCES AND MATERIAL

Sound material for *Sounds of Arpeggiation* came from the following instruments by creating custom patches within each, tailored towards the creation of the sound systems: *VCV Rack; Reveal Sound Spire; Spectrasonics Trilian; Native Instruments Battery;* and *Kick 2 by Sonic Academy.*

SOFTWARE SYSTEMS

VCV Rack system: The modular setup created within *VCV Rack* comprised six voltage-controlled sound producer oscillators, each equipped with its own ADSR envelope, low-frequency oscillator (LFO) for modulation, and a voltage-controlled low-pass filter. These oscillators were triggered by modules created by *MSC Hack*, including the *ARP 700* 7-note programmable arpeggiator, the *WINDZ* random step generator, and the *MSC Hack Triad 2* three-channel sequencer. These devices served to trigger sound modules in various ways. Additionally, the *MSC Hack* ping-pong delay effect was incorporated into the system, along with an array of mixers to combine audio signals. The *VCV Rack* system was meticulously built and explored until the produced sounds became intriguing. Modular setups typically involve creating an initial plan, which is then modified multiple times, re-cabled, and the parameters modulated until the desired sound is achieved. For this piece, real-time manipulation and adjusting of ADSR envelope parameters and filter movements yielded a 4-minute explorative performance of the modular system that was then recorded to a stereo file, with the purpose of further editing and processing within *Ableton Live*.

Figure 16 - The MSC Hack ARP 700, WINDZ, and TRIAD 2 devices in VCV Rack for *Sounds of Arpeggiation.*

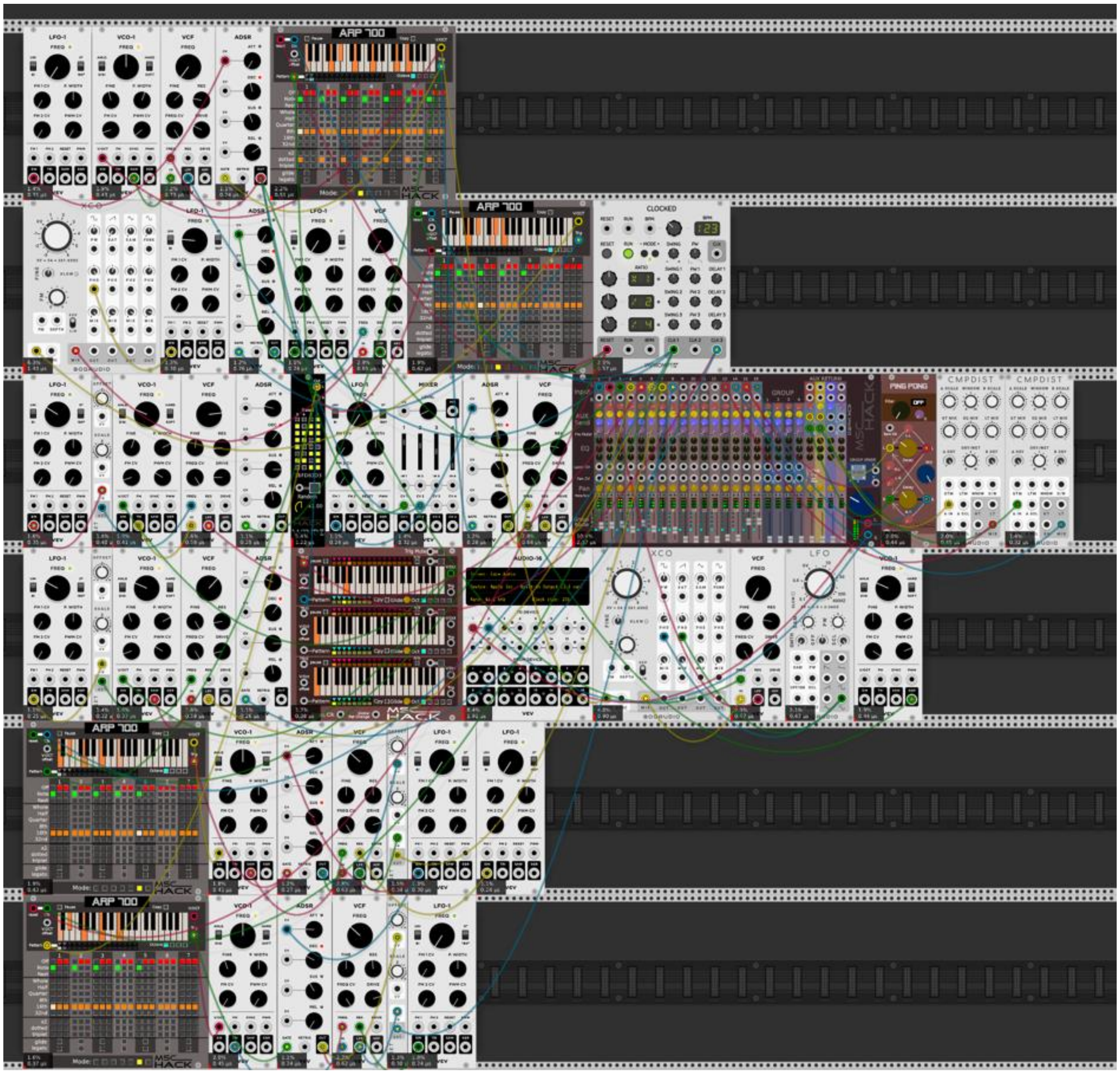


Figure 17 - A complete view of the *VCV Rack* system in *Sounds of Arpeggiation*.

Reveal Sound Spire system: The custom-made pattern generator *Beat Machine* was utilized as a trigger for eight instances of the *Spire* plugin. A focus on layering was employed to create rich, full-sounding pluck/pad sounds. Each of these instances was routed through a binaural panner, spatializing the sound to cover front, left, back, and right. All instances of this system also passed through equalizer and delay effects to achieve the desired sonic outcome.

The Trilian system: *Ableton Live's* built-in *Arpeggiator* device controlled *Trilian's ARP 2600* sample instrument. A simple pattern was utilized for up and down movement. The system also incorporated *Max for Live's* arpeggiator device used to control parameters in the spatial binaural panning field. With the same tempo subdivision parameters as the sound-triggering *Arpeggiator* device, this second arpeggiator triggering mechanism resulted in the sound being placed at a distinct point in the binaural field each time a sound was triggered. Furthermore, modulation was added so that sounds were spatialized above the listener at first to then open gradually to front, back, and sides before repeating.

The drum system: Drum samples from the *Native Instruments Battery* device were triggered by the custom-made *Beat Machine* device. The device randomly triggered samples in a 16-beat arpeggio pattern. Additionally, a custom-made *Max for Live* control device for pattern type modulation, named *Super Control*, modulated the panning of each drum hit in the binaural spatial field, resulting in drum sounds being triggered from different points within the field.

The kick and bass system: Beat based kick drum and bass patterns were added to tie together the different arpeggiation systems. These were produced in order to complement the composition.

THE PERFORMANCE SYSTEM

The process of bringing *Sounds of Arpeggiation* to life involved several performance instances and subsequent editing to finalize the composition.

VCV Rack performance: As previously mentioned, the modular system within *VCV Rack* underwent meticulous variations and transformations until intriguing sonic results emerged. A performance of this was mixed down to a stereo channel. Once produced, this result was imported into *Ableton Live*, where it was edited and enhanced with equalization, reverb, delay, and filter modulation effects to fit within the piece.

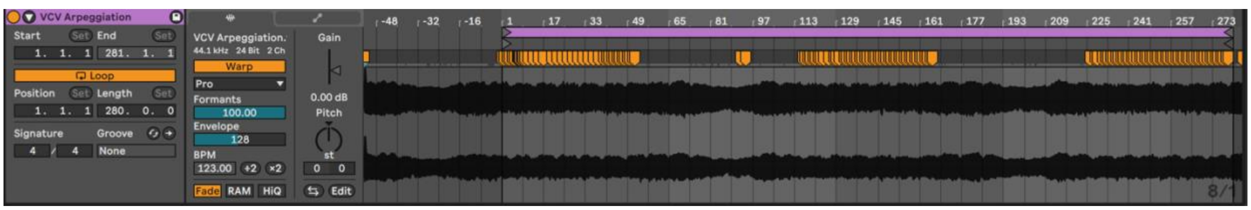


Figure 18 - A two-track recording of the VCV Rack system placed within a track in Ableton Live for further processing and editing for *Sounds of Arpeggiation.*

The Ableton system: All other systems, the *Reveal Sound Spire system*, the *Trilian system*, the *Drum System*, and the k*ick and bass system*, operated within *Ableton Live* and were controlled by the *MIDI Fighter Twister* hardware control device. This device was utilized for triggering the different scenes within *Ableton* and controlling individual parameters and levels. Through various trials, an optimal performance was achieved that seamlessly blended all elements together. Upon completion, the performance was further edited in the *Ableton* arrange window in order to complete the final version.

STRUCTURE

0:00 – 8:15: The opening section introduces the *Spire sound system*, characterized by a rich, full-frequency content pad with intricate high-frequency detail. Gradually, the *Trilian arpeggiation system* emerges, emphasizing repeating synthesizer patterns. Filter modulation plays a crucial role in varying the timbre, alongside envelope modulation, which transitions the sound from shorter to longer bursts. At 3:06, the bass and kick elements enter, establishing a clear rhythmic tempo. Hi-hats and snares gradually fill the binaural field, contributing to the high-frequency element content. This section explores the possibilities within these sound systems, transitioning through distinct variations gradually. By 5:40, the *Trilian* arpeggio takes center stage, showcasing its clarity as a lead. The binaural panning from center to out pattern is distinctly evident. Later, this lead is accompanied by a variation of quick arpeggiated bursts, adding rhythmic variation.

8:15 - 9:19: This segment serves as a transition between sections. The drums exit the composition, allowing for a gradual evolution of sound to pave the way for the third section.

9:19 – 14:15: In the final section, the *VCV Rack system* audio comes into play, gradually blending with the previous system audio and eventually crossfading into its entirety. The intricate possibilities of the modular system are explored, ranging from short attack-type sounds to slow attack and long release-type sounds, which alter the arpeggiation feeling and overall timbre. This section serves as an exploration of the *VCV Rack system* and concludes the piece.

PIECE SUCCESSES AND SHORTCOMINGS

The main success of *Sounds of Arpeggiation* lies in its effective deployment of the concept of arpeggiation throughout the entire piece. This success is largely due to the focused incorporation of arpeggiation as the central theme when designing each of the systems for the piece. By consistently prioritizing arpeggiators, these systems maintained this core concept, resulting in a composition that is cohesive in its sonic outcome. The piece is also successful in presenting a clear and consistent sound and style. Although various systems exploring different types of arpeggiators were used, the sound material remains consistent, allowing for variation across different sections while maintaining a sonic identity, which is crucial for the piece's distinctiveness. This was achieved by carefully selecting and varying the sound source material without straying too far from the concept. The sonic identity was further reinforced by the kick and bass, which anchor the piece's electronic dance music identity.

However, this focus on a coherent tonal and stylistic identity also presents a shortcoming. Could the arpeggiator mechanisms have been used more freely to create a sonically more interesting piece, yielding greatly varied results and leading to new ideas and sounds? Ultimately, the piece plays it safe in this regard, opting for a more controlled and less varying sound. This approach supports the coherence of the composition yet misses the opportunity to explore more diverse sonic outcomes.

SOUNDS OF MOTION (Stereo)

CONCEPT AND SYNOPSIS

The original concept for *Sounds of Motion* was inspired by my interest in non-traditional hardware control devices and their potential use to trigger and manipulate sound. During my master's studies a few years ago, I explored this area extensively, from building my own custom control device using an *Arduino* to using commercially available devices that could be re-purposed for music and sound control. One such device I tested, though not fully utilized for a piece, is the *Ultraleap Leap Motion Controller*. This device is a small rectangular box equipped with infrared sensors that can detect left- and right-hand movements, including distance from the device, speed, hand gestures, and even finger movements (Silva *et al.*, 2013), though it is not a novel idea, as this device has been widely used for music performances. The Leap Motion (2013) blog post "6 Songs in the Key of Leap Motion" shows six examples of pieces driven by the device.

In my composition portfolio, I found a great opportunity to fully understand this device that I am intrigued by, its strengths and weaknesses, and to compose a piece solely using the *Leap Motion* device. The questions that guided the conception of the piece were:

How can this device yield novel results by exploring expression beyond typical knob, fader, and button controllers?

Is it feasible to use such a device for standard electronic dance music production or as part of a performance?

Do the characteristics of the device offer significant differences in control that could lead to unique outcomes?

These questions drove the piece's development as I aimed to explore the device while striving to create a successful composition. Building on what I have outlined as the initial concept, *Sounds of Motion* employs the *Leap Motion* controller as the primary tool for performance and composition. The piece leverages the device to control elements commonly found in electronic dance music within *Ableton Live*. These elements include drums produced in *Battery*, synthesizer sounds generated in *Spire*, *Serum*, and *Trilian*, and the *Ableton Drum Rack* instrument. Multiple instances of these software instruments are used to create the sonic palette of the piece, complemented by an extensive array of audio effects. Additionally, given the nature of the device and its performance capabilities through hand gestures and movements, a live audio input is also employed to capture clap sounds. All these components were performed and manipulated in real-time, resulting in various performance instances that ultimately led to the final composition. A video rendition of the piece is presented in my portfolio to better illustrate the use of the device in composing the piece.

SOUND SOURCES AND MATERIAL

Sound material for *Sounds of Motion* came from the following elements: *Native Instruments Battery; Vengeance Drum Samples; Reveal Sound Spire; XFer Records Serum; Spectrasonics Trilian;* and a *Live Audio Input.*

SOFTWARE SYSTEMS

All audio for *Sounds of Motion* was produced within the *Ableton Live* software. Various combinations of elements were created and organized into groups to establish sound-generating systems within the piece.

The rumble system: Comprising a blend of multiple instances of the *Spire* and *Serum* software instruments, the *rumble system* was engineered to yield a deep, low-frequency rumble that underpins the composition. This rumble evolves dynamically throughout the piece, employing techniques such as pitch shifting alongside filters, reverb, delay, and granular effects to achieve its desired sonic progression.

The drum hit system: Constructed from a diverse selection of drum samples sourced from the *Vengeance* sample library and arranged within *Ableton's Drum Rack* device, the d*rum hit system* delivers rapid bursts of tension throughout the composition. *Serum* supplements this system, providing a release function following each drum sample. Various effects such as filters, reverb, and delay further enhance the impact of this system.

The rhythmic system: Multiple instances of the *Native Instruments Battery* drum machine, controlled by a *Max for Live* device known as the *Step Sequencer*, generate clear and dynamic rhythmic patterns. The *Ableton Beat Repeat* plugin was added to add looping bursts of drum sounds when activated. Resonators were also employed to provide tonal centers to the drums. The *Rhythmic System* evolves throughout the composition with changing timbres due to active and inactive effects.

Live input system: This system integrated a microphone input to capture hand clap sounds driven by gestures, using a gate to suppress soft sounds. Processing through reverb, delay, and the *Fracture* audio effect plugin by *Glitchmachines* introduces granular, modulating effects, resulting in a persistent high-frequency glitch noise that permeates the entire composition.

The tonal pattern system: Centered around the *Trilian* software instrument triggered by my custom-made *Max for Live* device *Beat Machine*, the t*onal pattern system* generates rhythmic pitch-centered patterns. Effects such as reverb, delay, and filtering further shape the tonal characteristics within this system.

THE PERFORMANCE SYSTEM

The performance system, focused on capturing the nuances of movement, revolved around the central device of the *Ultraleap Leap Motion Controller*. This device served as the driving force behind the entire composition, interpreting hand movements from start to finish. Hand gestures were used to navigate through various combinations of the aforementioned software systems, shaping the evolution of the piece.

Figure 19 - The Ultrealeap Leap Motion controller device used for *Sounds of Motion.*

The *Leap Motion Controller* is accompanied by proprietary software designed to recognize hand movement and gestures. Data from this software was taken and then transmitted to a *Max* patch originally developed by composer *Chi Wang,* whom I know from my master's degree studies and who has explored the *Leap Motion* device in detail for music performance and composition. I further customized *Wang's Max* patch to extract specific data needed from hand gestures and movements. The final programming of this *Max* patch involved multiple iterations of trial and error.

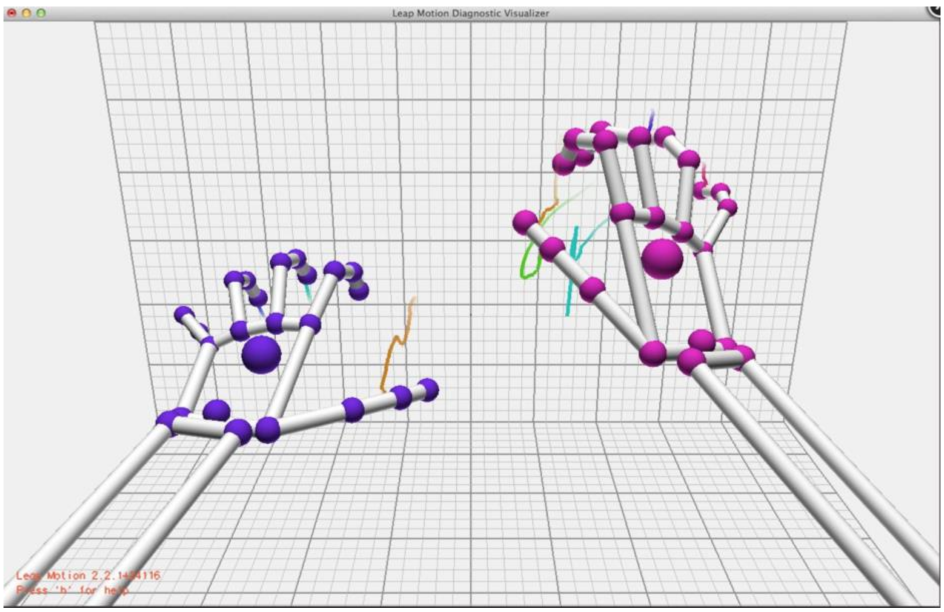


Figure 20 - A view of the Leap Motion controller included software used for *Sounds of Motion.*

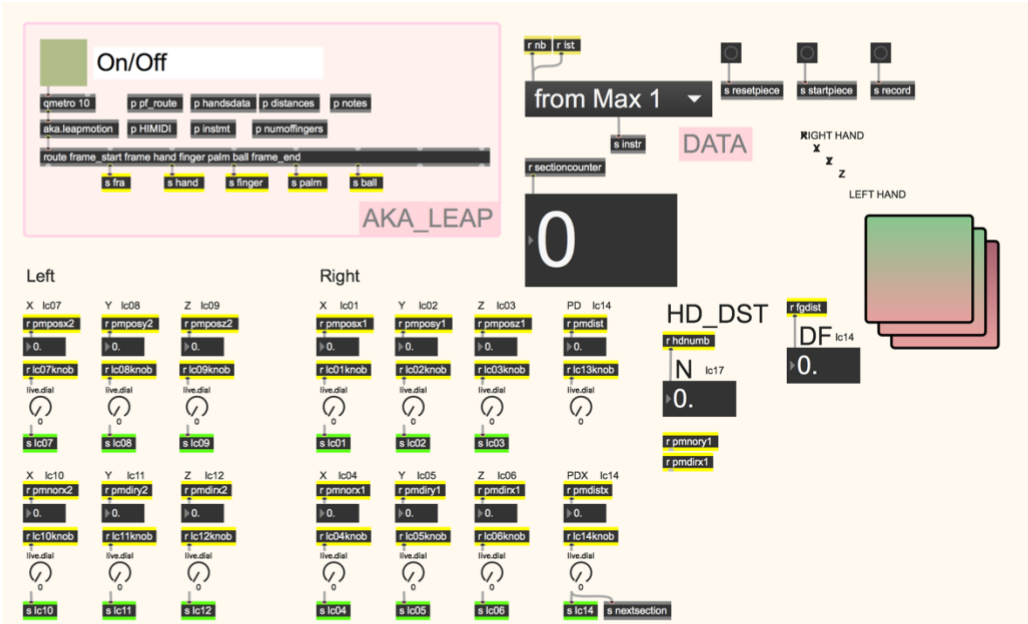


Figure 21 - An edited iteration of Chi Wang's Leap Motion controller Max patch used for *Sounds of Motion.*

Sounds of Motion begins with the arrangement being triggered by a clap. Each clap signals a transition to a different section of the piece, with each section featuring either a single or a combination of the software systems running concurrently. Parameter control varies between sections.

The rumble system performance: Hand movement controls various parameters within the rumble system. For instance, vertical movement of the right hand regulates filter frequency, modulating the high-frequency content. Additionally, tilting the right hand adjusts timbral modulation effects by manipulating parameters such as *Serum's* wavetable position, warp, and fine-tune parameters.

The drum hit system performance: Activation of this system is triggered by rapid movements resembling drumming. A downwards strike movement with the left hand, or a quick right-to-left strike movement with the right hand (the gesture used to trigger the drum hit system depends on the specific section of the piece), triggers a drum hit sample, followed by a release tone in the *Serum* software instrument. Hand gestures, particularly pointing fingers up and down, control the pitch of the release tone.

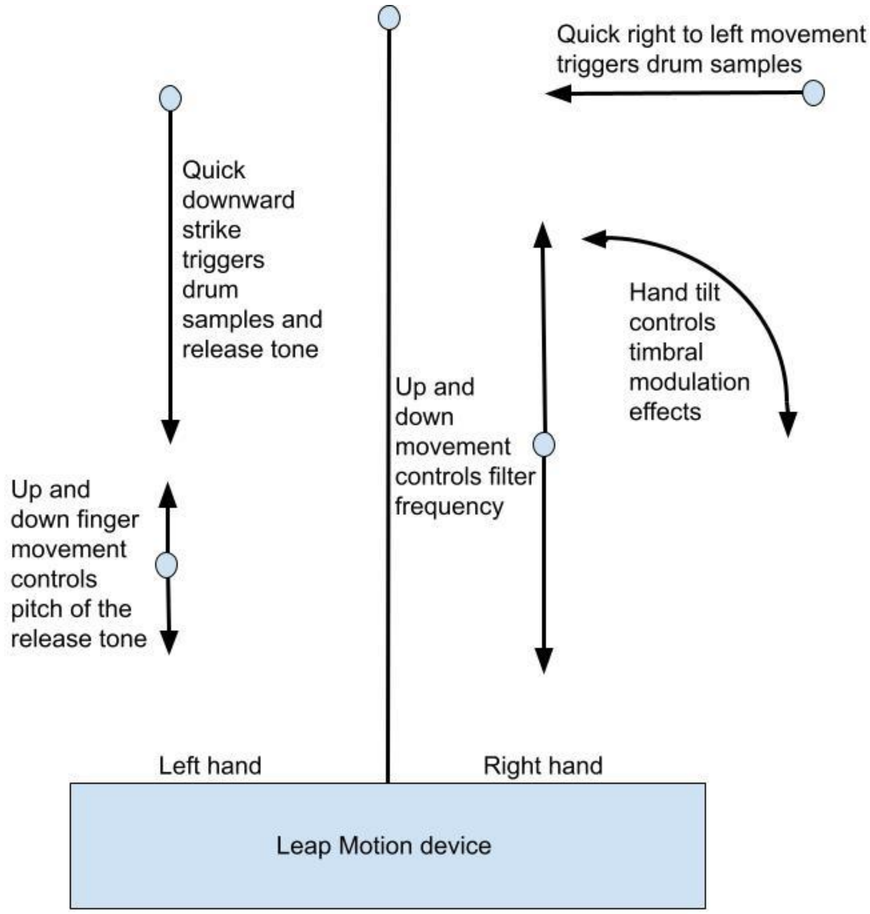


Figure 22 - The Rumble System and the Drum Hit System with the Leap Motion Device for *Sounds of Motion.*

The rhythmic system performance: For this system, left hand vertical movement modulates the density of rhythmic content based on vertical motion, ranging from sparse to dense rhythms. Furthermore, a striking down movement with the left hand activates the *Beat Repeat* plugin. The control for this system is further developed by left-to-right movement controlling resonance of drum samples, blending tonality with rhythmic sounds, while vertical movement controls the pitch of the drum samples.

The tonal pattern system performance: Activation of this system involves vertical movements of the right hand to control filter frequency, gradually turning the sound source on and off. Hand tilt adjustments manipulate timbre through the frequency modulation amount parameter in the *Trillian* software instrument.

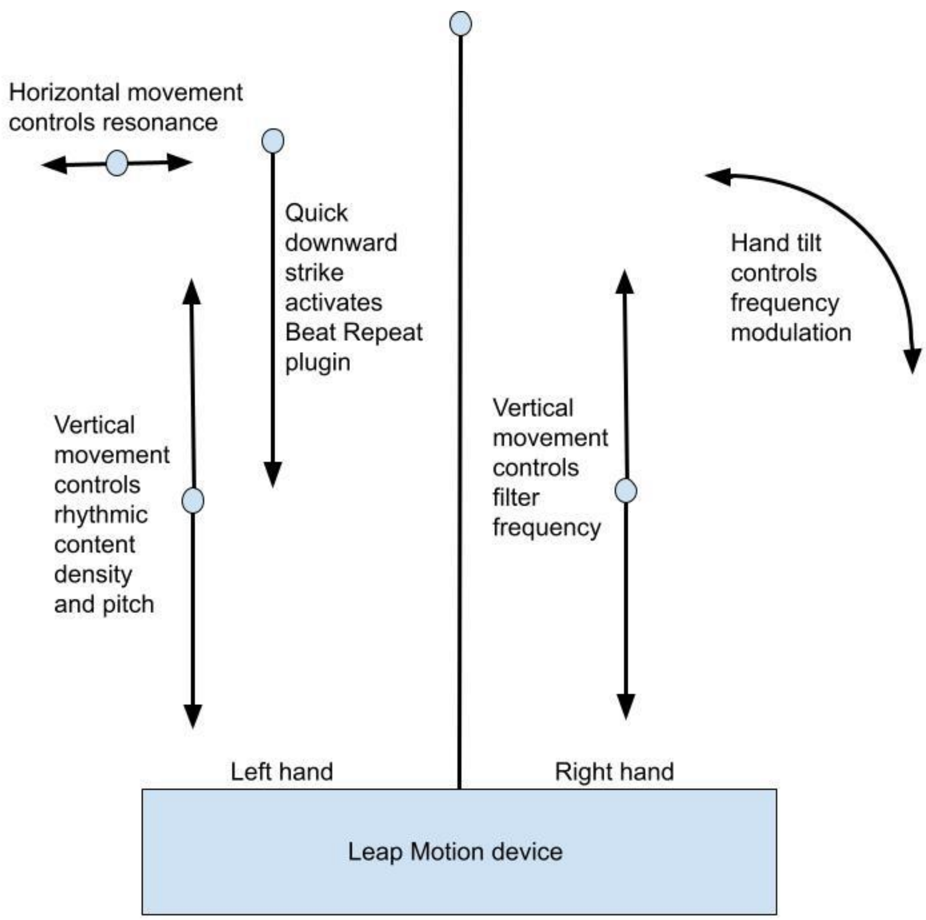


Figure 23 - The Rhythmic System and the Tonal Pattern system with the Leap Motion device for *Sounds of Motion.*

The live input system performance: This system remains continuously active throughout the piece. The system employs gate processing to keep the amplitude of the microphone input at lower levels and reach normal levels when a clap is performed. By using the *Fracture* plugin as part of the chain, with its parameters being constantly modulated by a random LFO, a constant evolving array of modulating granular high-frequency sounds are present throughout the background of the piece as the microphone input is always active. When clapping occurs, the gate opens, raising the clap level and all its processing.

STRUCTURE

0:00 – 2:57: The initial segment of the piece begins with an introduction followed by the exploration of the *low rumble system*. Subtle changes in filters and timbre can be noticed through gentle upward and downward hand movements, as well as tilts. At 1:38, the *drum hit system* is introduced. Intense moments can be appreciated with every drum hit attack, and the immediate release portion yields nuanced sound, helping the piece organically. In general, this first section delves into alternating between low and high intensity moments by exploring the active sound systems.

2:57 – 5:59: A clap marks the transition to the second section, characterized by a distinct timbre-modulated *low rumble* and the inclusion of the *rhythmic system*. Left-hand movements delve into the density of the drum patterns, while the right hand modulates the *low rumble*. Clear instances of the *Beat Repeat* plugin can be heard with left-hand strikes. This section gradually grows in intensity leading to the next section.

5:59 – 7:58: The third section begins by reducing intensity, featuring a prominent auditory example of the *live input system*. At 6:00, a quick clap reintroduces the l*ow rumble*, along with a second version of the *rhythmic system*. This time left hand vertical hand movements control pitch, while left-to-right movements control resonance. Rhythmic resonance bursts differentiate this section from the previous ones. At 7:15, a rise in the frequency of the *low rumble* creates climactic moments, with hand movement simulating an exploration from the inside to the outside of an imagined hemisphere.

7:58 – 9:22: The *rhythmic drum system* returns to its usual state, and the *tonal pattern Trilian system* is activated. Once again, varying intensity moments are explored within this segment, finally leading to an abrupt break.

9:22 – 10:45: The outro section ensues. With only the *low rumble* element active, gradual growing bursts lead to a final new tonal synthesizer pattern to break down the piece.

PIECE SUCCESSES AND SHORTCOMINGS

Sounds of Motion is successful mainly because of the interaction with the *Leap Motion Controller* as a means of exploring sound through space in real time. The end result is positive as the compositional work permits an artistic and expressive interaction with the device, leading to the final iteration of the piece. Furthermore, the piece represents a personal success due to a deeper understanding of the *Leap Motion Controller* device, which posed one of the main challenges in the composition of this piece. Initially, setting up the device was challenging due to various factors. To begin, lighting in the space where the device was used affected its sensor recognition, making it difficult to move the device to a different setting for repeated performances. To address this, I used the device in my controlled studio setting, maintaining consistent lighting and keeping the device in the same position. This leads to the question of how to make this performance device portable; further tests would need to be conducted in various settings to figure out a solution. The device software itself posed no major problems, yet translating the data information to a *Max* patch presented various challenges. Initially, I aimed to create my unique *Max* patch from scratch, and I was partly successful. I managed to input data into *Max* in a raw form; the challenge was organizing this data as the *Leap Motion Controller* receives numerous streams of incoming data simultaneously. This attempt failed, yet it allowed me to gain a deeper understanding of the device by learning how the data streams are organized. My second attempt involved finding a pre-made *Max* object that read the *Leap Motion* data. At this point, I reached out to *Chi Wang* who graciously sent me her *Leap Motion* device data patch, which helped tremendously. With this on hand, I modified it according to my ideas through many instances of time-consuming trial and error, ending up with sixteen versions to finally settle on one that worked for my piece. Latency was also an important factor to consider. As a starting point, running the *Leap Motion* software together with the *Max* patch on the same computer that produced sound was impossible. Constant crashes occurred and the latency was unbearable. As a solution, I used a separate computer to read the *Leap Motion* data and process it though *Max,* and then sent the MIDI information results to the main sound producing computer. Furthermore, even with this system in place, latency of the device was enough to inhibit a natural feeling of triggering as in an acoustic instrument such as a keyboard. This led me to program systems that, rather than act as triggers, modulated parameters by continuous movement, masking the problem of latency. Literature on the device, such as the article *A Preliminary Evaluation of the Leap Motion Sensor as Controller of New Digital Musical Instruments* (Silva *et al.*, 2013), served as a usual reference on initial aspects to understand the controller, yet as mentioned in the article:

> Concerning future works, the analysis of other music gestures using the device itself or its tracking principle has to be made. Furthermore, the analysis of other music instruments and their gestures is of utmost importance to investigate more the device's capabilities. (Silva *et al.*, 2013, p. 1)

The reference investigates certain aspects of the device, such as the detail in recognition of specific hand or finger movements, or latency aspects; nevertheless, actually using the device gives a clear conclusion that its capabilities are dependent on many factors unique to the piece being composed and performed.

I find the final iteration of the piece, when viewed as a whole, to be lacking. The piece successfully explores sound and manipulation of sound individually, yet as a whole it feels more like an improvisation piece with a forced arrangement. I believe this was due to the fact that most time spent on the piece development was on understanding the device and programming it, rather than focusing on aesthetics and sound. On the other hand, through trial and error, I was able to create successful individual systems that "worked" and are sonically compelling. This was a difficult task, as ideas had to be proven to work using the technology, leading to edits in the *Max* patch as the piece was being composed to make these possible. Examples of these include finger pointing up and down movements, hand height, and striking actions to trigger or modify sound.

Returning to my initial questions and goals for the piece, I find that the device does hold unique characteristics of control that can create nuanced and diverse outcomes that surpass simple knobs, faders, and buttons. However, these have constraints that need to be considered, especially since there is no true independent movement in one hand; you may tilt or move a finger, but that inherently creates other movements. Careful testing and data patch modification are important to achieve desired results. As a means of production for electronic dance music, the device can be handy if used in a controlled studio setting, as it can create nuanced streams of automation to help produce more organic and modulating sound material. I would find it difficult to use in a performance setting, as there are too many unknowns regarding space and lighting for it to be reliable.

SOUNDS OF ANALOG (Stereo)

CONCEPT AND SYNOPSIS

The concept for *Sounds of Analog* arose from the growing resurgence of analog synthesizers in the current electronic music production scene. Although digital tools within the digital audio workstation are the primary means of producing electronic dance music, recent years have seen the introduction of new and less expensive versions of analog synthesizers available to the public. This trend is partly driven by the sought-after "warm analog sound" that these devices produce. Honing in on the reasons behind the warmer sound of analog synthesizers reveals various dimensions. One perspective could be cultural, rooted in nostalgia. Accessing these types of devices can be seen as a way of achieving vintage sound aesthetics. For instance, using similar machines to those available in the 1980s is a great way to replicate the techno sounds of that era. Furthermore, these devices are visually striking and contribute to the visual aesthetics of an artist, especially when their music is reproduced not only in audio but also in video format, or when utilizing these devices in live shows. Another perspective lies in that the actual sound of analog synthesizers truly has distinct sonic characteristics. Unlike digital sound, which is mathematically synthesized to perfection, analog machines are imprecise. These slight variations can occur in analog circuits due to factors like heat, usage time, or overloading leading to harmonic distortion. In his paper *Analog Sound in the Age of Digital Tools: The Story of the Failure of Digital Technology*, Gaute Barlindhaug explores this, mentioning, "In the same way as the errors and inaccuracy of analog recording technologies were crucial in defining its sound, distortions and noisy sound in analog synthesizers is what makes them stand out from their later digital counterparts" (Barlindhaug, 2007, p. 80).

The electronics inside these devices can make them yield a non-linear in equalization, favoring bass and smoothing harsh high frequencies, as well as gently compressing the sound, taming fast and harsh transients, making the sound smoother, or "warmer."

Moreover, the process of producing music with a hardware device that has inherent constraints can often yield faster and more distinct sounding results, as the sound palettes of these devices are characteristic of each model. Pinak Agte stresses this point in his article on *Seamedu* by stating:

> One of the key reasons for doing so is to bring back the sonic characteristic of analog sound that the ears take to very pleasantly. Several synthesizer manufacturers have built their entire reputation based on the sound and character found specific to their make and this resurgence of analog synths will only enhance the sonic palette available to a contemporary electronic music producer or performer. (Agte, 2024, para. 11)

With this backdrop, *Sounds of Analog* explores the sonic possibilities offered by analog synthesizers, particularly the *Dave Smith Prophet Rev2* and the *Behringer Poly D*. Utilizing these synthesizers as main sources, I custom-edited presets and consequently sampled the output to stereo recording files. These samples underwent further performance and processing in the *Symbolic Sound Kyma* software, where distinct sonic exploration outputs were created by manipulating sound through real-time triggering and parameter modulation in order to navigate through potential soundscapes.

The results were subjected to various processing techniques, including binaural spatialization. The resulting recordings were subsequently imported into *Ableton Live*, where they were arranged in a conventional timeline format, forming the final composition.

SOUND SOURCES AND MATERIAL

Sound material for this piece came from the *Dave Smith Prophet Rev2 Analog Synthesizer* that yielded 243 samples, ranging from percussive sounds to plucks, pads, and bell tones, and the *Behringer Poly D Analog Synthesizer* that yielded 104 different sound files including stabs, chords, noise, simple tones, swells, and pads.

SOFTWARE / PERFORMANCE SYSTEMS

Poly D sound world system: This *sound world* originated from the exploration of *Behringer Poly D* synthesizer, incorporating its four oscillators, filter, envelope, noise generator, chorus effects, and distortion, while utilizing the device's arpeggiator for dynamic performances with real-time manipulation of parameters. After extensive experimentation, two recordings were performed and further processed for sound quality enhancement.

Prophet Rev2 swell sound system: This system featured various pad and swell samples from *Dave Smith's Prophet Rev2* synthesizer as the main sound source material within a *Kyma* patch. The patch enabled real-time self-starting random triggering of samples, with each sample undergoing pitch, time, and density adjustments controlled in real time by fader movement. Additionally, binaural panning was implemented through a random moving algorithm within the spatial field. This resulted in multiple samples floating across the binaural space, modulating in response to real-time controls. The system's output was recorded and later inputted into *Ableton Live*.

Prophet Rev2 buzz sound system: This system functioned similarly to the previous one within *Kyma*, utilizing different buzz-like samples to create a distinctive *sound world*.

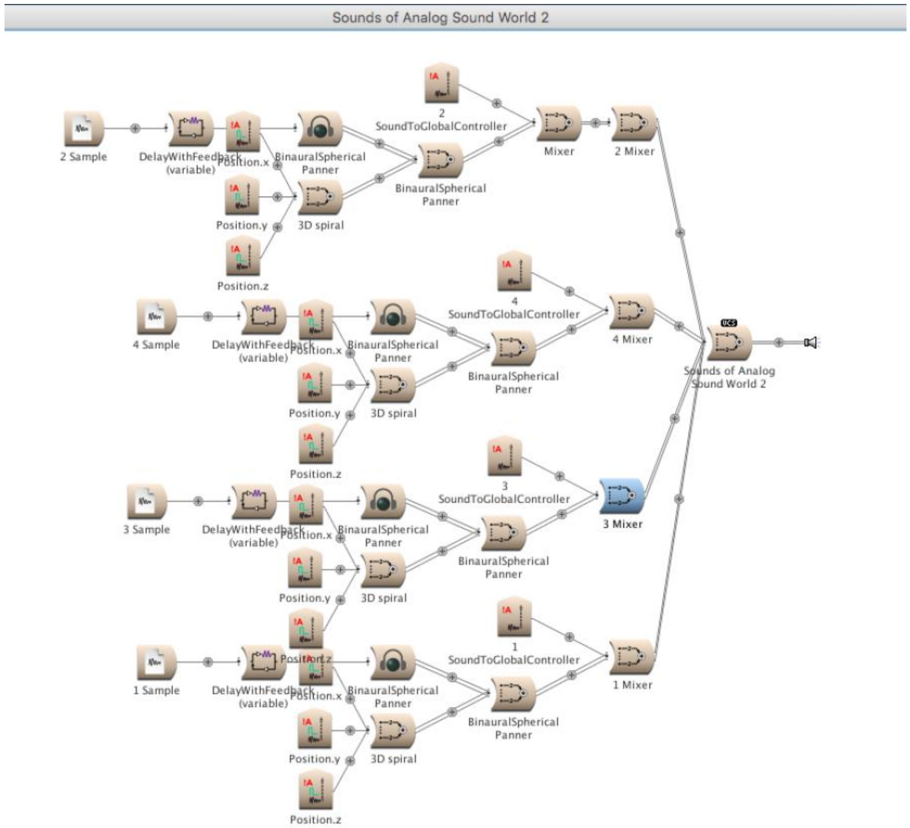


Figure 24 - Kyma patch programmed to create sound worlds for *Sounds of Analog*.

THE COMPOSITION ARRANGEMENT

The arrangement of the piece was created within *Ableton Live's* timeline. The resulting recordings from the *sound world* explorations served as the primary foundation for the piece. Also, multiple unprocessed samples from the *Prophet* and *Poly D* analog synthesizers were introduced in *Ableton* to support the *sound worlds* and create effective transitions within the piece. The main objective of the arrangement was to showcase the diverse explorations in distinct sections and convincingly transition between them.

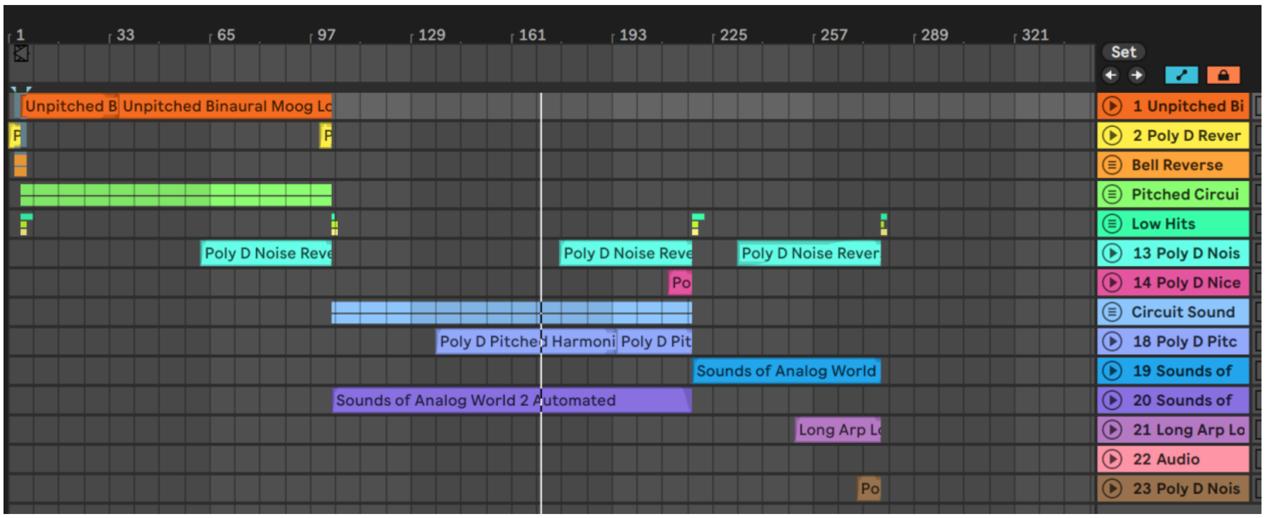


Figure 25 - Arrangement for *Sounds of Analog* within Ableton Live.

STRUCTURE

0:00 – 3:36: This section initiates with a rising introduction, serving as a segue into the *Poly D sound world system*. Noticeable left and right channel separation is evident. Given *Poly D's* arpeggiation, rhythmic elements are distinctly present. The section highlights instances where rhythms gradually synchronize on and offbeat, creating intriguing moments. Additionally, sound modulation occurs gradually within the section through adjustments to the filter and noise controls.

3:36 – 7:16: A rising transition marks the shift to the second section, introducing the *Prophet Rev2 swell sound system*. Besides the obvious swell samples, this section also incorporates a rain-like granular high-frequency sound to fill the non-tonal high-frequency space, accompanied by a pad sample providing a foundation. The binaural effect of the swells is prominently featured, encompassing the entire binaural sound field. The section evolves gradually from sparse to dense content, with a slow rising of pitch of the samples used.

7:16 – 9:36: A rising noise sample transitions to the third section, showcasing the *Prophet Rev2 buzz sound system*. Various buzz samples are dispersed throughout the dynamic binaural field, with pitch modulations covering the frequency spectrum. The density of samples progressively increases, culminating in an arpeggio riser created for support using the same samples, leading abruptly to silence and marking the end of the piece.

PIECE SUCCESSES AND SHORTCOMINGS

Sounds of Analog successfully portrays the samples of the utilized analog synthesizers in a clear fashion. Throughout the piece, the introduced elements are clear and concise, remaining faithful to the original sound of the synthesizers used. This fidelity is achieved by intentionally not processing the original samples excessively to preserve their unmodified sound, while subtly enhancing them to feature these characteristics more prominently. The way these sounds are presented through different sections is also a success of the piece, as it leads to variation within the piece; each section is distinct from the others, each concise in the main sound palette or *sound world* it presents. I believe the general sound palette of the piece to also be a success. The original samples created for the piece were meticulously crafted on each synthesizer to meet my aesthetic needs as a composer, and this resulted in well-made base material consequently ending in coherent and clear sounds throughout the piece.

Sounds of Analog has its shortcomings in that exploring more synthesizers would have been a great addition. As only two were used due to physical and economical constraints, the general sonic outcome is limited in timbre. I would find it intriguing to sample a wider variety of analog devices meticulously and to replace the samples within the systems created for it, to see what sonic results would emerge from that. Fortunately, the piece permits this easily as the performance systems can be readily sample replaced. In retrospect though, the limited devices used also help in keeping the piece sonically concise and effective, as it does not stray too far from what is presented, making it a success as well.

SOUNDS OF CLUBBING (Stereo)

CONCEPT AND SYNOPSIS

The concept behind *Sounds of Clubbing* arose as a means to capture and expand upon the sensation of being inside an electronic dance music club through sonic exploration. This idea originated from personal experience in electronic dance music clubs and the quality of sound within them. Sound in these environments varies greatly due to factors such as quality of the sound system, frequency response, and the acoustic characteristics of the spaces where they exist. These factors significantly affect the listener's experience, characterize different venues, and define the sonic experience. Editor Sebastian for *Clubnight* in his exploration of his visit to Panorama Bar in Berlin, Germany, states:

> The sound system played a major role. Never before have I experienced something as powerful as this. That system finally provided the feeling in the gut that techno required. A punch to the stomach where instead of pain, a deep pleasure radiates through the body and puts goosebumps on the skin. It was a self-build system with dozens of speakers hanging from the ceiling. At first, I couldn't even pinpoint where the sound was coming from exactly. I only noticed how it hugged me, lured me in, and gave my body the energy to move further and further. (Sebastian, 2023, chap. 3)

These types of experiences in clubs are highly sensory, as sound radiates from large systems, you are surrounded by people everywhere, and the experience can feel dense due to the multitude of sonic and visual stimuli. Many people consider that the only manner to have the club feeling is by actual physical experience, and I agree. Yet, I decided it would be interesting to create a piece using multiple samples of sound produced during actual club events, expand upon these to create a piece where the listener feels immersed in these spaces, and create an experience resembling part of the real thing.

For *Sounds of Clubbing*, these field recordings were made by various friends and me. I requested the recordings be made using simple devices, such as cell phones, and then be sent to me as sound material. The recordings used in the final piece were selected based on their sonic characteristics, which could add variance to the composition; some devices recorded more cleanly than others. These recordings were then processed using software systems within *Ableton Live* and *Kyma* before being arranged into a final composition within an *Ableton Live* timeline.

Various spectrum processing techniques were employed to explore different frequency ranges of the source material. This allowed for the segmentation of sound into frequency bands and independent processing of each band. The piece delves into these sonic explorations, transitioning from unprocessed organic club-like moments to heavily processed, denser soundscapes.

SOUND SOURCES AND MATERIAL

Dance club field recordings: Multiple field recordings from electronic music dance clubs were collected to create this piece. These recordings encompassed clubs in Madrid, Spain, where I resided at the time. Additionally, recordings were gathered in Quito, Ecuador, my hometown, with the assistance of friends who captured snippets of sounds while attending electronic dance music clubs. The recordings were captured using various cell phones, each contributing to different sonic outcomes depending on factors such as positioning within the club, overall volume, crowd size, and recording quality. This diversity ranged from clear recordings to distorted ones, enriching the outcome of the piece. In total, thirteen recordings were ultimately utilized.

Original previously produced dance music tracks: Two dance music tracks previously produced by my techno project, *Middle Earth*, were incorporated into the piece. These tracks underwent multiple processes and served to supplement frequency content that may not have been captured by the field recordings, including clear low-end and clear high-frequency content.

SOFTWARE SYSTEMS

The produced track system: This system, created within *Ableton Live*, utilized one of my original electronic dance music compositions. The track was segmented into eight frequency ranges, with each range explored using the *Spectral Blur* plugin within *Ableton.* The *Spectral Blur* audio effect permits the frequency band separation of the affected audio with specific band processes. The overall volume level of each frequency range was controlled by a random low-frequency oscillator, yielding slow and smooth modulation between the separate bands as the time factor was slow (from 0.1 to 0.5 Hz). Furthermore, similar modulation within the binaural field was achieved through a second random low-frequency oscillator, yielding movement in the imagined space. Additionally, another instance of this track was filtered to allow only low-frequency content, serving as the frequency foundation for the system. Equalizer and reverb effects were also incorporated within this setup.

Figure 26 - Separated audio in eight different frequency bands using the Spectral Blur audio effect within Ableton for *Sounds of Clubbing.*

The grain system: This system utilized three live audio inputs from the *previously produced track system*. Each instance of the system employed the *Apesoft Density FX version 2* plugin, a real-time live input granulator enabling modulation of parameters like grain length, pitch, and density parameters that can be randomized programmatically. Each instance was then separated into one of three bands across the frequency spectrum, lows, mids, and highs, and further routed through *Ableton's Grain Delay* plugin. This configuration generated granular effects in three distinct frequency ranges. Subsequently, each band was routed to the binaural field, with its position controlled by a low-frequency oscillator for smooth movements.

Figure 27 - High-frequency band information in the Grain System being processed with a Grain Delay device and spatialized in the binaural field for *Sounds of Clubbing.*

The club recording system: This system employed the sound material recorded in electronic dance music clubs for the composition. Initially, edits were made to each of the thirteen sound recordings to ensure sonic diversity. This involved purposefully choosing sections that had unique characteristics such as clear melodies or strong low end, amongst other notable sound imprints. The system was divided into two parts. In the first part, all thirteen samples were placed as clips in two *Ableton Live* audio tracks. When activated, each track played the clips in random order. Each track was then routed to a binaural field panner controlled by a smooth random low-frequency oscillator. The result yielded a blend of randomly triggered field recordings gradually moving along the binaural field. For the second part, the system used the same thirteen samples as clips in a new audio track, each sample triggered in a random order. In distinction from the first part, the volume level of this track was randomly modulated by two low-frequency oscillators. This created gradual to very fast level changes in the audio, all of them moving from total silence to maximum volume. The speed of these changes produced a granular-like effect on the samples.

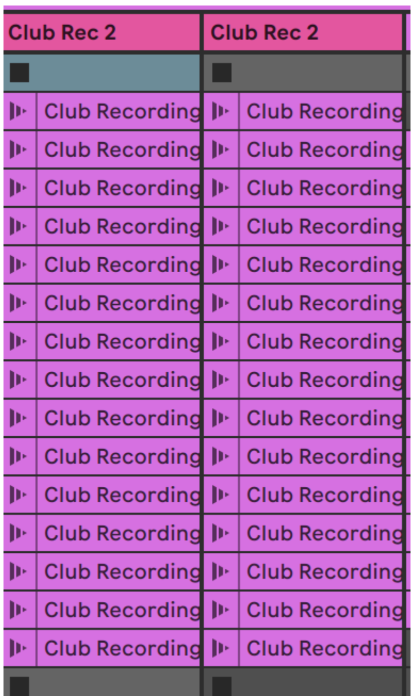
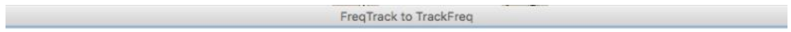


Figure 28 - Thirteen edited club recorded samples placed in two audio tracks for *Sounds of Clubbing*. The striped play arrow signifies random order triggering in Ableton Live.

Figure 29 - A low-frequency oscillator randomly controlling the spatialization of club track recordings for *Sounds of Clubbing.*

Figure 30 - Two low-frequency oscillators controlling the volume level of the audio track containing the thirteen club recordings for *Sounds of Clubbing*, resulting in quick level change bursts.

The Kyma system: In this setup, the second *previously produced audio track* underwent processing within *Symbolic Sound Kyma*. The *Kyma* patch employed frequency spectrum analysis of the track to manipulate its pitch in real-time. The pitch parameter was modulated by quick pitch change events coming from a randomizing algorithm, yielding a sequence of intense bursts ranging from very high to very low pitches.



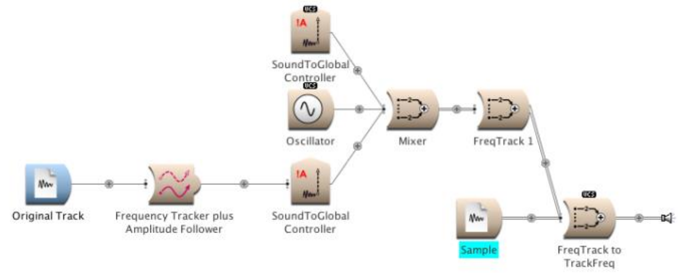


Figure 31 - Kyma for *Sounds of Clubbing*, using a frequency tracker for spectral analysis.

THE PERFORMANCE / ARRANGEMENT SYSTEM:

Each of the aforementioned systems was performed through its inherent random parameter changes and real-time adjustments of specific parameters using the *MIDI Fighter Twister* device. A multi-minute output of each system was recorded within *Ableton Live* and *Kyma*. These recordings were subsequently imported into a new *Ableton Live* session for timeline arrangement. Various edits were applied to each recording to fit into the arrangement. Further samples were also added as aids to transition between sections. The resulting composition showcases distinct sound systems operating individually or in combination to craft an effective arrangement.

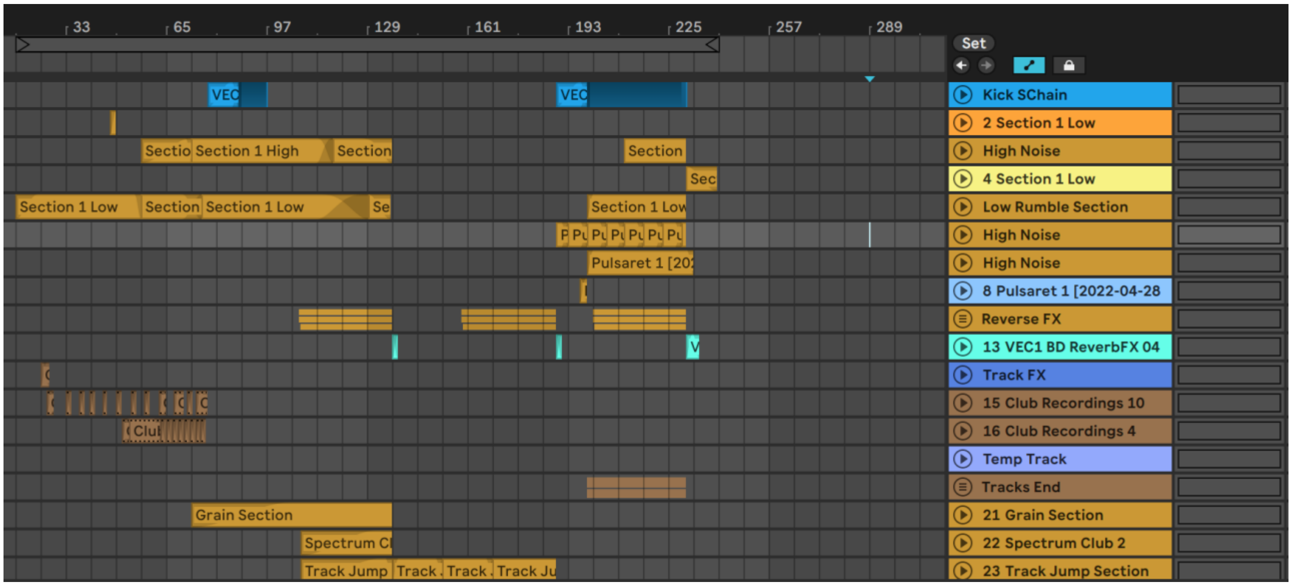


Figure 32 - Final arrangement in Ableton Live for *Sounds of Clubbing*.

STRUCTURE

0:00 – 4:00: The piece begins with a slow, gradual rising of volume level, introducing the *club recording system*. Different samples burst around the binaural field. At its foundation, the *previously produced track system* features a low pass filtered beat, maintaining a steady rhythm. By 2:00, the spectrum portions of the *previously produced track system* gradually emerge, along with the *grain system*. Throughout this section, the low pass filtered beat fades in and out, directing focus to different sonic elements.

4:00 – 5:50: An intense rise marks the transition to section 2, where the *Kyma system* is featured alongside the *club recording system's* modulated level part. This segment highlights heavily processed audio, creating a dense and intense atmosphere. Extreme bursts of audio enter and exit across various frequency ranges.

5:50 – 7:28: Another intense rise leads to an abrupt drop featuring a static synth tone, serving as a brief audio break. Moments later, the *club recording system* re-enters alongside the low pass filtered *previously produced track system*, reminiscent of the piece's drop, where a clear beat emerges. The piece concludes with a riser effect leading to an abrupt break, characterized by a reverb tail.

PIECE SUCCESSES AND SHORTCOMINGS

Sounds of Clubbing primarily succeeds in making the listener feel as if they are inside a club environment. The piece was showcased at the 2022 *BEAST FEaST* at *University of Birmingham*. This presentation functioned as a test, and the result was that attendees approached me to say they felt like they were inside a club, which brought back memories of their own experiences. This was a common theme in the feedback I received, confirming the success of the main intent. This success is largely based on the fact that most of the original samples were recorded in clubs, and their processing was meticulously crafted to enhance this effect at the right moments in the piece. Careful treatment of the low-end frequencies was crucial for success because the presence of subwoofers is a significant aspect of club environments, and this translation to the final composition sound is key. Furthermore, the success is also attributable to the spatialization of the presentation. The piece was diffused through a 32-speaker system, resulting in a sensation of being surrounded by audio, similar to what one would experience in a natural club environment.

In an effort to add variation to the piece beyond merely playing back club recordings, *Sounds of Clubbing* faces a shortcoming by utilizing the sound material in an excessively processed manner. In sections, I ventured into harsh explorations of the samples through granular sounds, extreme speed changes, and moving into more distorted environments. While successful on its own, this approach at times diverged too far from the main idea. A more controlled exploration would have made the piece more effective by not straying too far from its central theme. Nevertheless, these explorations yielded a positive learning experience in the processing of the sounds through the devices and mechanisms used.

SOUNDS OF SYNTHESIZERS (Binaural)

CONCEPT AND SYNOPSIS

The initial concept for *Sounds of Synthesizers* emerged from my fascination with composing and producing electronic dance music using hardware synthesizers. In the studio, the mechanical sounds produced by these synthesizers—the act of pressing keys and manipulating knobs—are fundamental to the creative process. However, these organic sounds never find their way into the final production, as they are a means of performance and control yet not part of the desired sound output. It is arguable that the mechanical sounds produced by synthesizers are unheard sounds by the listener and only apparent to the performer if focused upon, yet this is what I find intriguing, as it can be somewhat analogous to mechanical sounds produced in acoustic instruments.

If one analyzes acoustic instruments and their sound, the mechanical process is part of the sound, and this can be present in sound recordings. For example, the sliding sound of moving through chords in a guitar neck, or the sound of the hammers hitting a piano string, or the sound of the keys being pressed on a saxophone. These sounds tend to be unwanted as they distort the natural sound of the instrument. A simple web search yields this common practice. For example, in an article on plugin manufacturer's website iZotope (2015), techniques on how to remove mechanical sounds using the software *iZotope RX* is explained.

> Many of the issues we run into when recording guitars can be avoided by careful setup and proper room treatment. However, due to cost and time constraints, recordings are often made under less-than-ideal conditions—which can result in great guitar sounds affected by background noise, amp buzz, clipping, and other distractions. (iZotope, 2015, para. 2)

One cannot argue that these sounds are not there, but why not include them in the recording process?

As I encountered more of these moments with hardware synthesizer use, the idea of capturing recordings of these mechanical sounds began to intrigue me. Through various projects, I have discovered that the sound produced by distinct synthesizers vary—from the way keys are pressed to the nuances of button activations and knob movements. This realization formed the basis of my piece: a composition where sound material is mainly the mechanical sounds that synthesizers make.

The primary challenge I faced was how to present a final sonic outcome that would allow listeners to appreciate the subtle differences in the inherent mechanical sounds of each synthesizer. From this idea questions arose.

Could the sound of a key press on a *Moog MiniMoog* be distinguished from that of an *Oberheim OB-Xa,* for example?

Do the unique physical components of various hardware synthesizers produce distinct sonic signatures, and can these be reflected in a musical piece?

My previous experience led me to believe that these differences could indeed be discerned through acoustic listening, but translating them into a musical composition posed a unique challenge.

With this as a backdrop, *Sounds of Synthesizers* is a composition aimed at showcasing sampled sounds from vintage analog and digital hardware synthesizers. This involves capturing sounds generated physically by interacting with the synthesizers—pressing keys, adjusting knobs, and pushing buttons. The objective is to highlight the unique characteristics of each synthesizer, providing distinct sonic identities for each one used.

Adding to this, I further incorporated pre-recorded samples of the synthesizers themselves, complementing the hardware samples and enhancing tonal variety within each section. Additionally, a video component was introduced to aid audience understanding, allowing viewers to visually identify the synthesizer being played and better appreciate shifts in timbre and sonic qualities. This video element was collaboratively produced with the assistance of Marx Corella, a friend and skilled video editor.

SOUND SOURCES AND MATERIAL

For this composition, samples were sourced from field recordings of various vintage digital and analog hardware synthesizers, capturing the sounds of key presses, knob movements, button presses, and swipes across the actual synthesizer build materials. During the composition process, I had the fortune of residing in Madrid, Spain, where I was able to visit *Moogchild Synthdrome*, a renowned synthesizer repair shop and dealer specializing in vintage synthesizers. The shop boasted over thirty different types of synthesizers. After explaining the purpose of my project to the shop owner, I was granted access to spend half a day recording sounds from different devices, using a portable *Tascam* recorder. Recordings from multiple devices were made and later edited.

Field recorded synthesizers: From around thirty possible hardware synthesizers, fifteen were sampled using a portable *Tascam* field recorder. Recordings included key presses with varying strength, button presses, knob movements, and hand swipes on the synth material. Choosing the fifteen devices involved careful listening to each of the devices' sound characteristics, ultimately leading to sample the synthesizers that I thought had characteristic sounds. Furthermore, throughout this process the shop owner recommended synthesizers to sample as he knew their characteristics by having worked on them for several years. Of the fifteen devices recorded, eight were ultimately chosen in the editing process. These included the *Moog Minimoog, ARP Odyssey, Casio SK1, Roland Juno-6, Yamaha DX7, Oberheim OB-Xa, Korg MS-20,* and *Yamaha CS-80* devices. These synthesizers were chosen due to their diverse array of sounds made, offering rich potential for further manipulation. The editing process of these recordings highlighted the possibilities for the final piece.

Figure 33 - Eight synthesizers chosen for *Sounds of Synthesizers*. From top to bottom: Moog Minimoog, ARP Odyssey, Casio SK1, Roland Juno-6, Yamaha DX7, Oberheim OB-Xa, Korg MS-20, and Yamaha CS-80.

True synthesizer samples: In addition to these field recordings, pre-recorded samples of the synthesizers themselves were utilized to introduce further timbral variations. Unfortunately, direct recordings of the synthesizers at *Moogchild Synthdrome* were not feasible due to technical constraints—either the devices were disconnected or not functioning properly. To address this challenge, I sourced true samples of the Moog Minimoog, ARP Odyssey, Roland Juno-6, Oberheim OB-Xa, Korg MS-20, and Yamaha CS-80 from the dedicated sampler software instrument *Spectrasonics Trillian,* and sampled recordings available from the website freesound.org for the Casio SK1 (SK1 drum patterns REEL.wav by *makenoisemusic* -- https://freesound.org/s/499589/ -- License: Creative Commons 0), and Yamaha DX7

(TroubleCreepyNoise.aif by *cottager* -- https://freesound.org/s/90059/ -- License: Creative Commons 0).

SOFTWARE SYSTEMS

Pro Tools system: *Pro Tools* software was used to edit the raw recordings, employing fades, overall level matching, and equalization to craft high-quality samples from each of the recorded synthesizers. Once edited and processed, the samples were exported and arranged within folders.

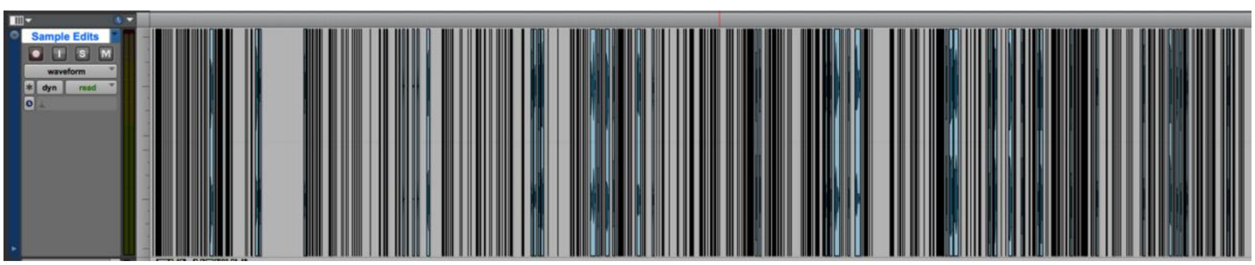


Figure 34 - Full view of the Pro Tools audio track with the edited samples for *Sounds of Synthesizers.*

The grain system: The compositional process unfolded primarily within *Ableton Live* through a custom-made system. The eight chosen synthesizers were organized onto individual tracks, each equipped with a granular-style system using *Live* devices. Within each track, a drum rack held the edited synthesizer samples, allowing for specific MIDI note triggering. To introduce spontaneity, *Ableton's Arpeggiator* device was utilized and set to random, resulting in the playback of random samples. To maintain tempo variability, the arpeggiator rate was mapped to a random low-frequency oscillator, ensuring that sample triggering varied from sparse to dense sections. Offset of this low-frequency oscillator was used to be able to explore sections of the loaded samples in the *Drum Rack*; a positive offset triggered samples placed within higher pitch MIDI notes, and a negative offset triggered samples placed within lower pitch MIDI notes. Moreover, the arpeggiator gate was mapped to a MIDI control, enabling adjustment of grain size and allowing modulation, yielding short snippets to full sample triggering. Additionally, pitch transposition control was incorporated for each sample within *Ableton*, generating a blend of pitch varying samples through random parameter adjustments. A master transposition control was also added and facilitated broad pitch variation across all samples. Spatialization was achieved through binaural processing, with each synth sample processed through a binaural panner set in a static position to fill the binaural field effectively. This comprehensive grain system yielded synth sample grains triggered within a binaural environment, offering options for pitch and length modifications.

Figure 35 - A complete processing chain for each of the samples used for *Sounds of Synthesizers*.

The synth vocoder system: Recorded results of the *grain system* were further processed and edited in a new *Ableton Live* session to complete the systems used for the arrangement and composition of the piece. The *synth vocoder system* was devised for each track to introduce variations to the piece, such as changes in timbre, pitched sounds, and the incorporation of the true synthesizer sounds produced by each device. This approach allowed for each synthesizer to be explored in a modulating manner, starting from clear and simple samples from the *grain system* and progressing into more complex sounds, always remaining faithful to the piece's concept of presenting the inherent mechanical sounds of the synthesizers. The *synth vocoder* *system* utilized the true audio samples from each synthesizer, which were layered into multiple pitches, spanning around two octaves, and randomly triggered by an arpeggiator. This sound result acted as a carrier for a *vocoder* device processing the g*rain system* audio, resulting in a morphing effect of the grains into pitched sounds with the sonic characteristics of the true synthesizer audio. Simple manipulation of the Dry/Wet parameter of the vocoder allowed for the modulation of diverse timbres. In this manner, the audio from each synthesizer in the *grain system* could be explored through vocoder processing, resulting in varied outcomes and piece variations.

Figure 36 - Vocoder processing for each of the Grain System recordings for *Sounds of Synthesizers.*

Furthermore, an additional layer of spatialization was introduced for this final system, as the original grain recordings featured fixed spatialization, and the need for movement became evident. To achieve this, the original grain synthesizer recordings were split into two frequency spectrums using filters. The lower spectrum, ranging from 20 Hz to 2000 Hz, underwent low-frequency oscillator modulation of the binaural spatialization parameters stereo width, location, and elevation. This created a more dynamic spatialization effect within the piece. The high spectrum, from 2000 Hz to 20000 Hz, maintained the original static spatialization.

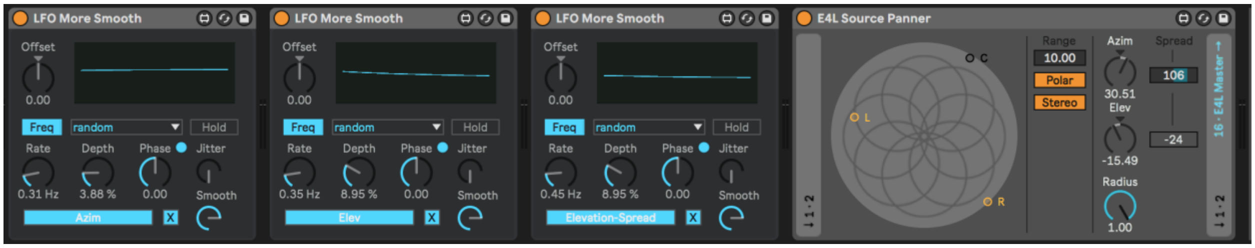


Figure 37 - Low-frequency band information modulated by low-frequency oscillator controlling binaural panner paraments for *Sounds of Synthesizers.*

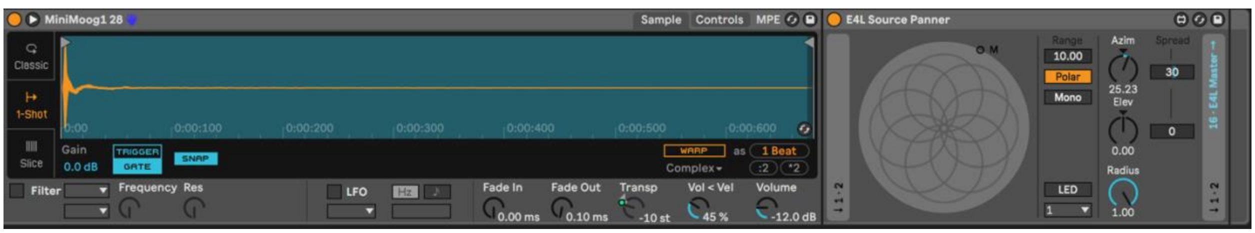


Figure 38 – Static high-frequency band information in the binaural field for *Sounds of Synthesizers.*

THE PERFORMANCE / ARRANGEMENT SYSTEM:

Using the *grain system*, performances of each synthesizer track were conducted to explore the sonic possibilities through live parameter manipulation. These parameters were controlled by the *MIDI Fighter Twister* device. Through various takes and trial and error to pinpoint the sweet spots, a final performance was recorded into a stereo binaural file. Eventually, eight of these files were created, one for the exploration of each synthesizer. Once completed, these eight recordings were imported into a new *Ableton* session created for the final arrangement of the piece. Each of the exported g*rain system* files, representing a specific synthesizer, was further edited to create a final take representing the sonic variety produced. For each of these takes, the s*ynth vocoder system* was added for further sonic exploration. The final piece resulted in a division of nine sections: the first eight exploring each synthesizer separately, and section nine combining all of them. Automation was used in each section to create results that started with sparser sounds, presenting the inherent raw sound of the synths and slowly transitioning into a denser climax that included vocoder processing, ending with a final reverb tail. Section nine is a final grand section where all is combined.

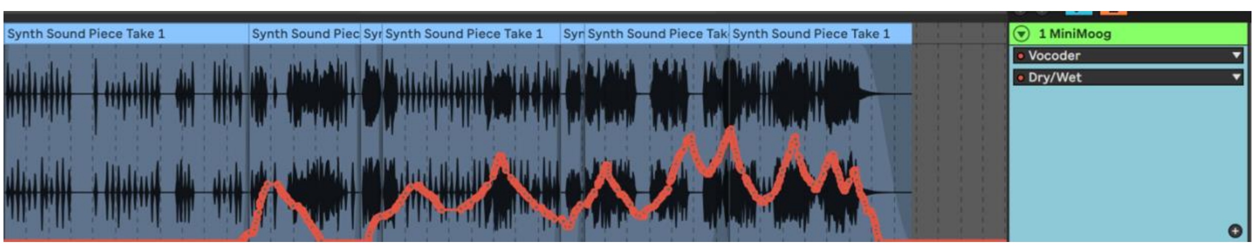


Figure 39 - Automation of the Dry/Wet vocoder parameter for *Sounds of Synthesizers.*

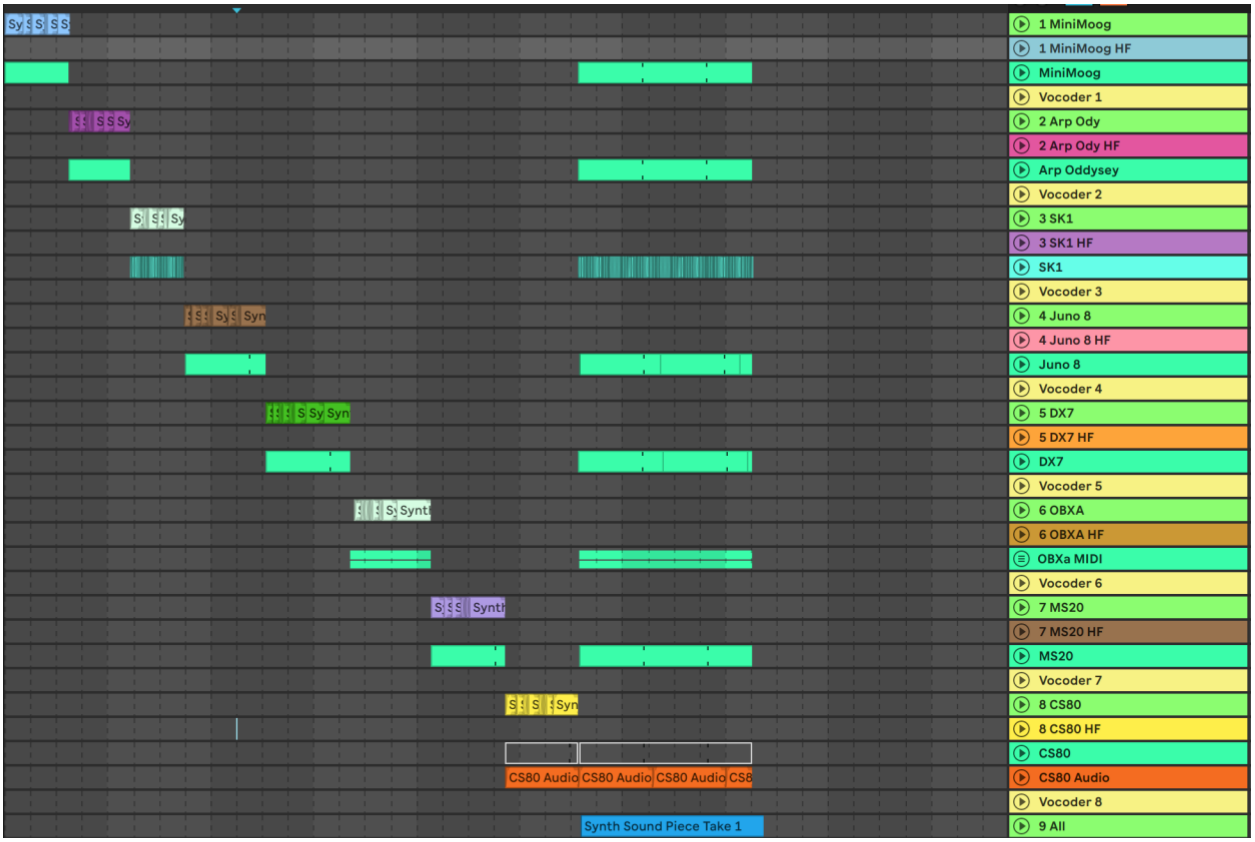


Figure 40 – Arrangement in Ableton Live of eight sections for *Sounds of Synthesizers*.

STRUCTURE

All sections of the piece follow a ramp-type intensity arrangement pattern, starting with cleaner, grain-inherent synthesizer samples, gradually incorporating vocoder processing, and culminating in a climax with a strong reverb tail.

0:00 – 1:18: This section explores the *Moog Minimoog* synthesizer. Vocoding is gradually introduced at 1:00.

1:18 – 2:36: This section explores the *ARP Odyssey* synthesizer. Vocoding is gradually introduced at 2:06.

2:36 – 3:43: This section explores the *Casio SK1* synthesizer. Vocoding is gradually introduced at 2:56.

3:43 – 5:25: This section explores the *Roland Juno-6* synthesizer. Vocoding is gradually introduced at 4:40.

5:25 – 7:14: This section explores the *Yamaha DX7* synthesizer. Vocoding is gradually introduced at 6:11.

7:14 – 8:50: This section explores the *Oberheim OB-Xa* synthesizer. Vocoding is gradually introduced at 7:40.

8:50 – 10:22: This section explores the *Korg MS-20* synthesizer. Vocoding is gradually introduced at 9:40.

10:22 – 11:57: This section explores the *Yamaha CS-8*0 synthesizer. Vocoding is gradually introduced at 11:14.

11:57 – 15:50: This final section explores all synthesizers together. At 12:40, a mix of all vocoders is gradually introduced. The intensity of grains and vocoding increases, leading to 15:05, where the final climax moment's growth can be appreciated.

PIECE SUCCESSES AND SHORTCOMINGS

I find that *Sounds of Synthesizers* achieves success in its alignment with its main concept and goal, as each section exploring the sonic qualities of the inherent synthesizer samples possesses its unique sound. While some sounds may appear similar, discernible differences exist in terms of sound body, attack, and release. Intensive listening with headphones or in a high-fidelity environment highlights these distinctions, endowing each segment with its distinctive identity. Although not immediately apparent, careful and thorough listening reveals each section's individual characteristics. This outcome is a culmination of various factors stemming from the compositional process: from the meticulous recording of samples, where considerations were made regarding which keys or buttons would yield optimal results, to the curation process during sample editing to enhance distinctiveness, and the compositional phase itself, involving trial and error to identify sections or sounds that harmonize effectively with the piece.

However, the piece also exhibits shortcomings, primarily attributable to the similarity of the sound sources. A retrospective analysis reveals that the limited variety of sounds and possibilities due to the nature of the samples themselves renders each section sounding remarkably alike, potentially leading to listener fatigue. These issues were addressed through compositional adjustments and feedback. Initially, sections were significantly shortened, and later decisions involved incorporating actual pitched sounds of the synthesizers through the *synth vocoder system*, resulting in appreciable differentiation between sections. Additionally, the video component created to accompany the piece is intended to provide the audience with a clearer understanding of what they hear. While the purpose of the video is evident and serves its intended functionality, I personally find that the video falls short in its integration with the piece, failing to establish a cohesive whole. There is room for the video to better interact with the sonics of the piece, creating a more interconnected experience that has clear sound action with video reaction.

CONCLUSIONS

The seven compositions presented in this portfolio, each with their unique characteristics, have led me to several conclusions. One of the challenges of my PhD portfolio was to create compositions that crossover between electronic dance music and experimental electronic music, through a focus on technology as a driving force for composition, and in the process, create coherent musical pieces that engage the audience. Each piece has a unique focus on addressing this challenge, and overall, I believe the pieces successfully crossover and portray the possibility of technology as a driving force for composition. This achievement was neither obvious nor clear from the beginning of my compositional work, which leads me to my main conclusion.

In preparing for composition, one can be as detailed as possible to have clear ideas and concepts to compose a piece. However, the act of composition itself truly reveals what the composition will be, how it progresses, and what it ultimately becomes. While having clear ideas and concepts is important, once the composition process has started, one must be able to act upon unexpected elements—be they technological, compositional, or conceptual—and be able to shift direction to progress. This adaptability is where the richness of this portfolio lies. The realizations of each piece, from their initial concept, through the means of composition, to the final result, yielded a vast array of learning experiences along the compositional process. This has led to clearer ideas of what systems might work or not for future endeavors.

Throughout all my pieces, technology as a driving mechanism for composition was key. This concept has shed light on the possibilities of technology to create new and interesting sound outcomes. By exploring technological tools from different angles and conceptualizing how they can be used beyond their initial purposes, one can expand on musical and sonic outcomes, yielding interesting results that can fit into any type of music where newness is desired. This is my main takeaway from this PhD, and in all future compositions of mine, this concept will allow me to create more original and unexpected material.

Continuing with conclusions from this work, another key takeaway is the balance within the compositional process. This balance involves creating pieces that not only fit the aesthetic needs of oneself as a composer but are also engaging to an audience. This means always composing with these two aspects in mind and being able to shift ideas or even go in the opposite direction of what was initially intended to strike a balance.

Furthermore, all my compositions, in some manner, use external control of elements to facilitate performance as a means of composition. I believe this to be key to the success of music composition. Being able to tactically control sound leads to nuanced results, which greatly enhance the final product, making the sound more dynamic. This focus on composition shifts the traditional view, as more time is spent creating performance systems that lead to positive compositional results. The act of performing becomes a musical experience, yielding great results through trial and error, similar to learning to play an instrument.

To summarize my conclusions and offer potential positive learning outcomes to those who take the time to listen and read, here are three aspects that can greatly help in creating better music with a less steep learning curve:

Using common technological musical tools in a creative way can offer expanded possibilities of sonic outcomes, ultimately leading to more originality in composed pieces. It pays off to take the time to explore tools and try new ideas with them.

One must be open to shifts in concept once the composition process begins, to strike a balance between the artist's aesthetic needs and what is thought to be expected by the audience. Taking time to think about this is key and can pivot the composition towards a more successful outcome.

Using external control to manipulate sound elements and create performative aspects within the composition can lead to better and more nuanced sound results. Taking time to explore possible control and to practice this as if it were an instrument can potentially yield very dynamic and rich outcomes.

Finally, a critical question to ask is: what are the implications of the work presented in this portfolio? Building on the previous conclusions, this portfolio represents a significant step forward in exploring how technology can shape composition through the lived experience of musical practice as both a performer and a composer. The main contribution lies in the realization that meaningful conclusions emerged only through the meticulous and time-intensive execution of compositions, leading to profound insights that integrate artistic practice with technological exploration.

The compositional process was not limited to executing a central research idea; artistic sensibility played a pivotal role, guiding and refining the pieces as they evolved. This iterative process ensured that the compositions prioritized musicality and resulted in works that are not only conceptually robust but also artistically engaging. These pieces, when listened to, reveal a shared artistic sensibility. They are effective, audience-focused compositions that succeed in their aim to captivate and communicate.

Ultimately, the depth and richness of the conclusions drawn from this process are invaluable. By documenting the journey behind each piece, this portfolio offers insights that can serve as a meaningful resource for future composers, inspiring and informing their own creative practices.

APPENDICES

APPENDIX 1: LIST OF COMMON TERMS

The following is a list of common terms that resurface in the compositional process.

Ableton Drum Rack: An included software instrument within the *Ableton Live* DAW software that acts as a grid-style sampler. Samples can be loaded in the provided square slots, each with custom independent processing.

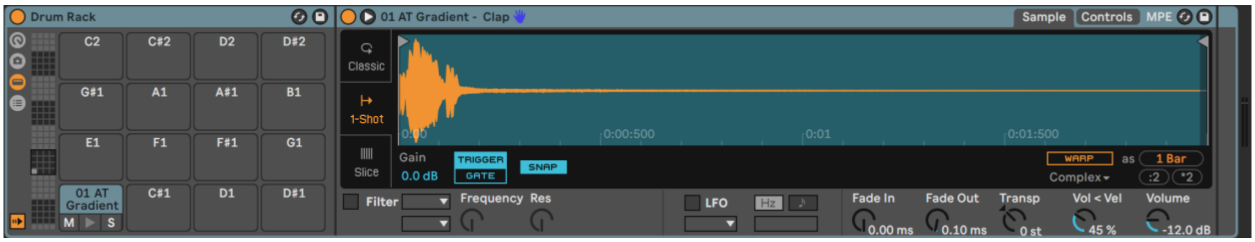


Figure 41 – Ableton Live Drum Rack device.

Ableton Live Session View: A DAW (Digital Audio Workstation) software popular for electronic music performance and production. Live includes an operation mode, referred to as the session view, where audio is treated as multiple clips between tracks, allowing for real-time launching and synchronization of these resulting in a software with string live performance capability.

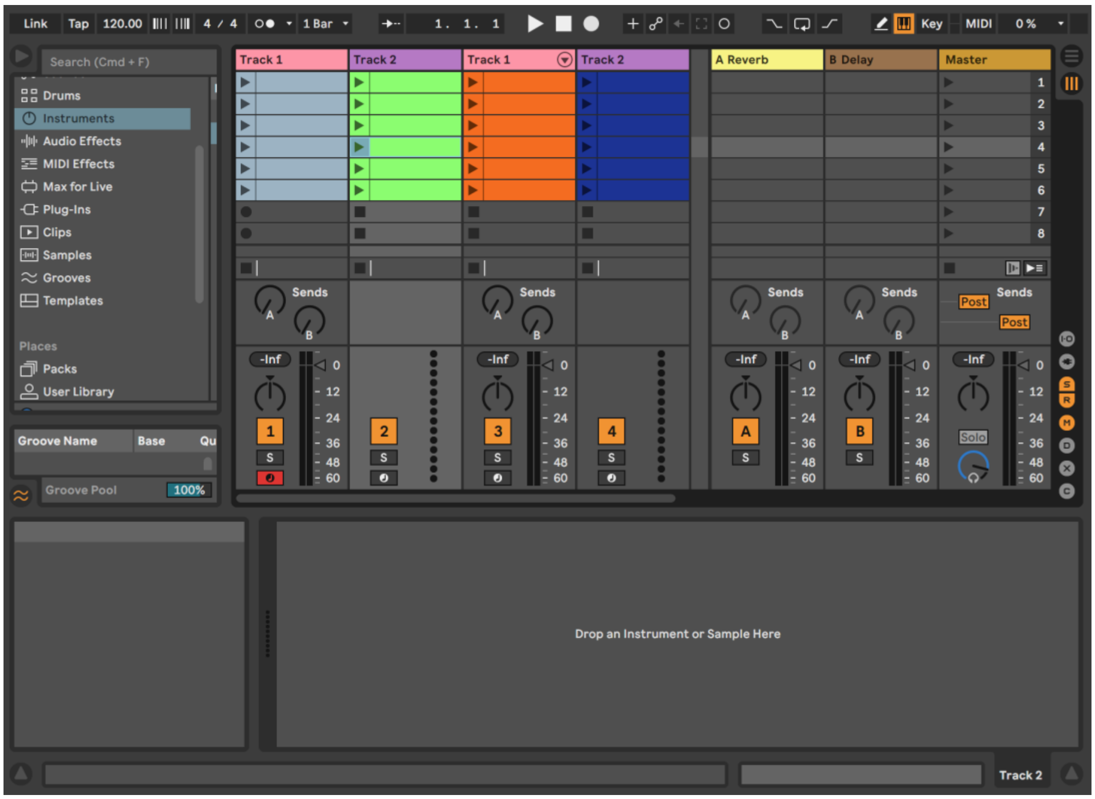


Figure 42 - Ableton Live software session view.

Ableton Live Arrangement View: *Ableton Live* also includes an arrangement operating mode, where tracks are set vertically and time runs from left to right. This mode of operation serves as a more traditional DAW setup mode, allowing for precise editing and automation.

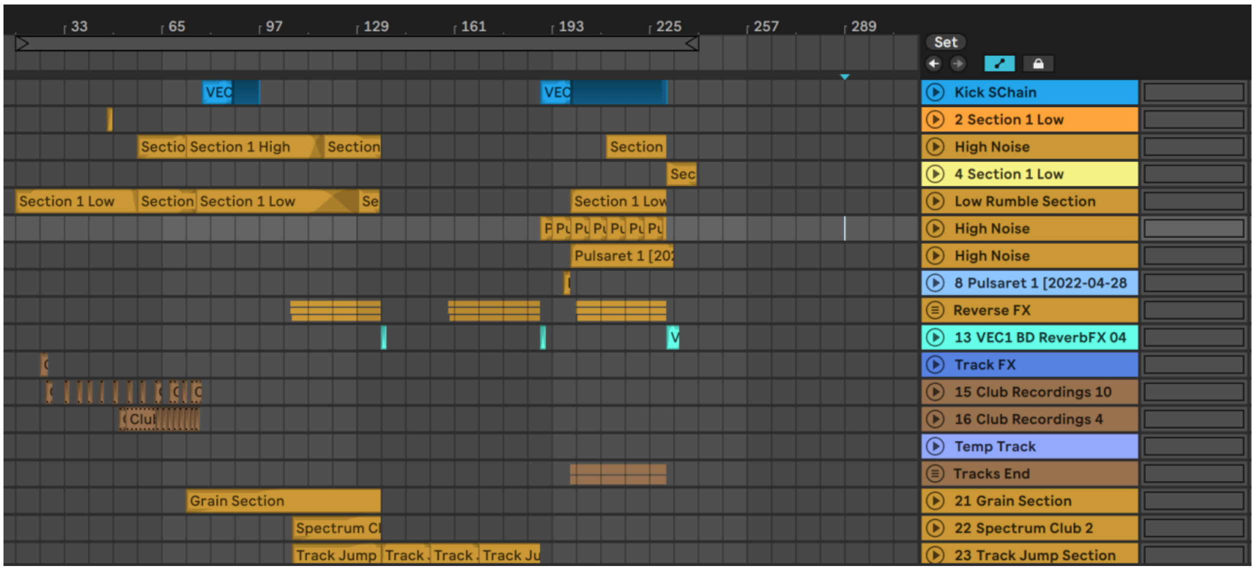


Figure 43 - Ableton Live software arrangement view.

Beat Machine custom built pattern generator: This custom built machine programmed in *Max for Live* creates random looping MIDI note patterns that can be used to trigger a variety of events. *Beat Machine* is used in *Sounds of Looping* and in *Sounds of Arpeggaition.*

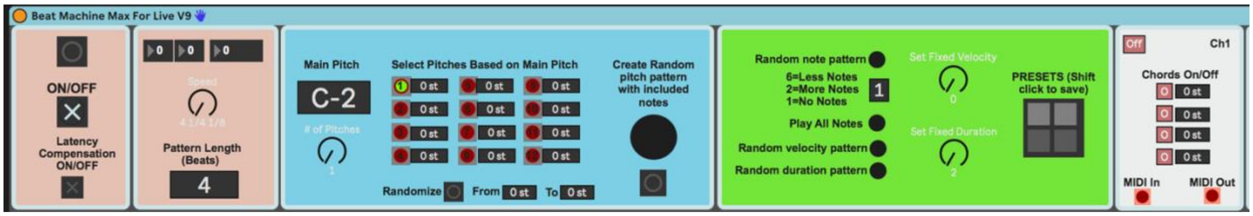


Figure 44 - Custom built Beat Machine looping pattern generator.

Behringer Poly D Analog Synthesizer: A paraphonic analog synthesizer developed by *Behringer,* produced as a recreation of the original *Moog Model D* synthesizer.

Figure 45 - Behringer Poly D analog synthesizer.

Cycling '74 Max: An object-based coding software designed for artists. One of its applications is receiving real-time data streams from computer peripherals, enabling users to manipulate and transform this data as needed.

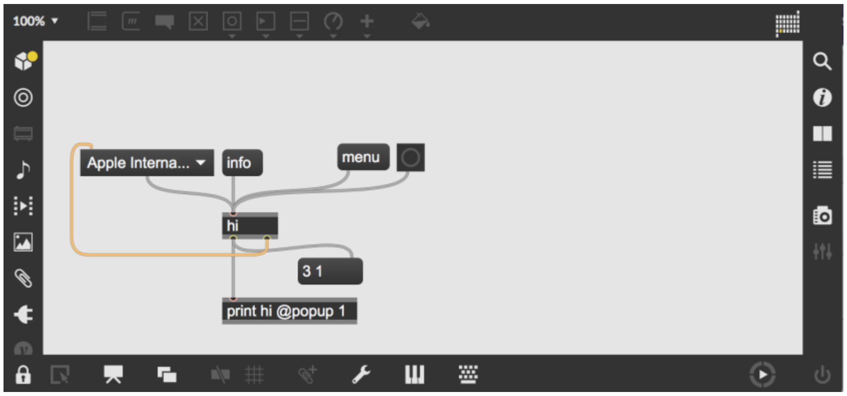


Figure 46 - Cycling '74 Max software.

Dave Smith Prophet Rev2 Analog Synthesizer: A polyphonic analog synthesizer that offers a wide variety of distinct analog sound possibilities through user control.

Figure 47 - Dave Smith Prophet Rev2 analog synthesizer.

Kick 2 Plugin by Sonic Academy: This software instrument is designed to custom create kick sounds by allowing extensive control over different elements in a kick sound. It can produce kicks that fit into other elements of a composition by allowing pitch control, sub-bass control, and attack control.

Figure 48 - Kick 2 plugin by Sonic Academy.

Max for Live custom built delay effect: This custom built delay effect was programmed for the piece *Sounds of Echoes.* The processor features eight distinct delay lines, each with delay time, volume and pan parameters that can be randomized. The parameters can also be modulated in looping patterns.

Figure 49 - Max for Live custom built delay effect.

MIDI Fighter Twister: A USB hardware MIDI controller with sixteen rotary knobs, each also acting as a button. Knob and button funtions can be customized through a prorietary app.

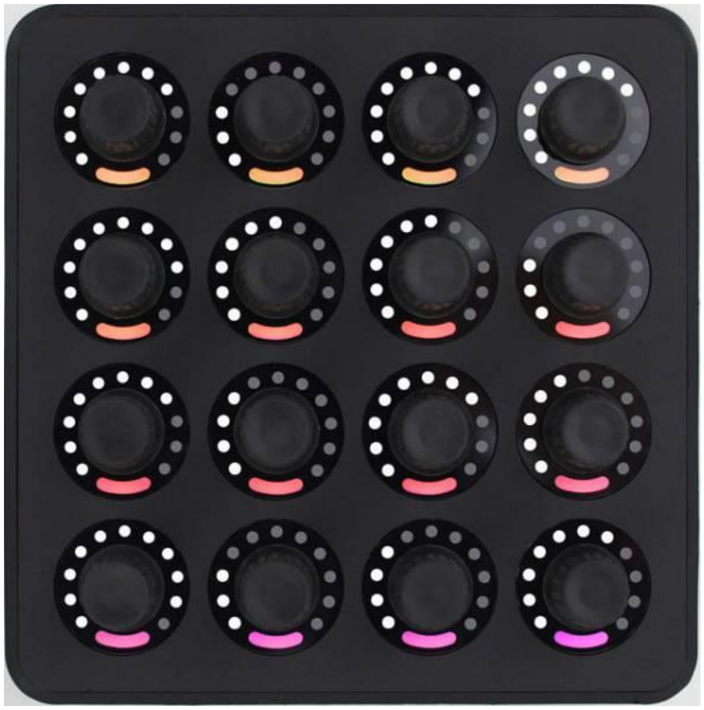


Figure 50 - Midifighter Twister hardware controller.

Native Instruments Battery: A sampler designed to organize and manipulate included drum samples as well as external and custom-made samples. The device permits extensive manipulation of each individual sound through processing chains.

Figure 51 - Native Instruments Battery plugin.

Reveal Sound Spire: A software instrument known for its software emulation of the digital hardware synthesizer *Virus TI*. *Spire* is a common tool utilized for electronic dance music production as it contains many presets categorized by genre within electronic dance music as well as available externally developed preset packs.

Figure 52 - Reveal Sound Spire plugin.

Spectrasonics Trilian: A software sampler designed for bass sound creation that contains libraries of multiple bass patches of hardware analog and digital synthesizers. Extensive control permits the modulation of parameters to custom edit presets to a desired sonic outcome.

Figure 53 - Spectrasonics Trilian plugin.

Symbolic Sound Kyma: A “sound design environment” software designed to create unique sounds with its included “audio synthesis and processing modules.” Kyma functions with proprietary hardware that executes all processing required (Kyma, 2024).

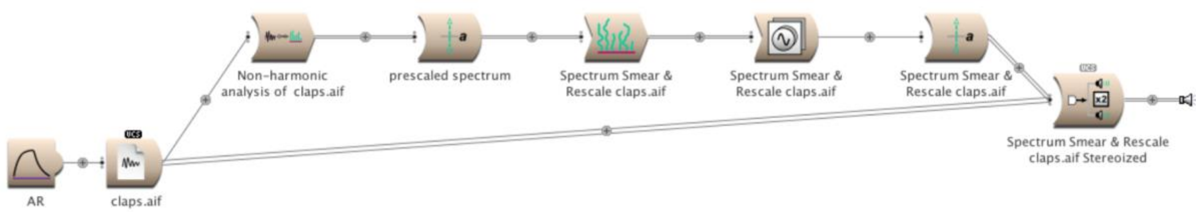


Figure 54 - Symbolic Sound Kyma software.

VCV Rack: A modular system emulation software employed for sound generation. VCV Rack includes various built-in modules and the possibility to install third-party modules.

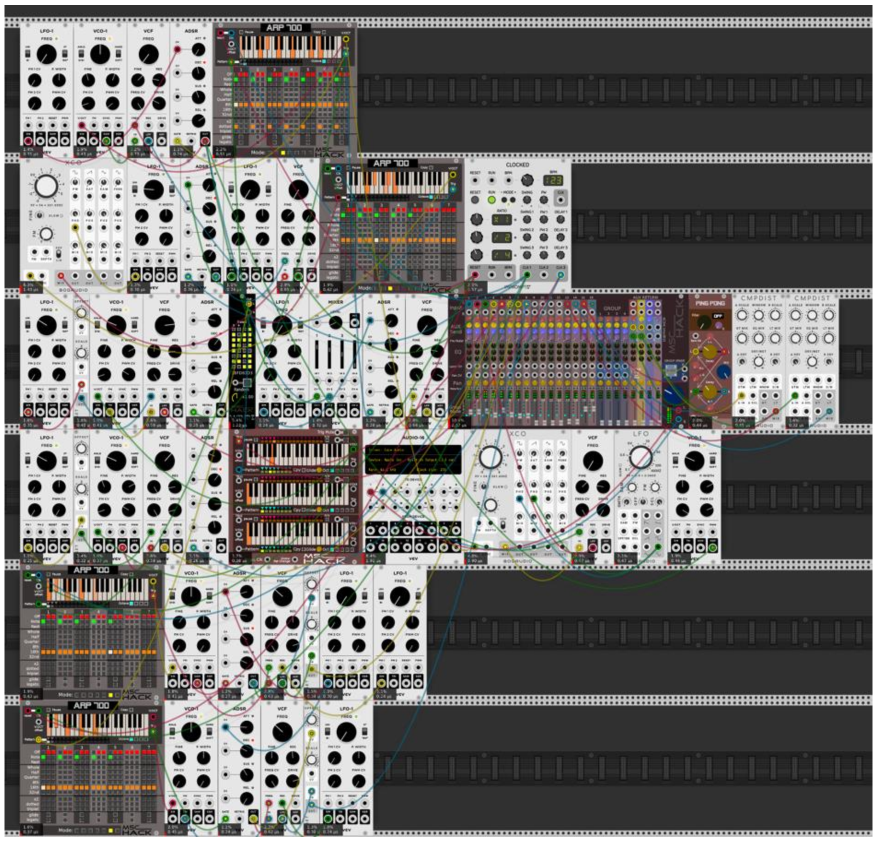


Figure 55 - VCV Rack software.

Vengeance Drum Samples: A collection of sample packs produced by *Vengeance Sound* that include a vast number of samples tailored to electronic dance music productions. It is very common as a source for kicks, snares, hats, cymbals, and FX amongst electronic dance music production.

Wacom Intuos Creative Pen Tablet – An electronic rectangular pad with digital pen control with a primary purpose for visual artists to engage with a computer. Interaction of the digital pen with the *Wacom Tablet* creates *XY* real time data, sensitive also to pressure, tilt, and two side buttons located in the digital pen. The data produced by the tablet can be repurposed as control for paramenters within a DAW.

Figure 56 - Wacom Intuos creative pen tablet.

XFer Records Serum: This software synthesizer is currently one of the most used devices in the production of electronic dance music. Based on wavetable synthesis, the software permits for the creation and manipulation of sound from original wavetable sources.

Figure 57 - XFer Records Serum plugin.

BIBLIOGRAPHY

Agte, P. (2024) ‘Analog Synthesizers Make a Comeback in the Digital Age of Music Production’, *Seamedu*, 12 March. Available at: https://www.seamedu.com/blog/analog-synthesizers-make-a-comeback-in-the-digital-age-of-music-production

Anderson, W. D. (1994) *Music and Musicians in Ancient Greece*. Ithaca, NY: Cornell University Press.

Assistant (2024) ‘What does the 'progressive' mean in progressive house?’, *Quora*. Available at: https://www.quora.com/What-does-the-progressive-mean-in-progressive-house

Baker, J. (2009) *Natural Audiotopias: The Construction of Sonic Space In Dub Reggae*. PhD thesis. University of South Florida. Available at: https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=2841&context=etd&sei-redir=1

Barlindhaug, G. (2007). *Analog Sound in the Age of Digital Tools: The Story of the Failure of Digital Technology*. Available at: https://munin.uit.no/bitstream/handle/10037/971/paper.pdf?sequence=1

Beatport (2024) Available at: https://www.beatport.com/

Bieger, H. (no date) ‘Fifteen Questions Interview with Hannes Bieger: Crossing the Invisible Line, Part 2’. Interview by *Fifteen Questions*. Available at: https://15questions.net/interview/fifteen-questions-interview-hannes-bieger/page-2/

Brewster, B., and Broughton, F. (1999) *Last Night a DJ Saved My Life: The History of the Disc Jockey*. London: Headline Book Publishing.

Brian Cid (2020) ‘Fill the Void’, *Be One EP*. Available at: https://open.spotify.com/track/2R6ERQwaSbvw45WKabdz0f?si=HQOHVisATfCmoygvV4v9sg&nd=1&dlsi=99512ee4778a4983

Butler, M. J. (2014) *Playing with Something That Runs: Technology, Improvisation, and Composition in DJ and Laptop Performance*. Oxford: Oxford University Press.

Chadabe, J. (1997) *Electric Sound: The Past and Promise of Electronic Music*. Upper Saddle River, NJ: Prentice Hall. Available at:

https://monoskop.org/images/4/40/Chadabe_Joel_Electric_Sound_The_Past_and_Promise_of_Electronic_Music_1997.pdf

DataMind Audio (2024) *DataMind Audio | Unparalleled Real-time Neural Synthesis*. Available at: https://datamindaudio.ai/

De Boer, M., Audiovisual Institute, and Pompeu Fabra University (2001) *Tapiir, A Software Multitap Delay*. Available at: http://193.166.3.2/pub/sci/audio/dafx/2001/www.csis.ul.ie/dafx01/proceedings/papers/deBoer.pdf

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

Dobrian, C. (2003) 'Aesthetic Considerations in the Use of "Virtual" Music Instruments', *UC Irvine: Integrated Composition, Improvisation and Technology (ICIT)*. Available at: https://escholarship.org/uc/item/6qd4d7nv

Earnest, J. (2013) *MIDI Controller Designs: The Best Options for Performing Live Digital Music*. Research Procedures in Music. Dr. Brown. Available at: https://static1.squarespace.com/static/5742099a3c44d80a9c34b868/t/5bd6995ee2c48350880e1692/1540790622794/MIDI+Keyboard+Designs.pdf

Fabesgl (no date) '10 Best plugins for electronic music', *Off The Beat*. Available at https://www.off-the-beat.com/10-best-plugins-for-electronic-music/

Fajar, K. E., and Sukmayadi, Y. (2021) 'Advantages of "DAW" Composing Music for the Effectiveness of Learning the Process of Musical Practice', *Proceedings of the 3rd International Conference on Arts and Design Education (ICADE 2020)*. doi: https://doi.org/10.2991/assehr.k.210203.055

Fell, M. (2022) *Structure and Synthesis: The Anatomy of Practice*. Urbanomic.

Fleck, D. G. (2009) *The Theremin*. PhD thesis. University of California, Santa Cruz. Available at: http://dave.ucsc.edu/physics195/thesis_2009/fleck_thesis.pdf

Garnett, G. E. (2001) 'The Aesthetics of Interactive Computer Music', *Computer Music Journal,* 25(1), pp. 21-33. Available at: https://web.archive.org/web/20190818092413id_/http://muse.jhu.edu:80/article/7774/pdf

Gordon, K. (2020) *The Story Behind That Really Creepy Sound in the Film Score from The Day the Earth Stood Still.* Available at: https://www.wrti.org/arts-desk/2020-10-27/the-story-behind-that-really-creepy-sound-in-the-film-score-from-the-day-the-earth-stood-still

Hamhuis, S. (2017) *Progressive House: From Underground to the Big Room*. Bachelor thesis. Available at: https://studenttheses.uu.nl/bitstream/handle/20.500.12932/30029/Hamhuis%2c%20Sonja%20-%20Bachelor%20Eindwerkstuk%20.pdf?sequence=2&isAllowed=y

Herrmann, B. (1951) *The Day The Earth Stood Still* [Film score].

Holmes, T. (2008) *Electronic and Experimental Music: Technology, Music, and Culture*. New York: Routledge.

iZotope (2015) 'How to Clean Up Your Guitar Sound After Recording', *iZotope*, 16 January. Available at: https://www.izotope.com/en/learn/how-to-clean-up-your-guitar-sound-after-recording.html

James, R. (1993) 'Aphex Twin'. Interview by Phil Ward, *Music Technology Magazine*, July. Available at: https://lannerchronicle.wordpress.com/2020/10/04/music-technology-magazine-july-1993/

Kyma (2024) Available at: https://kyma.symbolicsound.com/powered-by-kyma/

KVR Audio (2024) Available at: https://www.kvraudio.com/

KVR Audio (2024) 'The Newest Plugins VST, AU & AAX Music Software'. Available at: https://www.kvraudio.com/plugins/the-newest-plugins

Leap Motion (2013) '6 Songs in the Key of Leap Motion', *Leap Motion*, 10 September. Available at: https://blog.leapmotion.com/6-songs-in-the-key-of-leap-motion/

Lozej, M. (2016) *The Arpeggiator: A Compositional Tool for Performance and Production*. Master thesis. York University. Available at: https://yorkspace.library.yorku.ca/items/bd15a0d5-5ee9-4833-820f-b7b82db6359e/full

Marrington, M. (2017) 'Composing with the Digital Audio Workstation', in Williams, J. and Williams, K. (eds.) *The Singer-Songwriter Handbook*. New York: Bloomsbury Academic, pp. 77-89.

Mazierska, E., Rigg, T. and Gillon, L. (eds.) (2021) *The Evolution of Electronic Dance Music*. New York: Bloomsbury Academic. doi: https://doi.org/10.5040/9781501366390

McLeod, K. (2006) ‘Genres, Subgenres, Sub-Subgenres and More: Musical and Social Differentiation Within Electronic/Dance Music Communities’, *Journal of Popular Music Studies*, 13(1), pp. 59-75. doi: https://doi.org/10.1111/j.1533-1598.2001.tb00013.x

Mickey K. (2022) *Sasha, John Digweed, and the Rise of Progressive House and Mix Compilations*. Available at: https://digtokyo.jp/en/mp/032/

Noehren, R. (1995) ‘Notes on Bach and the Organ of His Time’, *Bach*, 26(1/2), pp. 74-75. Available at: https://www.jstor.org/stable/41640412

Owsinski, B. (no date) *A look at the history of console automation*. Available at: https://bobbyowsinskiblog.com/console-automation-history/#:~:text=Before%20automation%2C%20any%20mixing%20moves,their%20hands%20near%20the%20console

Pavel Khvaleev (2020) *Everything*. Available at: https://open.spotify.com/track/1Yb05QA4EvgterCgGApURI?si=fB7tl5XiSCaUl5M4TDnUeg&nd=1&dlsi=0448b0d595334eb4

Pebble Dev Studio (no date) *SynthGPT - Fadr*. Availabe at: https://fadr.com/synthgpt?gad_source=1&gclid=EAIaIQobChMIgZGK8KDohgMVL4ZaBR1EzwvIEAAYASAAEgKBifD_BwE

Puckette, M. (2007) *The Theory and Technique of Electronic Music*. World Scientific Publishing Co. Pte. Ltd. doi: https://doi.org/10.1142/6277

Reynolds, S. (1998) *Generation Ecstasy: Into the World of Techno and Rave Culture*. Boston: Little, Brown.

Sebastian (2023) ‘First Time at a Techno Club’, *Clubnight*. 13 December. Available at: https://medium.com/clubnight/first-time-at-a-techno-club-a8426d5be565

Silva, E. S. *et al.* (2013) ‘A Preliminary Evaluation of the Leap Motion Sensor as Controller of New Digital Musical Instruments’, *Universidade Federal de Pernambuco (UFPE)*. Available at: https://compmus.ime.usp.br/sbcm/2013/papers/sbcm-2013-5.pdf

Snoman, R. (2019) *Dance Music Manual: Tools, Toys, and Techniques* (4th ed.). Routledge.

Stewart, I. (2023) *AI & Automated Mastering: What to Know*. Available at: https://www.izotope.com/en/learn/ai-mastering.html

Tanev, G. and Božinovski, A. (2014) 'Virtual Studio Technology inside Music Production', in Trajkovik, V. and Anastas, M. (eds.) *ICT Innovations 2013.* Springer, Heidelberg, pp. 231-241. doi: https://doi.org/10.1007/978-3-319-01466-1_22

Teruggi, D. (2007) 'Technology and musique concrète: The technical developments of the Groupe de Recherches Musicales and their implication in musical composition', *Organised Sound*, 12(2), pp. 213-231. doi: https://doi.org/10.1017/S1355771807001914

Todoroski, J. (2020) *Back in Time: A History of Progressive House*. Available at: https://www.cultr.com/news/back-in-time-a-history-of-progressive-house/

Transeau, B. (2016) 'BT – My daughter can pick out Stutter Edit in movie trailers, records on the radio; we literally hear it on a daily basis in TV commercials, pop songs, country tracks down to electronic music, starting to hear BreakTweaker all over everything too'. Interview by Priya Sen, *Decoded Magazine*, 10 November. Available at: https://www.decodedmagazine.com/bt-interview/

Ultraleap (no date) 'The Leap Motion Controller Includes:'. Available at: https://www.ultraleap.com/leap-motion-controller-whats-included/

Van Buuren, A. (2009) 'Armin Van Buuren: Producing Trance'. Interview by Mike Senior, *Sound on Sound*, August. Available at: https://www.soundonsound.com/people/armin-van-buuren

Williams, S. (2016) 'Interpretation and Performance Practice in Realizing Stockhausen's Studie II', *Journal of the Royal Musical Association*, 141(2), pp. 445-481. doi: https://doi.org/10.1080/02690403.2016.1216059

Wiltsher, N. (2016) 'The Aesthetics of Electronic Dance Music, Part I: History, Genre, Scenes, Identity, Blackness', *Philosophy Compass*, 11(8), pp. 415-425. doi: https://doi.org/10.1111/phc3.12333

Zbyszynski, M. *et al.* (2007) 'Ten Years of Tablet Musical Interfaces at CNMAT', *NIME '07: Proceedings of the 7th international conference on New interfaces for musical expression*, pp. 100-105. doi: https://doi.org/10.1145/1279740.1279758

Zölzer, U. (ed.) (2011) *DAFX: Digital Audio Effects*. 2nd edn. John Wiley & Sons, Ltd. Available at: https://picture.iczhiku.com/resource/eetop/sykfGloQfYJRZBcv.pdf