COMPOSING AUGMENTED SPACES

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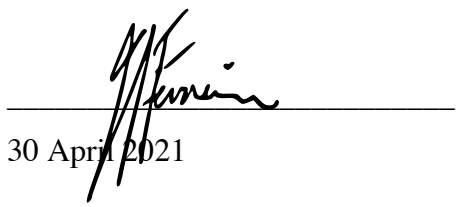
Declaration

I declare that this dissertation is my own unaided work. It is submitted for the degree of Master of Music in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination in any other university.



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Abstract

This dissertation explores the notion of place as sensed, conveyed and created through soundscape composition. This is done by looking at works in the genre of soundscape composition and a concert presentation that took place in the Great Hall at the University of the Witwatersrand, Johannesburg.

Spatiality in electroacoustic music is explored in relation to theories centred around the notion of place and practically applied to my concert presentation of *Sound Spaces*. Different forms of spatiality are explored from a compositional perspective with considerations for the listening space, the space created and occupied by the music itself and the methods of diffusion that allows for an augmentation of space.

Sound Spaces forms the basis of my investigation of how spatiality in electroacoustic music and soundscape composition can be used to engage with the notion of place as created through the musical experience and illustrates how the notion of place can be incorporated as an active compositional domain in soundscape composition and electroacoustic music.

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Chapter 1 – Introduction

As an undergraduate student, a single moment changed my perspective on sound and music and its ability to map itself onto one's experience of a place. I was driving to Wits University to attend class, while my mind drifted to something I had to do later that day, when my attention was suddenly pulled back to the present. I was driving past a traffic light in Melville, Johannesburg, when the radio presenter uttered a word that I immediately realised he had also uttered a few days back when I happened to be at that exact same traffic light. I cannot recall his exact words; it could have been any word. What mattered was that he said the same word I had heard before when I was driving past the same particular traffic light. Without intending it, my memory of this past event was evoked vividly. I had the sense that my memory was evoked not really due to language or the meaning of the word, but rather due to the sound that the uttering of the word produced. After all, I was not really paying attention to the radio when the word was uttered. It seemed there was a powerful link between specific sounds and specific locations and my experiences of those places and how I move around in those spaces daily, accumulating knowledge about them and mapping them out for myself.

This experience inspired this entire project for me. I became increasingly aware of hearing sounds repeated in space. I started noticing places and how sound could articulate links to my past experiences of those places. Of course, I can revisit memories of any place I have visited before and reminisce about the times I have spent there, but there was something about hearing a sound repeat itself in a location at different times that evoked an involuntary response from me. It was this moment that led me to the realisation that this could be investigated and I had to find ways of exploring this aspect of sound and its relationship to space more deeply.

At the time, I was interested in the ways in which sound was used which were novel in my perspective as a performing musician and composer. My interest, at the time, was directed at sound art and how one could use sound as a medium of self-expression and meaning-making outside the concert hall or as far away from the stage as I could imagine. I had grown slightly tired of playing music in front of people, as it somehow missed something that I was interested in at that moment in my life. I wanted the sound and music to speak for

itself: I did not want to be at the centre of the musical experience as a performer, but rather wanted to listen more, and I wanted others to do the same without being burdened by the presence of some custodian of the musical experience, i.e., the performer. Of course, my views of this have changed slightly since then, but it does illustrate some of my motivations and how they have directed me to take a specific path for this project.

My initial investigation into sound art revealed that it seemed to offer some way of putting the experience of the "viewer", or rather "listener", in the middle of it all. I had seen videos of works like Janet Cardiff and George Bures Miller's *Forty Part Motet* (2001) where listeners can move around a space that is outlined by a circular array of speakers, essentially determining much of the listeners' musical experience by their choice of location and how long they spent listening to the piece. This seemed to be a way of experiencing sound that more closely resembled how we experience sound in everyday life and tied in slightly better with what I had experienced at the traffic light. After all, it incorporated location, time and indeterminate duration, movement and an independence; the work did not seem to exclusively rely on the audience for it to exist. In other words, in the meeting of the work and the audience, the experience is defined, while outside the work continues to exist. This led me to more thoroughly consider the presentation practice in relation to electroacoustic music.

I also realised that there was the idea of "place" linked to my experience. To me, the idea of place reminded me of my classes on ethnomusicology, something I had enjoyed learning about, while I did not fully grasp the aspects thereof during the classes. I intuitively knew it was important and that place would play a big role in my exploration.

My initial investigation into theories of place led me to the discovery of composer and theorist Katharine Norman, who writes about metaphors of place-making in her article *Listening Together, Making Place* (2012). She looks at soundscape compositions and what she calls sound-based music from three different composers to see how the experience of those pieces creates a sense of place. She points out numerous ways in which we form a sense of place in our everyday lives and how those ideas could be used in music. For example, making a place is a process; places happen or come into existence as we move around in space and accumulate knowledge and lived experience in those spaces (Norman,

2012, p. 257). Norman's article immensely influenced my thinking and steered me in a specific direction for my project.

The initial idea for the practical project became clear after reading Norman's article. I thought: What if I could recreate that exact experience that I had at the traffic light for a listener, driving in the city? I could track them, using their smartphones, and play back certain sounds at certain times and locations over a few days to build a network of memories and triggers that would become the piece. I was inspired by the roads that were lined with ridges, where the application would play back a piece of music as the listener's vehicle's tyres interact with those ridges. Instead, my application, I thought, could involve an electronic version based on GPS coordinates. Early on, I identified some issues with this approach. I did not like the idea that the project could end up being a fairly static piece of music and that the relation between location and sound would not always be as direct as possible. I wondered whether there could be a more interesting way of exploring the same idea.

Accidental Recording

During my initial research, something happened that further shaped my idea of place and led me to a more specific point of enquiry. I previously carried my Sony PCM-M10 field recorder with me virtually wherever I went in my laptop bag. The recorder was thus with me in my car, next to my bed at night, and on my back when walking around. After a rehearsal one evening that I recorded for reference, I forgot to stop the recorder and just shoved it into my laptop bag. Weeks later, I discovered that I had recorded three continuous days of my life before the device's batteries died out. On a day when I did not have much else to do, I started scanning through the recording to hear if anything interesting had been recorded. What struck me was how terrifyingly boring and uneventful the recording seemed. What was even more striking is that I did not recall the events during those days being so unremarkable. After some thought, I came to the obvious realisation that the sound merely captured the external environment and not my experience of the space at that time or my internal state of mind and thoughts that were evoked by these seemingly uneventful events.

I ended up using these recordings in a residency in 2015 in which I developed processes of inscribing meaning into the recordings, placing particular emphasis on thought processes and how they shaped my experience of my surroundings.[1] This led me to value the importance of the internal state of mind in relation to the perceived environment and how it forms an essential part of the perception of place and the events that occur in that place. My conception of place expanded into something that can occupy real space as well as internal, mental spaces and remote spaces that are also independent of time. I realised that I wanted to explore place as a multi-layered, complex and dynamic concept.

Interactive Soundwalk

The idea quickly progressed and became what I initially set out to do in my proposal: An application for mobile phones that the listener would listen to, while walking through urban Johannesburg. Parallels can also be drawn with soundwalks where listeners are taken on a journey by listening to pre-recorded narration and soundscapes. Two variations of the traditional soundwalk that informed my thinking about the function of a soundwalk in terms of the material used as well as the structuring were Janet Cardiff and George Bures Miller's *Alter Bohnhoff Video Walk* (2012) and Hildegard Westerkamp's *Kits Beach Soundwalk* (1989).

The former is in the form of a video recording made by Cardiff and Bures Miller who walk through a space with commentary about events that are taking place in the surroundings. The viewer of the work would watch the film as they walk through the same space themselves. Cardiff and Bures Miller write:

> The overlapping realities lead to a strange, perceptive confusion in the viewer's brain. Hard to document and harder to explain. We only present the recorded audio here, but when doing the walk the real sounds mix with the recorded adding another level of confusion as to what is real and what is fiction. (2012, n.p.)

The fictional aspects of Cardiff and Bures Miller's work can be attributed to what is imagined and where the viewer follows and reconstructs the narrative in his or her mind. The perceptual confusion created by the blurring between what is real and imagined highlights

[1] Floating Reverie //2WEEKS 2015 Online Residency: *Floating Behind the Sounds*

precisely the inner and outer states that are always present in the comprehension of a soundscape. It is this relationship that I wished to explore in my practical work.

Westerkamp's *Kits Beach Soundwalk* borrows ideas from the traditional soundwalk and uses it to structure a soundscape composition. The work consists of field recordings of Kits Beach that is accompanied by Westerkamp's commentary about what she is hearing. Early in the work, the sounds that she describes enter the work as the field recordings are transformed and morphed into extra musical references. It is the composer's interpretation and experience of a space in terms of what is audible in the soundscape and what the sound of the environment evokes for her as she guides the listener through her own listening imagination. The composer's point of view and experience are foregrounded by the colourful and evocative transformation of the sound. It illustrates how abstracted sound can become part of a soundscape composition and how the format of the soundwalk can be explored in different ways.

I envisioned that my interactive soundwalk would have a general starting point, but that the listener would be free to explore the city (at least a portion of it) by walking and listening to the output of the application through their earbuds. This was a more developed version of the original idea. It would incorporate a location already rich with sound and would give me, the composer, the opportunity to create a tension, complement, or counterpoint with the sounds that my application would make and the sounds already present in the soundscape of urban Johannesburg. I viewed this as a kind of augmentation of place, where multiple layers are always present and informing each other. I borrowed here from the concept of augmented reality, where information is superimposed onto the viewer's or listener's actual surroundings, expanding what is already visible and audible. This would hopefully lead to a transcendence of place altogether as it breaks down the boundaries between internal and external spaces, the virtual and the real.

Implications on Presentation

The planned presentation of this proposed piece would have been inherently different from traditional electroacoustic music presentation practices and intersections exist with sound art presentation practices. One aspect of this composition that interested me is the

effect that it would have on form and structure. Such a presentation lends itself to something that is essentially non-linear, in a very similar way to many sound art installations. Artist and composer Adam Basanta writes in an issue of *Organised Sound* (2015, p. 171) about musical form as it relates to audio-visual installations and sound art. He argues that, in Western musical scholarship, form is often analysed from a bird's eye view of the temporal structure of the work as in the case of a score. Even in electroacoustic music, where there might be no score, the analysis often focusses on time-period-based segmentation of the work into gestures, phrases and sections that all have time as their foundation. Basanta also highlights that the concert presentation often takes on a sequential form that is bookended by events, such as the entrance into the space and the applause, defining clear beginnings and endings. This approach places the linear structure of a work as it unfolds in time in the foreground and contrasts with structure and form in audio-visual installations and sound art where viewers and listeners are mobile and spend an undefined amount of time experiencing the work. For example, with Cardiff and Bures Miller's *Forty Part Motet* (2001), the listeners can walk in and out of the multichannel installation at any point, thus defining their own beginnings and endings of the work. Furthermore, the fact that listeners may move between loudspeakers implies that the organisation of the material in terms of balance is also open ended and highly individualised.

First Developments

Next, I needed to develop the application. There were numerous considerations for the project to be practically viable. Firstly, I had to design a system that would allow me to compose the work, without having to be in the space most of the time. This would necessitate some kind of simulation of the space as I would not have been able to be in the space the whole time while composing. The most sensible way I could think of was to use a map of the location as the interface, where I could plot out different sounds and map out regions onto the location. Secondly, the system had to allow for sounds to be mapped to precise coordinates. Thirdly, movement through the space also needed to be simulated to trigger the events from a listener's point of view. Lastly, I wanted to track real-world data, such as user movement, weather information and time of day, and use that data to influence certain parts of the composition.

At the time, I was learning development in the Unity game engine for work-related purposes. I was mostly doing audio implementation via FMOD (2021) middleware in Unity. This led me to use Unity as the main platform for developing the application prototype. Unity was already set up to deal with interaction and had a host of libraries to aid in connecting user input to some kind of output. Unity had the added benefit of being compatible with many different platforms, including iOS and Android, the two most common smartphone operating systems. This meant that the application would be available to more users. As a community supported platform, Unity also offered open-source solutions and forum-based support at no cost. In addition, it offered flexible licensing for independent development and could be used at no cost for development and publication of smaller projects. Unity also accommodated extensions often developed by users and third-party developers that extend the functionality of the program. A particular extension of interest, namely the MapNav (*MapNav Geolocation Toolkit*, 2017), allowed for easy integration of GPS information as well as map information from sources like Google Maps into the application. This resolved one of the requirements for the prototyping system as it would present as a map. The engine then allowed for easy placement of markers, sounding objects and zones on the map that could be linked to the playback, parameter manipulation and synthesis of sound.

For the implementation of the sound, I considered using middleware. Middleware's purpose is to offer software developers a third-party solution specifically aimed at the development of sound and music that links directly with game engines and replaces its default audio engine with the middleware. Such software allows sound designers and composers to construct music and sound effects in an interactive and procedural way, without directly dealing with the development of the application or game. These programs also act as a bridge between normal digital audio workstations (DAWs) and the game engine.

FMOD (2021) is one of the most common examples of middleware and is used extensively in the gaming industry. One benefit that FMOD would have had for the proposed is that it allows for the construction of adaptive audio that could change in relation to parameters in the game or in this case the composition. User data and location, for instance, could have been linked directly to parameter changes in FMOD. Furthermore, FMOD's built-in three-dimensional sound algorithms could have allowed for easily simulated spatialisation. The spatialisation method most commonly used in FMOD is based on head-related transfer

functions which allow for three-dimensional sound over headphones. This would have been particularly useful for the composition as the listeners' orientation could have been tracked through their smartphones and sound could have been spatialised in accordance with their perspective. Unfortunately, the drawback of using FMOD is that it relies heavily on the playback of samples. Samples could be pitch shifted, stretched and crossfaded and some parameters could be randomised. Although the system itself allows for very dynamic treatment of recorded material, there is no way of synthesising sound in real-time using FMOD.

There are, however, other methods of synthesising material that are compatible with Unity. This includes using software like Pure Data. Pure Data is an open-source visual programming language designed for musicians, sound designers and artists to create programs by connecting visual objects to construct a program instead of the more traditional text-based scripting (Puckette, 2020). Pure Data can also be used to process and generate sound which would have allowed me to not only play back recorded sound, but also process that sound and generate sound in real-time. Although Pure Data is primarily designed to run as a stand-alone application, an extension for it called libPD (Brinkmann, 2020) was specifically made for mobile devices and the integration of Pure Data functionality into other software. There are also several different ways in which libPD could be integrated into the game engine. Options that arose in my initial research included Kalimba (Dorda, 2016), an extension for Unity specifically intended for integrating libPD into the application, and Heavy (*Enzienaudio/Hvcc*, 2018), an online tool that would recompile a selected number of Pure Data objects into code that would run natively in Unity.

Figure 1 – Early mock-up interface

Figure 1 shows an early mock-up of the proposed system which illustrates how the composition would have been created. The interface is displayed as a map and should be able to simulate a listener walking though the space in the software. Visually, the location of the listener is displayed on the map as an arrow. As part of the composition process, different points could be placed on the map. When the listener reaches one of these points, an event would be triggered. This data is then received by the Pure Data patch to either play back pre-recorded material, process existing material or synthesise sound in real-time. Apart from mapping specific points to specific events, there is also the option of defining zones. Zones are often used for reverberation in games to signal that the user has moved into a specific space, while, in reality, these zones could be mapped to anything in the sound engine. Zones can change and produce dynamic data in relation to proximity, the speed at which the listener moves, the number of listeners in a specific zone and so forth. This data can also be sent to Pure Data to dynamically change parameters, create crossfades between different parameters and affect the spatialisation of the sound.

Rethinking the Practical Project

This application was developed up to a prototype version which showed great potential, but also highlighted a few key issues. These issues led to the project taking on an entirely

different form from what I had originally proposed and envisioned. One issue, as mentioned in the proposal, was that FMOD (2021) does not support Pure Data patches and alternatives, such as Kalimba, were at the time already outdated and offered few features. I discovered an audio middleware for Unity called Fabric which promised to deliver Pure Data integration with Unity projects, but it was limited to desktop builds only. This meant that it could not be used on mobile platforms. Heavy was another alternative for embedding Pure Data patches into Unity projects and was briefly explored as well. I also tried alternatives, such as JavaScript, to develop an application that can be loaded on a web browser which would have meant that the application could run on any platform.

However, the biggest issue with the prototype was that GPS tracking was not accurate enough to track smaller movements. The GPS built into the average smartphone has an average accuracy of around 60 m which is functional while driving but inadequate for a soundwalk. This issue could have been solved but would have reached far beyond the scope of this project and would have shifted focus too far from the creative output to the technical development of a system. Although this is something worth pursuing in the future, it did not contribute directly to the creative work in the context of the research in question.

After deliberation, it was decided that my creative work should take a different direction in favour of something that more accurately reflected the core of the research. This process, however, led to valuable insights regarding the aim of the research: It allowed for a distillation and reconsideration of the primary conceptual matter of what this project was to achieve. This project in terms of where it started and what it would become is located within the creative practice as research paradigm (Crispin, 2015, p. 58). An iterative approach is what lead to the uncovering and development of the core concepts in this research.

In relation to the works discussed earlier in this chapter regarding their format being either sound installations or soundwalks, the role of the listeners as bodies in space as well as their movement and involvement in the unfolding of the work are key. This ultimately ties in with their emplacement in the work and their role in relation to the work in creating and experiencing a sense of place. My movement through space, while travelling to Wits, seemed to have been an integral part in creating links between space and the sounds heard in it.

From the accidental recordings I made it also became evident that sound itself is not the only carrier of meaning in the sonic experience, but that the context in which the sound is produced as well as the listener's internal processes collaborate with the external and physical. In the interactive soundwalk I had envisioned, the idea of augmenting the immediate sonic environment with remote, virtual and imaginary environments was at its core. A central idea lies within the investigation of place, its relationship to sound and the listeners' role in defining their own sense of place within the work.

A question for me then emerged about place and how it can be explored as a primary and active domain of composition in electroacoustic music, with specific focus on the spatiality of and around sound. The centrality of space inherently ties the corporality of the listener into the musical experience by virtue of its physicality and rootedness in three-dimensional space. My investigation of space would thus further extend into focussing on the multi-layered nature of space and how the manipulation of space can result in a sort of augmentation of the place that is experienced and co-created by the listener.

Sound Spaces: A Brief Description

A discussion of theories on the definition and formation of place as it relates to electroacoustic music and soundscape composition will be the focus of the second chapter. It is followed by a discussion of the theories on space as well as compositional and analytical strategies surrounding space. Thereafter, I continue to analyse my practical work in relation to these theories to illustrate how place can be used as an active domain of soundscape composition through the manipulation, transformation and augmentation of space.

A brief summary of the practical work will assist in contextualising the theories to follow before I delve into the analysis. My work, *Sound Spaces,* is a suite of five pieces which was presented in the Wits Great Hall in March 2019. These pieces are titled: *Tuning, Drones, bells and bowls, Interlude, Re:construction and Montage*. *Sound Spaces* was diffused into the hall via a custom eight-channel loudspeaker system. The programme notes can be found in Appendix A for reference. The system is discussed in more depth in Chapter 4, but essentially consisted of four loudspeakers in quadraphonic configuration inside the hall, two loudspeakers in the foyer outside the hall that could bleed into the hall through the

back doors that were left open during the performance, and two subwoofers positioned in the corridors on each side of the hall. The acoustics of the hall and the adjacent spaces played an integral role in the work and were foregrounded at times during the composition as sound was brought in and out of the adjacent spaces. *Sound Spaces* uses many environmental recordings, processing of those recordings, abstracted sound from those environments and synthesised sound. The recordings range from extremely recognisable field recordings of crickets and rain to more obscure recordings of sounding objects collected over the period of this research. These elements are woven together into new soundscapes and each of the five pieces takes on a different approach in terms of structuring and techniques based on the notion of place as it relates to soundscape composition.

Chapter 2 – Theories of Place

An investigation into the notion of place is key in *Sound Spaces* as well as how place is perceived and created in the practice of soundscape composition. As a starting point, I considered Norman's metaphors of making place, as applied to the analysis of three works by different composers (2012). These metaphors impacted many compositional decisions in *Sound Spaces* and will be further investigated in Chapter 5. In addition to arriving at a definition of place as it relates to soundscape composition, musical presentation and listening, I also discuss, in the second section on this chapter, soundscape composition in relation to my work to identify key factors that situate my work in this genre.

Place: How It Is Made

The main theory of interest here is centred around our experience of making place in everyday life. Norman (2012) proposes that ways of thinking about place outside music can be called upon in electroacoustic compositions. She identifies activities of place-making in everyday life, arguing that they may be incorporated in aurally perceived works and elicited in listeners to achieve a greater sense of connectedness to sound-based music which is itself about our connectedness to the environment. She uses the term "sound-based music" here as a broad category that includes soundscape composition but can be extended to many forms of electroacoustic music and primarily uses the term to differentiate it from traditional instrumental music.

This notion of place is closely related to the spaces in which people find themselves, but could be further defined through the actions, exchanges and relations that happen within such spaces. Norman states that place is not inherent to the external environment, but forms part of what we make of it (2012, p. 257). Norman further details that, whereas space is delineated by extent, a place begins and ends with a relationship between the perceiver and the perceived. The primary enquiry of her work is focussed on whether music and sound art could elicit the same kind of place-making conditions that are found in everyday life. The outline of these conditions or place-making metaphors, as Norman describes them, consists of five aspects adopted from philosopher Edward Casey's definition of place (1996). These

specific ideas each relate to the perceiving body within, with and as part of place from a phenomenological perspective.

Firstly, Norman argues that the notion of place, how it is sensed and made, is a process. She quotes Casey, "We move, and in moving create place" (1996, p. 27), and highlights that places not only "are", but also "happen". A space being perceived as a place requires a lived experience through a bodily presence, being within an environment even if in metaphorical terms (Norman, 2012, p. 258). An accumulation of knowledge of this lived experience is what forms our sense of a place.

Secondly, Norman continues from the above point to highlight that this process requires not only the *bodily presence,* but also *movement* of that body within a space. She further details that, even if stationary, the body is always moving (2012, p. 258). This movement could be seen as physical and emotional movement in terms of how we react and respond continuously to our conditions. A listener who enters a concert hall and remains seated for the duration of the work is stationed there with the prospect of going elsewhere once the concert is concluded, already mapping out his or her future trajectory however unconsciously. It is within this movement that perspectives and focal points are shifted and where trajectories in space, whether physical or imagined, create links between events, things and our relationship to them. It is the mapping out of these relationships, both over time and within space, that Norman argues is part of the process of creating a sense of place. This movement relates back to the first metaphor that is centred around the idea that places are not something that simply exist but "happen" through the movement of people in space and time. As Tim Ingold puts it when discussing the difficulty of creating maps with high accuracy, since what constitutes a place is always shifting, "the world of our experience is a world suspended in movement, that is continually coming into being as we – through our own movement – contribute to its formation" (2011a, p. 242).

This notion of movement leads to Norman's third metaphor. There is a dynamic relationship between body and place and the two constantly inter-animate each other. "The lived experience is vital to the continuation of place, and place in turn is vital to the existence and continuation of lived experience" (Norman, 2012, p. 258). This is a key factor that differentiates space from place. For a place to exist in and around existing spaces, it needs to be experienced or lived in by a bodily presence however continuous or periodic it may be.

Without the existence of place, the spaces that we occupy and live through are just empty containers.

The fourth metaphor is that, if perception of place is required for lived experience, then perception must have an "ingredient" that conveys place. Norman states that we are surrounded by depths and horizons of perceptual experience, rather than by a confusing kaleidoscope of free-floating sensory data (2012, p. 258). Perception is never without both cultural and social components, embedded in the lived body that does the perceiving. This is particularly important in the context of soundscape composition and wherever the sound material creates references to the world outside the music. It also bears relevance to the structuring and organisation of referential sound material where the cultural and social components from which the sound originates are then contained in the sound material itself. This can be extended even into musical material that does not directly refer to a particular place. When considering more traditional forms of music, for example where pitch, harmony and rhythm are at the centre of the musical form, it is also a development arising within social and cultural contexts. On a more literal front, the listening space, such as the concert hall itself, is experienced from the listeners' perspective and evokes a whole array of connotations and connections to their lived experience and understanding of such spaces.

Lastly, we are both "with" and "in" place. While places are something that we form through perceptual experience and in which we move, they are not external to us: They enter and form us through our being in the environment. Norman explains this by referring to philosopher Alfred North Whitehead's term "withness" which is concerned with the awareness by the perceiving body of both its experientially infused perceiving activity and its position in the landscape of perceived objects (2012, p. 259).[2] In the perceptual experience of an object, the sensing body of the subject itself becomes an object of that experience and it is within this meeting point where the perception lies. Within this experience, there can be no distinction or separation between the two for the experience to exist and as such we find ourselves "with" and "in" place, as Norman suggests.

[2] From Alfred North Whitehead's *Process and Reality: An essay in cosmology* (Whitehead et al., 1978)

Norman mentions the idea of a place as a gathering (2012, p. 285), a term adopted from Casey (1996, p. 38). Further elaboration on this idea of the gathering characteristic of a place is important in the context of my own creative work. Casey identifies this characteristic as an essential trait of place beyond the role of the lived body in a space. He states that places gather memories and things (animate and inanimate) as well as thoughts, histories and languages. He attributes this ability not to individual human subjects as they draw on their bodily and perceptual faculties to produce and project place, but something that inherently belongs to a place. "This power belongs to place itself, and it is a power of gathering" (Casey, 1996, p. 39).

Casey elaborates on the hold of a place and its gathering action. The first aspect that he puts forward is that it is a holding together in a particular configuration, establishing a particular ordered arrangement of things, even if those things are disparate and in conflict with each other. "[It] allows for certain things – people, ideas and so forth – to overlap with, or sometimes to occlude, others as they recede or come forward together" (1996, p. 25). In the case of a concert hall, this arrangement is well established as the space holds the audience and the performer, or the music, and arranges them in a specific configuration. It establishes the relationship between the occupants of the space. Within its boundaries, it holds all the occupants of the event and occludes whatever else can be found in and around the space that might not contribute to the sense of place that is inherent to the dealings and purpose of the concert hall. This bring me to the second aspect that Casey puts forward that the hold is both holding in and out. It holds the occupants within its boundaries and in the first place defines its boundaries in relation to what is expected of that place. The doors of the concert hall, the curtain and the area behind the stage are all boundaries that compartmentalise the various functioning aspects of the concert hall. It also contains and encourages certain sounds and attempts to keep out the sounds that are not regarded as part of the musical presentation.

Listening, Mediation and the Archetypal Concert Hall

Norman specifically states that the metaphors of making place do not engage with listening strategies. Although recognising their importance, she rather tries to focus on an interdisciplinary approach that does not limit itself to the aural mode of perception. I want to connect this with a particular form of listening which Rui Chaves and Pedro Rebelo propose

in their article, *Evocative Listening: Mediated practices in everyday life* (2012). Even though Chaves and Rebelo's article focuses on personal technologies, such as mobile devices, and networked experiences through which sound is mediated, it does so by looking at environmental philosophy and reassessing the subject-object relationship that forms part of the listening experience (2012, p. 216). Particular focus is placed on new listening typologies that arise in the engagement with work that focuses on the context of what one is listening to and foregrounds the notion of place as multi-layered. This bears relevance to how *Sound Spaces* was composed and the rationale behind how the music is structured. While not ignoring the fact that Chaves and Rebelo draw from examples of music mediated by personal technology to formulate their arguments, they offer a definition of mediation that would place even a concert experience in the same domain. They borrow here from philosopher Timothy Morton who defines mediation as the relationship between inside and outside, private and public, me and other, and foreground and background.

Another view on mediated musical experiences can be found in Iain Chambers's *The Aural Walk* (2004). Chambers indicates that the Walkman offers access to a portable soundtrack that, unlike the transistor radio, car stereo or "ghetto blaster", is an intensely private experience. Indeed, this has often been a common criticism of the Walkman as it encourages an aggressively private listening experience. Chambers offers a counterargument and states that however private the Walkman provides the listener with a tool for mediating their public experience and turns this experience from a passive one into an active one (2004, p. 100). This ties in with the effort it takes in the mapping out of place, creating a geography so to speak by active participation. Although my work is not presented through personal listening technology like the Walkman in its current form, but rather as a concert hall presentation, the same relationship between the listener and the presented sound can be brought into the foreground of the musical experience by means of a metaphorical reference to mediated sound. Examples of this can be found in many parts of my work where sound mediated through technology, such as radio communications, is used. Such material could evoke similar ideas in the mind of the listener when the mediation itself is the primary referential feature of the sound. This creates a remote sense of place that is connected to the current listening environment only through its interpretation by the listener and in the listener finding a place for this remote material within the composition. This remoteness that the

material evokes can be pushed further away to the point where only vague connections can be drawn as to its origin and function within the rest of the sound material in the work.

The use of loudspeakers in the concert hall as the technology for sound delivery can also be viewed as a mediation in and of itself. Furthermore, if the work is contextualised and presented as such, these relationships can be explored regardless of whether the work in question is mediated through personal technology like the Walkman. Regardless, as Chaves and Rebelo (2012) highlight, the concert hall as an archetypal space is in itself a mediator of the experience of the work. They define it as a space that clearly demarcates the positions of the audience and stage according to the notion of projection. By entering the space, the occupants enter into a listening contract where the role of the producer of sound is assumed by what or who is on the stage, while the role of the spectator is assumed by the audience members. Casey's idea of the hold of place is particularly relevant in further defining this archetype (1996). This type of listening invited by this archetypal space is further characterised, according to Chaves and Rebelo, by communicating an experience that is notionally equal to all audience members and therefore treated as an object that is to be projected. This paradigm is clearly visible when looking at the development of sound projection technology and acoustic design of concert spaces (2012, p. 217).

The concert hall as archetypal space essentially defines a particular relationship between the listening subject and the projected object. This subject-object relationship in the context of a concert performance has of course been challenged by many. In *4'33"*, John Cage redirects the notion of projection away from the stage and into the environment and social interactions in and around the concert hall as the sounds emerging from these elements shift into focus. Nonetheless, the concert hall as archetypal space remains a site fertile for the exploration of the notion of place in terms of how it holds its occupants and defines the relationship between them and how its occupants and its use for musical presentation can reshape the sense of place that it carries.

Norman's Case Studies

Norman discusses three works in relation to the place-making metaphors: Steven Feld's *Rainforest Soundwalks*, David Monacchi's *Integrated Ecosystem* and Francisco López's *La*

Selva. The importance of bodily presence is outlined in the metaphors of place-making and forms an integral part in each of these compositions. All three composers use field recordings of rainforests as the raw material for their works. However, they all take different approaches to organising and presenting the material to the audience. In these different approaches, Norman identifies metaphors that relate to how we create place in everyday life.

Steven Feld is an anthropologist and composer whose academic research is principally concerned with the anthropology of sound, a term he coined in 1972, which extends the anthropology of music and language into a critical sensory and aesthetic focus in domains such as environmental and ecological acoustics. Some of his most notable work includes his anthropological sound studies in the Bosavi rainforest region in Papua New Guinea where he researched relations of environmental sound from 1975 to 2000 (Feld, 2019).

Rainforest Soundwalks uses recordings of the rainforest environment in the foothills of Mount Bosavi. The four tracks are crafted by layering different heights and depths recorded in the rainforest. *Rainforest Soundwalks* contains no direct reference to bodily presence, as any sound of human presence was omitted or extracted from these recordings. Feld, however, shapes the aural experience by layering recordings of microphones placed on different levels in the forest to attempt to give the listener a hyper-real listening experience from the composer's vantage point. This representation of the forest is based on Feld's own listening experience of the place as well as the knowledge he has gathered through his anthropological research about how the Bosavi people perceive the sound of the forest. His vantage point serves as an entrance for the listener into a place that Feld is familiar with and, as such, emplaces the listener directly into the environment. Feld indicates in the liner notes that these recordings are not literal soundwalks through the forest, but rather a metaphorical movement that focusses on the organic experience of sound in motion through space and over time. He encourages the listener to imagine their movement through the soundscape, as the sound of the forest shifts and changes around them. Norman argues that by presenting the material to the listener in such a way they can share in the sense of place, a sense that Feld already has with the location where the material was recorded, by virtue of its unique vantage point as well as Feld's personal connection with the location. It is not so much a documentation of the forest as space, but rather an experience and personal account that goes beyond a literal and realistic representation.

David Monacchi is a composer, sound artist and researcher working in the field of acoustic ecology. He approaches his work from an ecological as well as aesthetic point of view. Monacchi's work is concerned with fostering an awareness of the biodiversity crisis through music and sound art installations of three-dimensional soundscape recordings. Part of his research centres on an ongoing multidisciplinary project, *Fragments of Extinction,* where he conducts field research in the world's last remaining areas of undisturbed primary equatorial rainforest (Monacchi, 2021).

Monacchi's work *Integrated Ecosystem* takes on various approaches to sound organisation. The first section consists of snippets of recordings of different ecologies in the forest which were recorded during various timeframes. These snippets are presented as snapshots, cascaded one after the other, with no apparent sense of abstraction. Norman argues that presenting the material to the listeners in this way already starts to form a sense of "connectedness" between the listeners and the environment due to the recognisability of the recorded environments and the listeners' intuitive ability to recognise those sounds. Even though the location of the recordings is quite far removed from most listeners' frame of reference, the sounds are still recognisable as insects, such as crickets, and various other animals in the forest. In the second section of *Integrated Ecosystem*, the sound becomes more abstracted through processing with the live intervention of a performer whose movements are tracked by sensors that directly affect the sound. Norman states that in doing so another sense of emplacement is created within the concert hall as the audience listens and relates to the sound though recognition of its source, but also through the relationship with the movement of the performer's body.

Francisco López is a Spanish sound artist whose work exploits the connection between field recordings and "acousmatic listening". He primarily works with field recordings and his work is situated within the practices of acoustic ecology. At the same time, his work rejects some of the claims set forth by the founder of acoustic ecology, R. Murray Schafer. In *Le Selva,* for example, "López rejects the idea that sound recordings can ever be simply representational and argues instead that it is always a creative act" (Cox & Warner, 2004). His work often seeks to call the listener's attention to the sounds themselves rather than to the sources that created them.

La Selva consists of recordings of a rainforest in Costa Rica, containing insects, animals, plants as well as non-biotic elements, such as wind and rain. López, however, presents these sounds with no distinction between background and foreground sound. This is achieved by the way in which the sound sources were recorded and layered to obscure any sense of perspective. The presentation aims to make no distinction between the different categories of the sources of these sounds to encourage a perceptual shift from the recognition and differentiation of sound sources towards the appreciation of the resulting sound matter as a whole. López refers to this as a "transcendent" listening experience (2004, p. 83). One of the motivations behind this idea is that López wants to stress that when we listen to an environment without attempting to identify the different components within it we can better understand the relationship between its different components in terms of how they affect each other. This is in terms of the acoustic ecology that it creates as well as the sound-creation and sound-modification elements that each of these elements contribute to this acoustic ecology. To elaborate on this idea, López uses the example of the sound of rain consisting of both the sound of water drops falling as well as the sound of the leaves on which they fall.

Norman discusses the "transcendent" experience as theorised by López. She argues that this kind of listening is almost impossible to achieve because of our desire to know the causes of sounds (2012, p. 264). Norman perhaps speaks about the identification of separate elements. López does not directly ask the listener to entirely disregard identification, but rather attempts to shift this act of source-cause identification towards the whole and the relationship between the sonic environments' components.[3] What Norman identifies as a failure on López's part to create a "transcendent" listening experience along with the natural inclination of the listener to identify and distinguish between different elements of a whole is exactly what she argues to be the success of the composition in relation to its ability to facilitate the making of place to the listener. She further details that it should not be without effort that one creates a sense of place, and again refers to the mapping out of place through quotidian movements as being an involving process (ibid, 2012, p. 265).

[3] Source-cause in the sense of Denis Smalley, see Chapter 3. Michel Chion's causal listening mode (2008, p. 28).

Norman speaks about place-making strategies applied to music through presentation, performance and to a certain degree spatialisation, but does not go into detail about how it could be approached from a compositional standpoint. I later show how I approached these metaphors through a number of compositional techniques, including a broader discussion on space in electroacoustic music as well as the material used in *Sound Spaces*.

Finding a Place in the Soundscape

My work is situated in the practices and processes of soundscape composition. This is evident by the use of environmental material, the aesthetic and, to a certain extent, the environmental philosophy that accompanies soundscape composition. The influence on this project from the field of soundscape composition primarily takes on the form of the sonic rather than some of the narratives surrounding the field. The presence of environmental sound in the composed music nevertheless requires consideration of the field of soundscape composition in this report. The first point of interest relates to the use of environmental sound material, while the second relates to how soundscape composition engages with the listener's mode of listening. I also address British anthropologist Ingold's critique of the term soundscape as well as Robin Parmar's critique of some of the concepts that R. Murray Schafer laid out in his seminal work *The soundscape: Our sonic environment and the tuning of the world* (1993).

When listening to the material used in most of *Sound Spaces*, it can certainly be described as containing a large number of environmental sounds. The material use itself is, however, not the only aspect that situates this work within the genre of soundscape composition, and I would like to elaborate on the concepts and traits of soundscape composition that are inherent in my work. First, I will highlight some of the material that consisted of field recordings of different environments. Then, I will expand from there to indicate how the abstract elements in my work can also be viewed as soundscapes.

During the compositional process I often started by making field recordings of various environments around me. *Drones, bells and bowls* captures the build-up and release of a thunderstorm. It also contains many layers of rain falling on tin roofs, the foliage of trees and bushes, and bare soil. There are also transitional sounds contained within this set of

recordings. Before the rain started in the evening, the crickets chirped at their peak, but the sound slowly subsided as the intervals between each raindrop got shorter and the overall density of the accumulating rain started to drown them out. *Re:construction* contains sounds captured mainly from my balcony where I could hear builders hammering away at rocks dug up from the surroundings as they built walls. In the distance, I could also hear construction vehicles backing into driveways where the residents of the area where presumably doing renovations. These two similar but spatially separated events were tied together by the unrelenting chorus of lawnmowers and weed eaters that swamp my suburb every Friday. *Montage* is filled with perhaps the most varied set of field recordings from all the pieces in the work; with this recording, I expanded my horizons to even include some environmental recordings made by strangers on the other side of the world an example being the recording of a train approaching the platform in a metro station with indistinct conversations in the background.[4] Pulling the metaphor of a soundscape into the unseen world, I also made many recordings of radio transmissions captured via a software defined radio (SDR). These recordings were encrypted and thus the contents could not be understood, but the sounds in the recording had a certain topography to them. It was as though the sound was a representation of an abstract landscape and contained in it the calls of unfamiliar animals. As I go into more depth about the use of the material in Chapter 5, I will move on to the discussion of soundscape composition. However, this brief description suffices to illustrate the prevalence of environmental sound in my work.

Schafer speaks of sonic environment as a term that may refer to actual environments or to abstract constructions, including musical compositions and montages, particularly when considered as an environment (1993, p. 274). When looking at what it could mean, when one considers sound as an environment that clearly has no immediate nor direct connection to a real-world environment, it might be useful to turn to Westerkamp's proposition of what could be included in soundscape composition (2002). She suggests that soundscape composition is, in fact, not limited to environmental sound recordings as source material. "Soundscape composition […] places its focus on the concept of acoustic ecologies that deal with issues of environmental listening and an active engagement with our soundscapes" (2002, p. 51). I want to emphasise an aspect of my work here that plays an integral part in how I approached ideas on listening and engagement. Perhaps when looking back at the example of the SDR

[4] More about this in the section on *Montage*.

recording I made of encrypted radio transmissions, the fact that I identified and recognised some topography as I listened to it and described it is not because it is inherently true of the sound but rather because I approached it with a particular attitude towards listening, what Westerkamp refers to as environmental listening. An ecology refers to an environment and the relationship between its components or inhabitants. Acoustic ecology, as Westerkamp states, deals with the interrelationship between sound, nature and society.

Soundscape composition in relation to acoustic ecology, in the physical sense, can often deal with issues of the environment, especially pertaining to acoustic environments and the human influence and the effect on the state of the environment. This often goes hand in hand with environmental activism and politics. Soundscape composition, however, is not limited to such outcomes and could use the concept of ecology in a more philosophical way, where the intended outcome of a soundscape composition could be to stimulate some kind of awareness and sensitivity in the listener towards their environment on an auditory level. My work certainly does not aim to address issues of environmentalism and does not take a particular stance on that matter.

Barry Truax also argues that soundscape composition does not limit itself to environmental recordings, but rather places the available material for such compositions on a continuum between found sound and abstracted sound (2002, p. 5). He continues that contemporary signal processing can easily render environmental sounds unrecognisable and completely abstract and thus cause the sounds to easily fall outside what can typically be regarded and recognised as soundscape composition. For this reason, Truax limits soundscape composition to a work that is clear about its intention and keeps a clear degree of recognisability in its sound to invoke the listener's association and recognition of the sounds. In *Acoustic Communication*, Truax also elaborates on the idea that the use of environmental recordings in electroacoustic music does not classify it as soundscape composition, but rather that the recognition of the context that the environmental sound retains is acknowledged, preserved, transformed, enhanced or exploited by the composer of the soundscape works (2001, p. 237).

Abstract sound material that does not directly link to real-world associations can still be organised in such a way that it creates an imaginary world where the composition could be

structured so that the sound materials communicate their relationships with each other. These relationships can be established in terms of spatiality and when considering Denis Smalley's indicative fields which are rooted in the listener's multimodal perception of their everyday lives (2002). These can be considered among the variety of electroacoustic techniques that Truax indicates composers can use to expand the communicational scope of their composition beyond a seemingly literal representation of actual soundscapes (2012, p. 196). An example of such use of abstract material can be heard in Truax's *Riverrun* (1986) where the sound material is mostly synthesised, while it uses the metaphor of a river as the main organisational principle for the synthesised material. Truax mentions that, as soundscape compositions can incorporate abstract elements into their language, they can also be further developed to create entirely imaginary spaces that transform real-world experiences into hyper-realistic representations (2012, p. 197). I investigate this concept of hyper-realism further in the analysis of *Drones, bells and bowls*.

Another perspective on the notion of the centrality of context in soundscape music can be found in Truax's artist statement. He speaks of the importance of incorporating factors that are usually external to a composition, such as the context in which it is heard, real-world acoustic environments and extramusical references, into his work. This can be seen as an extension of Westerkamp's environmental listening, where listening in and to context is at the centre of the aim of soundscape composition (2002). In Truax's artist statement, he writes:

> [Soundscape composition] involves listening to the world differently, being constantly aware of its outer complexity, and finding ways in which that complexity can inform what we compose. Most satisfying is the way in which soundscape composition offers to re-engage listeners with something they already understand, but often haven't thought much about. By heightening their experience of the all too familiar, or taking them on a voyage into imaginary or idealised soundscapes, I hope to revitalise the listener's connection to the real world, as well as my own. (2007, p. 189)

Arguably, much of what Truax speaks about could be discussed in terms of the notion of place as outlined in the first half of this chapter, especially the fact that a sense of place could already be instilled in the listener but highlighted by a composition. Truax's idea of connectedness to the environment resonates with the core of Norman's argument of emplacement through the engagement with the metaphors of place-making through music.

The active engagement of the listener is at the centre of soundscape composition and is caused by the type of listening that such works can encourage. Soundscape is often associated with environmental music and is as such music that forms a background upon which more important events can take place. The intention of background music is, however, completely different from soundscape composition; the former can serve as a background that can be ignored by what Truax calls the *distracted listener*. He points out:

> [E]arly examples of soundscape compositions from the World Soundscape Project were designed to engage the listener in a more active form of listening. These works would often bring the listener's existing relationship with everyday spaces into a sharper aural focus, both in listening to the composition and in daily life. (2012, p. 199)

Soundscape composition framed in this way seems to place value on listening practice and context-specific environmental awareness and could suggests a rather utopian view of the role of sound in our apprehension of the world around us. Such an attitude can be read into the literature and is often where the critique of soundscape lies. The concept of soundscape composition naturally evolves as composers find new ways of engaging with the environment through musical practice, but it is useful to return to its origin momentarily to see where some of these problematic areas lie.

Shafer, along with coining the term *soundscape,* also coined the term *schizophonia*. The latter refers to the separation between sound and its electroacoustical transmission and reproduction (Schafer, 1993, p. 90). In broad terms, it can be used to refer to sound mediated through the recorded medium as well as sound transmitted over networks, such as radios, telephones and recorded media in general, where the source of the sound is no longer part of the environment it is ultimately heard in. Robin Parmar critiques this notion of the *schizophonic:*

> While Schafer performs a valuable service by estranging us from what contemporary society takes for granted, he is unable to greet the schizophonic with joy, as his use of a term evoking schizophrenia makes obvious. Rather, he wishes to rebuild a (perceived) lost connection, by way of the 'preservation of soundmarks', 'repairs to the soundscape', 'imaginative excursions into utopia', encouraging nature to 'speak for itself', and 'the recovery of silence as a positive state'. (2012, p. 204)

Parmar argues that Schafer's goal is to bring together the acoustical and the physical by reconditioning the listeners' relationship with and attention to sound but that Schafer approaches this from a nostalgic point of view that does not take into account the contemporary milieu. A milieu for which Parmar argues schizophonic is the norm (2012, p. 204).

Referring back to Chaves and Rebelo (2012), if work is integrated tightly with context, which focuses on the notion of place as multi-layered and which invites evocative listening that is tied to the experience of everyday life, then excluding the schizophonic from the soundscape would in fact neglect the mediated sound experience that soundscape composition can draw upon as well as the pool of memories, experiences and images that are evoked in the mind of the listener. Taking the idea of the schizophonic as something to avoid in soundscape composition would put it at odds with electroacoustic music in general and thus exclude a whole range of sounds and even a large portion of what can be considered the contemporary sonic environment. Truax in fact also suggests that electroacoustic music itself can be listened to as if it were a soundscape (2008, p. 106). He also suggests that this idea is not entirely unprecedented in the sense that various forms of audio communication, such as radio and background music, evolved to create extended artificial environments that have become commonplace.

Another critique of Schafer centres around the repositioning of the subject-object relationship, as expressed through the role of the listener to the soundscape:

> Significantly, the sounds Schafer considers are situated through an act of attention or capture. 'To record sounds is to put a frame around them. Just as a photograph frames a visual environment, which may be inspected at leisure and in detail, so a recording isolates an acoustic environment and makes it a repeatable event for study purposes' (Schafer, 1973: n.p.). It is clear from this that a listening culture provides a necessary context for any soundscape. But it is equally clear that 'place' has been aestheticised in this process. The soundscape creates distance between us and our environment; an interface has been constructed where before there was none. (Parmar, 2012, p. 204)

This aligns with one of Ingold's critiques of the notion of soundscape where he compares the idea that soundscape is to sound what an image is to the visual, reducing the environment to a recording that is to be auditioned or an image of a landscape to that which is to be viewed (2011b, p. 137). This suggests a subject-object relationship that is hierarchically

defined by creating a distance between the observer and the observed rather than recognising that the environment is not separate from the observer and that the observer is inherently part of the environment.

In my work, I aim to make my position on this issue clear by considering the role of the listener in the experience of the work. I do not wish to represent soundscapes as phonographic artifacts, but rather wish to make it apparent that the experience of the work, of which the recorded material only forms one part, is where the soundscape occurs. Similarly to the way in which López (2004) rejects the idea that field recordings can ever be only representational, I argue that the presentation of such material always functions in the same way. The act of presentation along with all the constituents transcends the ability for it to be only representational. The experience of the work lies between the listener and the presented sound; it involves the listening space as well as the musical space and the apprehension of both simultaneously. Whether or not these aspects are in the composer's control does not reduce the profound effect that they have on each other and on the experience of the work.

The connection between these aspects highlights and simultaneously offers a solution to a problem that Truax (2012) identifies with the way in which referential material is presented in soundscape compositions. This idea gives rise to a problem that the composer has to face where all the elements of a composition cannot be controlled to the same degree but that a great part of the meaning of a piece lies within the context in which it is heard. He refers to this as an aesthetic dilemma prevalent in soundscape compositions. He furthermore discusses how the meaning of a composition is often found within the specific sound material, the way in which it is structured and the relationships between different components of the composition (Truax, 2012, p. 194). Sometimes the composer has his or her own motivations for different compositional decisions that may not be clear to the listeners without them first knowing about these motivations. Truax states that external elements influence the meaning of the composition, such as the acoustics, psychological effects, political associations of the space in which the piece is heard or the soundscape of that particular place (ibid, 2012, p. 194). He refers to this as the context and to the internal elements as text. He places these as polar opposites on a continuum and argues that composers should have a greater focus on context and should integrate context more tightly into their work.

In my view, this aesthetic dilemma could also be viewed as a strength of soundscape composition, one that gives rise to many interesting possibilities when composing soundscapes for specific contexts. As Truax (2012) suggests, and in line with Casey (1996), this interaction is inevitable, and I would argue that it should rather be acknowledged as a feature of soundscape composition.

I would also argue that, in some cases, text and context can deliberately be placed in dialogue with each other and should not necessarily be seen as opposites on a continuum through which a composer has to navigate. This context includes the soundscape of the specific place that would be known to the composer, the social significance of that space as well as the typical emotions and memories that such a space would invoke in the listener. This approach brings the text and context closer together. What remains is how a composition plays with this relationship. This concept requires further investigation in terms of how a space can determine how a listener relates to the sounds that they hear within that space. The material for composition would certainly be considered in terms of this effect as well as how the sounds relate to the space. Defining a space that a composition would be listened to outside the concert hall places the work slightly out of the typical sphere of traditional presentation practice and places it more in the area of sound art and audio-visual installation presentation practice. The dilemma that Truax refers to could easily be extended in the context of sound art as it adds yet another layer of indeterminate parameters to the composition, such as the form of a musical work.

I would like to argue further that the function of such soundscape composition is not only to create a sense of place and interact with an already existing sense of place but also to use place as raw material for soundscape composition, not in the sense that certain source sounds conjure up certain ideas around place in its inevitable referentiality. Place thus becomes an active domain for traversal through electroacoustic composition. It also becomes a structural element of soundscape composition. Just as a work of sound that is played back in a space without care for the imposed sense of space that the listening environment imposes on the work differs from a work that actively uses space as a formal component of the work, I would like to argue that this active incorporation of place as a compositional domain provides new possibilities in soundscape composition and electroacoustic composition as a whole.

A Frame Through Which to Enter Place

> Following the lead from Merleau-Ponty[5], Casey (1996) examines how to be in place is to know, is to become aware of one's very consciousness and sensuous presence in the world. From there, Casey argues that the experience of place is no secondary grid overlay on the presumed primacy of space. Rather, he contends, place is the most fundamental form of embodied experience – the site of a powerful fusion of self, space and time. (Feld, 1996, p. 9)

In the case of my work, the self can be seen as the listener and composer, while the piece itself attempts to incorporate the listener and by default the composer as well as express the meeting of space and time. This is true if music can be seen as the articulation of space and time. These are, after all, the domains which sound occupies on a physical level. The work also illustrates that the self is an integral part of the composition and that context, which can be viewed partly as constituted of space and time, is a key factor in soundscape composition at least when the notion of place is foregrounded as Chaves and Rebelo (2012) have it.

My investigations of spatiality in and around electroacoustic music thus do not aim to view it as a primary feature of place, but rather to focus on it in recognition of its role in creating place. Space and time can be seen as a frame through which place can be experienced. The duration of the concert does not signal a beginning and an end to place, but rather serves as a frame in which an existing sense of place can be engaged with and in which a new sense of place can be formed. I, therefore, focus on spatiality firstly as a means to discover place for myself in the work and investigate place as a primary compositional domain in electroacoustic music and secondly as a means to give the listener a multitude of frames in which they can map out their own position and thus establish their own sense of place in their experience of the work.

To elaborate on the idea that place can be incorporated as a domain of compositional exploration I will look at theories centred on space in electroacoustic music. This will serve as a framework for mapping out my compositional approaches that aim to create, evoke and

[5] Phenomenological philosopher and author of *Phenomenology of perception* (Merleau-Ponty & Smith, 2018)

play with the senses of place. It will also allow me to connect attributes of my creative work with Norman's metaphors for place-making.

Chapter 3 – Mapping out the Soundscape

Space is an integral component in the formation of place. Spatiality is also a primary feature of electroacoustic music. The exploration of different aspects of space in electroacoustic music as well as the identification of key concepts surrounding space form a framework to enable the discussion of the practical work in relation to the formation of place.

As a starting point, it is useful to consider that spatiality can be understood on different levels in a musical experience; the listening environment itself contributes a significant portion of what the listener experiences regarding the spatiality of the music. I was privileged to have access to the Great Hall prior to completing my composition. I had always envisioned a space similar to the Great Hall for a presentation and, as soon as the venue was confirmed, I could explore the space while considering some of its acoustical aspects. In the next chapter, I will elaborate on this in terms of how it influenced the process of spatialising the music in the hall – the space itself played an important role in defining the experience of the music.

The first section of this chapter thus deals with principles relating to acoustics and sound localisation to establish a set of ideas from which a discussion of the *Sound Spaces* can flow in the analysis. It is important to note that I do not aim to undertake an acoustical analysis of the Great Hall itself, but rather want to elaborate on acoustical concepts that feed directly into how a listener experiences space in general. The second section serves as the groundwork to effectively analyse the work in reference to the theories on place discussed in the previous chapter. I use Smalley's concepts of space in electroacoustic music and point out its function in establishing these ideas around place. I give a brief overview with particular focus on *perspectival space* and *source-bonded space* (Smalley, 2007).

The Listening Space

When thinking about the listening space in terms of how it may shape the listener's perception of the work presented in it as well as the interactions that may arise between the musical space and the listening space, one must consider the acoustic makeup of the space. Other aspects, such as the perception of the space as a place and in particular the concert hall as an archetypal space, are of equal importance and have already been discussed in the

previous chapter. In the physical, the hall has a particular design related to aspects of this archetype, such as its ability to reinforce and distribute sound projection from the stage onto the seating area where the audience is situated. Acoustic design often sets out to give the listener an equal listening experience regardless of their position in the designated seating area. Other attributes of such a listening space are often centred on containment and isolation. The Great Hall in particular is surrounded by classrooms and offices that often value silence and thus a frequent feature of the concert hall is that it contains any sound that is produced in it to maintain the silence surrounding the building. The building itself is also situated in a central point on campus and experiences a lot of traffic from students walking to their classes or taking breaks on the steps leading into the building, constructing a soundscape that the hall sets out to isolate itself from.

Any enclosed space carries with it an acoustic signature related to the shape and size of the architectural space. The materials in the space can also affect the shape of this signature. The most fundamental part of the acoustics of a space can be understood in relation to the dimensions of the room. From a listener's perspective, the difference between small and large spaces is clear purely based on how a space responds to sound. Any sound presented from any point in the space can be broken into three components that will affect the listener's perception of the size of the space. As sound is being projected from a loudspeaker, it propagates in all directions; even though sound becomes slightly more directional in the higher frequency range, it eventually spreads around the space as well. This propagation of course happens quite instantly in terms of how humans can perceive it. As the sound propagates, it arrives at the listening position and the sound waves that arrive there first are defined as the direct sound; the direct sound essentially travels the shortest distance between the sound source and the listener. The sound that passes the listener soon arrives at a boundary in the room. Some of the energy will be transmitted through the boundary, some energy will be absorbed and the remainder of the sound is reflected back into the space. The amount of reflection occurring at a boundary depends on various factors, including the material that the boundary is made of as well as any acoustic treatment that has been applied to it. As the reflections travel back into the space, they can either pass the listener and interact with another boundary or end back at the listening position. By the time that the sound arrives at the listening position, the listener would have already heard the direct sound. In this case, one of two things can occur: The reflected sound is either perceptually fused with what the

listener has already heard or it is perceived as a separate sonic event. The balance between these lies in a psychoacoustic effect known as the *precedence effect*.

The precedence effect theory was first developed by Helmut Haas and is often referred to as the *Haas Effect* (1972).

> The human auditory system combines the information contained in a set of reduplicated sound sequences and hears them as though they were a single entity, provided (a) that these sequences are reasonably similar in their spectral and temporal patterns and (b) that most of them arrive within a time interval of about 40ms following the arrival of the first member of the set. (Benade, 1985)

> At the onset of a sound accompanied by reflections in an unfamiliar setting, it appears that we hear everything. Then, after a brief build-up interval, the precedence effect causes our attention to focus on the first arrival, and we simply are not aware of the reflections as spatially separate events. (Toole, 2017, p. 172)

This lack of awareness is illustrated in Figure 2 where (a) indicates the onset of the sound and accumulated reflections at the listening position and (b) indicates the perceptual shift towards the direct sound regarding its localisation.

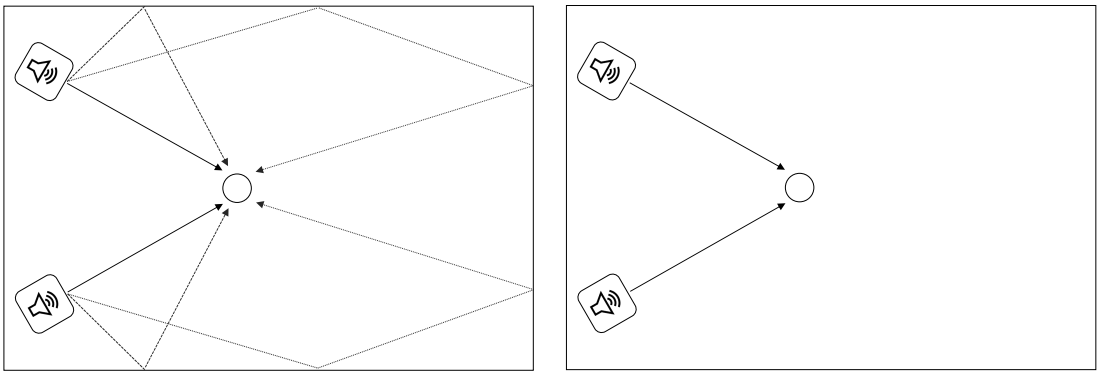


Figure 2 – Illustration of precedence effect

There will be differences between the reflected and direct sounds due to the interaction that occurs at the boundary where the sound is reflected back. This is due to the nature of the material at the boundary which, in addition to reflecting the sound back into the space, will also absorb and transmit components of the sound. The result is a spectrally similar sound that has slight differences due to the interaction with the boundary's material. Although the direct and reflected sounds will be perceptually fused in terms of appearing to originate from a single location in space, due to the spectral differences being negligible as well as arriving

within the 40 ms window, the reflected sound does have a noticeable effect on the direct sound. As the time of arrival at the listening position is slightly different, the phase relationships between the direct and reflected sounds will be changed. Constructive and destructive interference will be spread across the frequency range as it relates to the different wavelengths and the amount of delay between the direct and reflected sounds. There is a general pattern, known as comb filtering due to its visual shape, which describes how the phase relationships are distributed across the frequency range.

To illustrate this, Figure 3 shows the spectrum of white noise representing the direct sound without any reflected instances of the sound, while Figure 4 shows the kind of interaction that would occur between the direct and reflected sounds. The latter is a computer-generated simulation of comb filtering which I created by combining the original white noise signal with a duplicate of the signal delayed by 10 ms. In reality, the resulting pattern will be much more complex since there are many reflection points in real-world spaces. The reflected sound in real spaces will also be affected by the absorption that occurs at the boundary and thus the effect will not be as pronounced and dramatic as in the simulated version pictured in Figure 4.

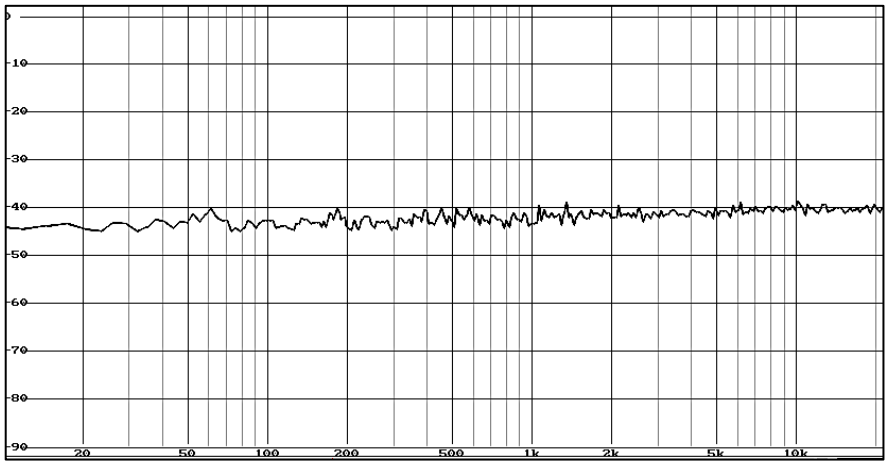


Figure 3– White noise spectrum

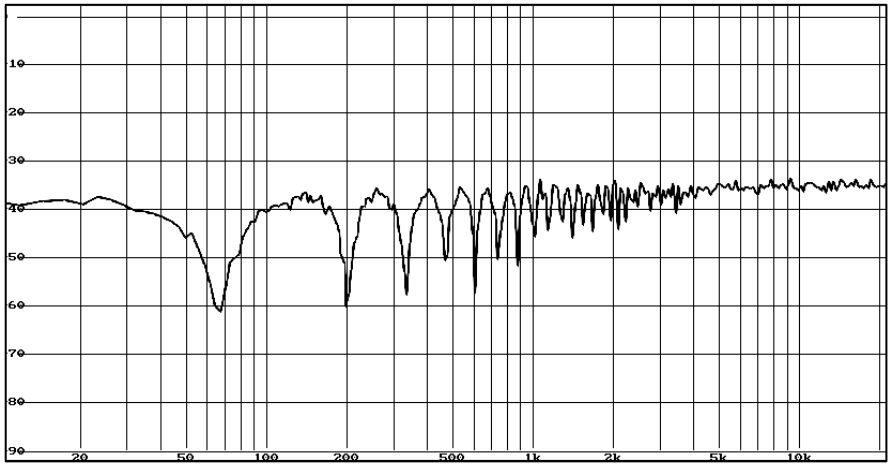


Figure 4 – Interaction between direct and reflected sounds – comb filtering

Comb filtering depends greatly on the position of the listener in relation to the sound source since the amount of time that the early reflections take to reflect back to the listening position is determined by the distance between the listener and the boundary where the reflection occurs. The longer it takes for the reflection to return to the listening position, the lower the comb filter will appear in the frequency spectrum. Comb filtering is thus responsible for indicating how far away boundaries are from the listener, giving a kind of spatial cue that forms part of the perception of space.

Reverberation in enclosed spaces can be considered in the following way: In a room, the direct sound, the early reflections and the late reflections eventually accumulate into a unified reverberation field. Since all these instances perceptually fuse together, the result is perceived as a unified field called the reverberation field. What the listener ends up hearing is determined by all these factors and the occurrence of comb filtering relates directly to their position in relation to the sound source.

> In enclosed performance spaces, a new phenomenon appears: reverberation, which is caused by sounds being repeatedly reflected from all surfaces and objects in the room. If the sound source produces a sustained sound, a steady-state reverberant sound field builds up to a level where the sound energy is absorbed at the same rate at which it is being created. When the sound source ceases, the reverberant sound field decays. The time it takes to decay by 60 dB is called the reverberation time (RT). (Toole, 2017, p. 43)

These are only a few aspects of acoustics that contribute to how a space is experienced, but they can already account for a large portion of how the acoustics of space greatly influence how music is heard in that space. It also forms the basis upon which spatial

illusions can be created inside the musical space. With an awareness of the acoustics of the listening space, the illusions inside the musical space can be more accurately produced, and an interplay can occur between the listening space and the musical space where certain acoustic properties may be highlighted, exaggerated or contrasted.

Space in Electroacoustic Music

I shift my focus here to musical space, which is space as created within the musical work, and specifically to concepts of space in acousmatic music composition. As a basis, I consider Smalley's concept of space, published as an extension of his concept of spectromorphologies (1997). In particular, I look at perspectival space as this relates to the previous concepts of acoustic space as perceived from the listener's vantage point as well as source-bonded space, which is the spatial cues that recorded sound carries with it. This will serve as a framework to analyse *Sound Spaces* in the fifth chapter.

Smalley proposes that space can be made the central point from which to view an electroacoustic musical work and that it can reveal much about the acousmatic image that is created in such works.

> We can use spatial concepts to investigate soundscapes, source-bonded approaches, and more 'abstract' or 'abstracted approaches', celebrating the unique richness of the only aesthetic medium that can truly explore sonic space. But above all, acousmatic space-form is centred on us, not only as receivers and perceivers, but also as producers and inhabitants of space. (Smalley, 2007, p. 54)

The use of space as well as the analysis thereof in Smalley's writings developed from his concept of indicative fields and their various relationships. Indicative relationships form part of three subject-object listening relationships that listeners have with the sounds being heard in an acousmatic context, although these relationships are not exclusive to acousmatic music and can be applied to instrumental music as well. These relationships can be understood in terms of Pierre Schaefer's concept of listening, linking to the first mode of listening what Michel Chion (2008, p. 28) calls semantic listening where the listener processes sound in relation to the meaning it carries, based on what the sounding object is. Smalley refers to this as *indicative listening*. Smalley builds his notion of indicative fields on Simon Emmerson's concept of mimesis in that it relies on the sound material's quality of

imitation or representation of aspects of nature and culture (1996, p. 84). He identifies a range of different indicative fields; however my focus is the indicative field of space.

For Smalley, the indicative relationship is about sound as a message or information about environmental action, events and occurrences (1996, p. 82). This seems to be particularly relevant when looking at the analysis and reception of soundscape compositions as it deals with extrinsic qualities of sound: what the sound brings to the composition apart from its relation to the rest of the material in the work. Of course, this does not mean that the intrinsic attributes of the sound are not of equal importance to the work. When looking at indicative networks formed in the interaction between indicative fields, this will become apparent. Smalley indicates as follows:

> Indicative relationships […] are largely regarded as a trivial and inferior attitude to sounds when it comes to considering the sounding materials of the art of music, where interactive relationships are considered psychologically more rewarding. However, if we do not confine the notion of the indicative relationship to mere messages, events and information but extend it to include a wider frame of references to experiences outside and beyond music, we immediately penetrate both more extensively and deeply into the relationship between musical experience and our experiences of living. (1996, p. 82)

Thus, the indicative relationship goes beyond the experience of the sound itself and extends towards the non-sounding experience of living. This resonates particularly well when viewed through the lens of Norman's metaphors of place-making where everyday life experience is at the core of the listener's ability to be emplaced in a musical work. Chaves and Rebelo (2012) also draw fundamental links between the listener's experience of everyday life and how that informs how a musical work is listened to.

This also forms the basis of Smalley's concept of space-form that takes an analytical approach to defining the spatial relationships within a work as well as how the form of a work can be understood through this view.

The Musical Space

Smalley's (2007) development of a framework for viewing the function, centrality and spatial zones in electroacoustic music can serve as a way to analyse the spatial characteristics

and implications of my work. Furthermore, it can be tied to the potential that sounding materials have to evoke senses of place as well as provide a basis for discussing and discovering the compositional implications it reveals on the active incorporation of place and place-making processes in electroacoustic music. His concept of space-form (Smalley, 2007) is perhaps the most comprehensive approach to space in all his writings, even though it was developed from different views of space related to his other theories, such as *spectromorphology, spatiomorphology* and *indicative fields and networks*.

In electroacoustic music, the musical space, namely the space intrinsic to the musical work, can be analysed via three zones: Source-bonded space, perspectival space and spectral space. These spatial zones are defined by various categories first identified by Smalley as part of the indicative field of space. These spaces all operate on different levels and somewhat depend on the mode of listening employed by the listener. They are, however, always present, even though their exploration is not always embraced as a primary strategy towards composition. The spatial zones also do not exist in isolation and their interaction and relation to each other can be defined by the composer. The listener can be orientated towards a specific spatial zone by shifting the spatial focus in the work.

Moreover, these spatial zones can be thought of as spatial qualities that are intrinsic to the musical work and do not include the listening space. Smalley (1996) points out that all these spatial zones are inevitably perceived in relation to the listening space and that musical space is always superimposed onto the listening space. He also states that the composer usually does not have control over the ultimate listening space and that the listening space often differs from the space in which the work was created (1996, p. 91). However, in the case of *Sound Spaces,* the listening space was known beforehand and contributed to the spatiality of the musical experience in a significant way. Smalley also points out that these spatial zones are never occupied only one at a time, but they are always seen in relation to each other; these zones can be brought to the forefront of the listener's perception to varying degrees.

When looking at the overall form of a work viewed from a spatial perspective and focusing on the spatial zones that a work occupies, Smalley (2007) uses the term *holistic space* and states that it can be viewed independently from temporal form. Smalley further describes *holistic space* as an analytical stance, realised by mentally amalgamating an array

of spatial forms into a unified spatial view and *space-form* as an approach to musical form and its analysis, which privileges space as the primary articulator (2007, p. 55–56).

Source-Bonded Space

Source-causes create space and are bearers of space. The sounds of a frog, a cricket and water create an image of an outdoor space at a particular point in time. Smalley (1997, p. 110) originally developed the term source-bonding to explain the intrinsic and extrinsic relationship that a sound source enables in electroacoustic works. Intrinsic refers to the relationship between sounds within the musical work, while extrinsic refers to things, natural and cultural, outside the music and likewise how they can contribute to the understanding and reception of the work. Smalley also argues that the extrinsic gives rise to meaning to the intrinsic aspects of the music.

Source-bonded space occupies a position on a continuum between nature and culture, where the purest form of natural-based domain includes those where no human presence can be detected. Initially, Smalley used this framework in relation to sounding models in *The Listening Imagination,* where he arranges the material used in electroacoustic music between nature-based and culture-based sound sources (1996, p. 96). Later, Smalley defined source-bonding as "the natural tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared or associated origins" (1997, p. 110).

In the cultural domain, source-causes are produced by human activity either intentionally, as in the case with music-making, or unintentionally, where the sounds produced are by-products of human activity (Smalley, 2007, p. 38).

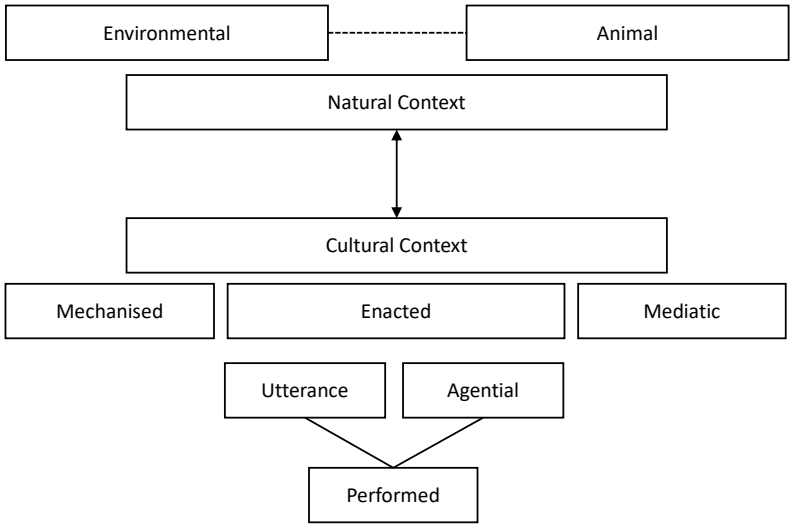


Figure 5 – Graph of source-bonded space from Smalley (2007, p. 38)

From Figure 5, one can place *enacted space* under the cultural source-bonded spatial zone that depends on activity. Such activities can include vocalisations that form an *utterance space* or the physical movement or interaction with an object by a human agent to form *agential space*. In the example of someone playing a musical instrument, the *enacted space* can be classified more appropriately as a *performed space*. Such a space carries with it a particular kind of spatial geography that can in one way be viewed as what Emmerson identifies as space-frames relating to the musical event and its production or reproduction (1998, p. 138). *Mediatic space,* relating to sound produced through media such as radio, often includes utterances, including voice-overs and announcements. The production of sound is once removed from the original source and/or mediated through technology. *Mechanised space* occurs in the absence of a human agent, such as unattended machinery producing sound, and thus also creates an *enacted space*.

All the spatial zones under *enacted space* contribute to the cultural domain of *source-bonded space*. The concept of *source-bonded space* also applies to abstracted forms of sound since "the kinds of spatial forms and organisation found in the natural environment could be taken on by spectromorphologies whose surface identity might appear tangential in source-cause terms. The idea of source-bonded space is never entirely absent" (Smalley, 2007, p. 38).

It is also worth noting that there is a relationship between source-bonded space and spectral space, as already mentioned. The ability to make sense of spectral space relies on an understanding of sound in everyday life as is made clear by theories of surrogacy and mimesis. However abstract, there is always a sense of a cause, even if only by the most remote relation between the spectral shape of a sound and the identification of a pattern in that shape that can be related to something known.

Natasha Barrett (2002) writes about strategies for composing spatiality in music and identifies numerous ways in which composers can work with space. Among these, she distinguishes between the *illusion of space* and the *allusion to space*. The illusion of space can be said to operate in what Smalley refers to as perspectival space and anything that relates to the transformation and manipulation of these aspects of spatiality. Barrett also notes that these relate to "spatial laws", which I have discussed in the first half of this chapter, and how those laws can be drawn on to create the illusion of space in the material. This would include the use of artificial reverberation, comb filtering, delays and echoes. What Barrett refers to as the *allusion to space* is directly linked to Smalley's concept of source-bonded space. "Under such situations the 'listening imagination' is important: composers need to make assumptions concerning aural interpretation, and listeners have a more active role in the experience" (Barrett, 2002, p. 315).

This idea is of particular relevance when linked to Norman's metaphors of place-making. If listeners have to play an active role in creating a mental image of a space as they engage with the work, it enables them to map out their place in relation to what is presented to them in their sonic environment that they now have to make sense of. The listeners have to find their place in the work as they apprehend the music from their vantage point. More generally this question of interpretation is true for source-bonded sound, especially when the source-bonded sound has undergone processes of abstraction. The relationship that the listeners form with the sound and the type of source and consequently the type of space that it bears become more difficult for the composer to predict. This ties in with Truax's dilemma of the balance between text and context or, in this case, what is represented in the work and what the listeners perceive to be represented in the work.

The same can be said for illusions of space created in musical works. It can be argued that the way in which the listeners comprehend such material, for example buying in to illusions of space, is through their prior experience and accumulated knowledge of physical acoustic spaces. This ultimately lies in the listeners' experience of the world as a moving body. I do not regard this as a particularly pertinent problem in my work as the use of material and the purpose of its abstraction generally focus on other aspects of the work that do not solely rely on the listeners' recognition of the sound in one particular way. At the same time, the ambiguity that can arise could serve as a mechanism to incorporate the listeners into the work as active participants.

In my work, the assumption that a particular source-bond will be apparent to the listeners is avoided when the degree of recognisability shifts. Where source-bonding is direct, as in the case with material presented without much alteration and processing as well as material that is commonplace and derived from everyday life, I assume a certain recognisability on the part of the listeners; however, where material has been abstracted and processed, the focus of the work shifts away from the need for the sources to be recognised. This can be expressed in relation to Emmerson's language grid (see Table 1) regarding material either derived from or relating to sound materials (1986). When approaching non-musical sound integrated into electroacoustic music, Emmerson makes a distinction between sound that is used in respect of its referentiality to the world or its ability to imitate an auditory event. This mimesis is further expanded into timbral mimesis, where the sound quality and tonality are the primary aspects that relate it to the original cause, and syntactic mimesis, where the rhythmical or temporal and pitch or spectral characteristics are being imitated in the electroacoustic work. Emmerson refers to this use of referential material and patterns as *mimetic discourse*. This is opposed to *aural discourse,* where the quality and nature of the sound in the work in a more abstract sense assume primacy above the sound's ability to evoke images extending outside the music itself. Furthermore, the organisational principles of the music are considered and range from *abstract* to *abstracted syntax*. Simply put, when the organisation of the material is driven by a system that does not directly relate to the material being used and is imposed onto the material, it is using abstract syntax. If the material itself somehow guides the organisation or is derived from the material, it uses *abstracted syntax*. Emmerson constructs a two-dimensional grid with discourse on the vertical axis and syntax on the horizontal axis.

Abstract syntax			
Combination of abstract and abstracted syntax			
Abstracted syntax			
	Aural discourse dominant	Combination of aural and mimetic discourse	Mimetic discourse dominant

Table 1 – Language grid from Emmerson (1986, p. 42)

The language grid in Table 1 is intended to be applied to the overall material use and organisational principles of a work and will certainly lose its usefulness if applied to every single event within a piece. In *Sound Spaces*, I apply the language grid to different sections and pieces as a way of determining how it relates in the orientation of the listeners towards specific spatial zones. For instance, it can highlight when source-bondedness cannot be assumed on the part of the composer, indicate when the discourse shifts from mimetic to aural, and indicate the dominant spatial zone in relation to the organisational principles employed in a section or piece.

Smalley also highlights that the listeners' comprehension and identification of different spatial zones rely on their ability for transmodal perception (2007, p. 39). Experience of electroacoustic music where spatiality is identified always involves the listener's body as the central point from which to view the acousmatic image.

The Body in Space

The listener's body is always involved in the experience of electroacoustic music and by implication all the senses are active in the process of perceiving the work. Even when no sound sources are visible, the senses always combine in the perception and understanding of the aural work, making the perception of music a transmodal experience.

> Our sense of texture is learned through vision and touch as well as sound; our experience of the physical act of sound making involves both touch and proprioception; spectral motion, and the movement and distribution of sounds in

> space relate to our own experience of physical motion and cultural and natural environments. (Smalley, 2007, p. 39)

Thus, the human body is always at the centre of perception as listener. "Transmodal linking occurs automatically when the sonic materials seem to evoke what we imagine to be the experience of the world outside the music, and in acousmatic listening" (Smalley, 2007, p. 40). This is evident in the case of gestural surrogacy, where a physical act is associated with the resulting sound, even if the level of surrogacy is remote. It can also be true for materials with syntactic-mimetic links to extramusical events.[6]

This is in line with another of Ingold's critiques of soundscape, namely that the term itself suggests an artificial split of the senses. "In ordinary perceptual practice these registers cooperate so closely, and with such overlap of function, that their respective contributions are impossible to tease apart" (Ingold, 2011b, p. 136). There is no need to assume that soundscape composition aims to occupy only the attention of one of the senses, but transmodal engagement can be used as a feature of soundscape composition as a way of incorporating the listeners in the work through their embodied experience. If this is actively called upon and integrated in the work, it allows for the ability to call for active participation in the work, even when non-physical, as Norman suggests when referring to the metaphorical movement of the body. The compositions themselves allow for such movement, encourage it and enforce it, leaving gaps for the listeners to build bridges over as well.

In relation to space, the listeners' vantage point is defined by their physical location and is where space will be perceived from. Its perception always occurs in relation to the listeners' perspective. Therefore, space can be approached analytically and compositionally from this perspective as relationships between the musical space and the perceived space can be drawn.

Perspectival Space

Perspectival space relates to sound and its position and movement in space as perceived from the listener's vantage point. Thus, it can more directly be accessed in the meeting point

[6] Emmerson's language grid (1986)

between the spatiality in the musical work and the listening space it is projected into. It is an amalgamation of the listening space and musical space as perceived by the listener. The framework that Smalley puts forward relating to perspectival space is also useful from an analytical viewpoint when discussing the spatial qualities of a work and I will use the framework as such in the analysis of *Sound Spaces*.

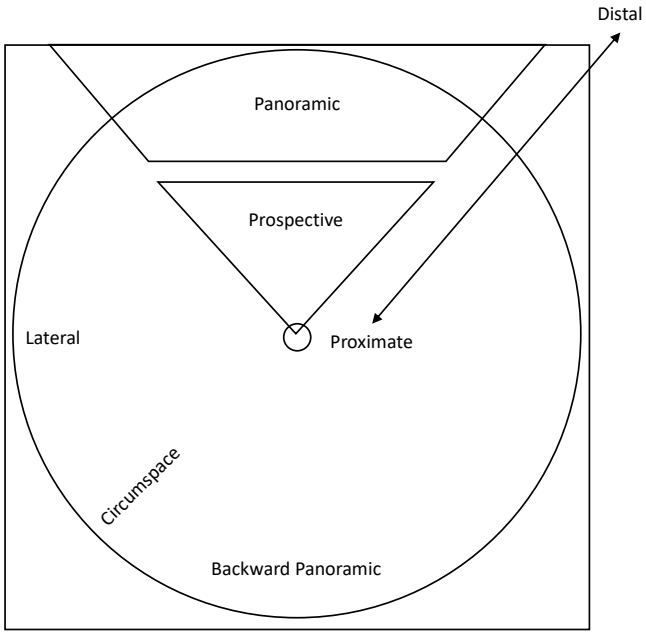


Figure 6 – Graph of perspectival space

As seen in Figure 6, perspectival space is broken into a number of categories, each relating to the listener as the centre of the experience and how listening could be shifted outward from their egocentric space. What occurs directly in front of the listener and that which relates to their visual field is what Smalley refers to as *prospective space* (2007, p. 48). This space can extend forward and outward beyond the image of the loudspeakers to form *panoramic space*. When using a diffusion method that has surround capabilities, it is possible to move sound outward to the sides of the listener into *lateral space*. Extending the sound towards the back from prospective space, thus surrounding the listener, puts it in *circumspace*. The acousmatic image, as Smalley describes, strongly relates to the visual sense, and he argues that the listener places more importance on sound in front of them as it occupies their visual field. It is therefore not entirely amiss that there is no term in this framework to describe sound that shifts perceptual focus towards the back of a listener, since *circumspace* accounts mostly for sound that extends from the prospective space to surround the listener. In *Sound Spaces,* I used the back of the main quadraphonic system on numerous

occasions in a way that did not relate to what was projected in the front as a way to shift the listener's attention to the relationship between these two orientations.[7]

I would therefore like to coin my own term to describe sound that demands focus shifts toward the back of the listener: *backward panoramic space*. It might also be interesting that there is no antonym for *frontal* that conveniently fits into this framework as proposed by Smalley. In addition, I would like to add to this framework a term to describe the perceived space that is activated when using the secondary systems outside the hall.[8] I use *extended space* to refer to situations where panoramic, lateral or backward panoramic space is pushed beyond the boundaries of the physical listening space.

Spatial Map

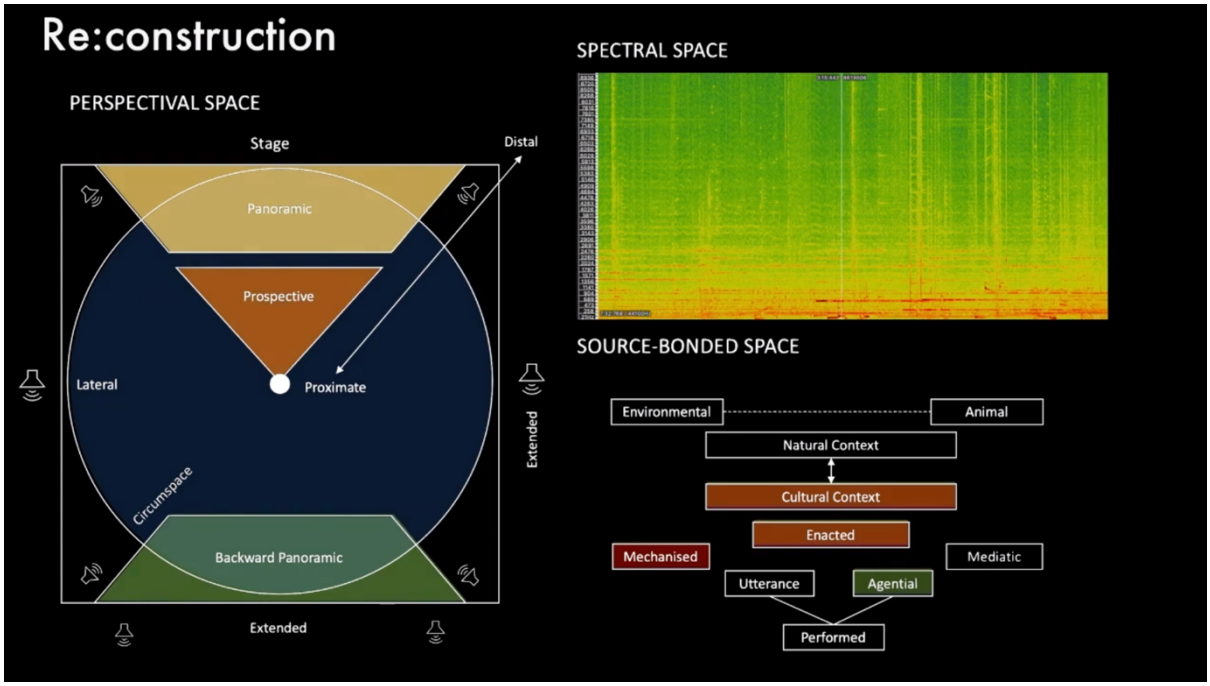


Figure 7 – Spatial map example

The spatial map is intended to illustrate the different aspects of spatiality simultaneously present in each piece and accompanies this dissertation in video format for each of the five pieces of *Sound Spaces*. The three zones identified as components of the holistic space are laid out on the map. The purpose of the map is not to provide a

[7] A more detailed explanation of how this system was set up and used follows in Chapter 4.
[8] The use of loudspeakers outside the hall is explained further in Chapter 4.

comprehensive view of the spatial zones occupied in each piece or to highlight every intricate relationship that might arise between different spatial zones, but rather to aid in the discussion on the multi-layered occupation and creation of space that might be present in each piece. It will assist in more easily making connections between the various zones. Perspectival space takes on the form of a simplified map of the concert hall, although it does not correlate directly with how sound was spatialised in each piece. The map rather indicates which zones of perspectival space can be viewed as dominant in each section, as it relates to the musical space as well as the occasions where the musical space interacts with the listening space. I have included the addition of backward panoramic space as well as the extended space that can recede into the corridors, foyer and behind the stage. Spectral space is expressed by a spectrogram display and is useful to get an overall sense of how spectral space is explored in relation to the other spatial zones. Source-bonded space is laid out in a similar way to perspectival space, indicating which spatial zone is most prominent in relation to the referential source material and processed sound that is used at any given moment.

Such a map cannot indicate the complex relationships that arise in the interplay between these spatial zones or between the listening space and the musical space. Therefore, the map should only be viewed as an aid that accompanies the written analysis of the work as well as the recordings of the musical presentation.

The way in which the pieces traverse between different zones of space is of great importance when considering the metaphors of place-making mentioned in the previous chapter. There is an interplay among source-bonded space, perspectival space and archetypal space in the concert hall that allows the listeners' attention and focus to move around in the different layers of space, thus emplacing them into the work and making them an active participant in creating meaning in the work. The centrality of the listener with respect to these spatial zones also emphasises the listening body as forming part of the musical experience and the formation of place.

Chapter 4 – The Creation of Place and Tools of Augmentation

With the notion of place as central to the work through the manipulation, transformation and augmentation of space, the system used for the presentation had to be set up in such a way that it supported these overarching ideas. The system is therefore specific to the work, while borrowing from more traditional configurations, such as a quadraphonic speaker arrangement. My approach to the configuration was to include the areas outside the hall, namely the foyer and the corridors on the sides of the hall, as part of the diffusion space. This was fuelled by the idea that such a system could facilitate an expansion of the listening space beyond the boundaries of the hall in a literal sense and establish conceptual links with the outside versus the inside area.

In addition, the system was designed so that real-time control could become part of the diffusion of the work. The decision to have real-time control over certain aspects of the spatialisation of the music was informed by two major factors. The first was that the translation of the work from a studio where it was originally composed to the hall where it was eventually presented is extremely difficult to predict. This is certainly the case with many electroacoustic musical works. Even though I spent time in the space to firstly undertake some acoustic measurements and again later to rehearse my work, the relationship between the musical space and the listening space is intricate and extremely complex. If a certain amount of control over how sound is spatialised is possible and the spatialisation can be tweaked and determined in real-time, it can result in an experience that brings the listening space and the composed space much closer together. The second motivation was to have a performative aspect to the presentation. Although there were no performers visible on stage, my performance in this case was more of a guided listening between the audience members and myself.

System Overview

The diffusion system for the concert consisted of three main components that were used in different ways throughout the concert. These three components were placed in different areas, the first inside the hall, the second outside the hall in the foyer, and the third in the corridors next to the hall. Having these three systems allowed me to diffuse the sound in three

different locations that would all be audible from inside the concert hall. Some of the doors between the hall, the foyer and the corridors were left open for the duration of the concert to allow sound to flow freely between these spaces. This gave me the significant ability to augment the spatial qualities of the music and push the sound beyond the boundaries of the concert hall. Another striking aspect of the system was that it occupied three acoustically different spaces and that these unique spatial qualities could co-exist and form a layered conception of space in a very direct way. The configuration is illustrated in Figure 8.

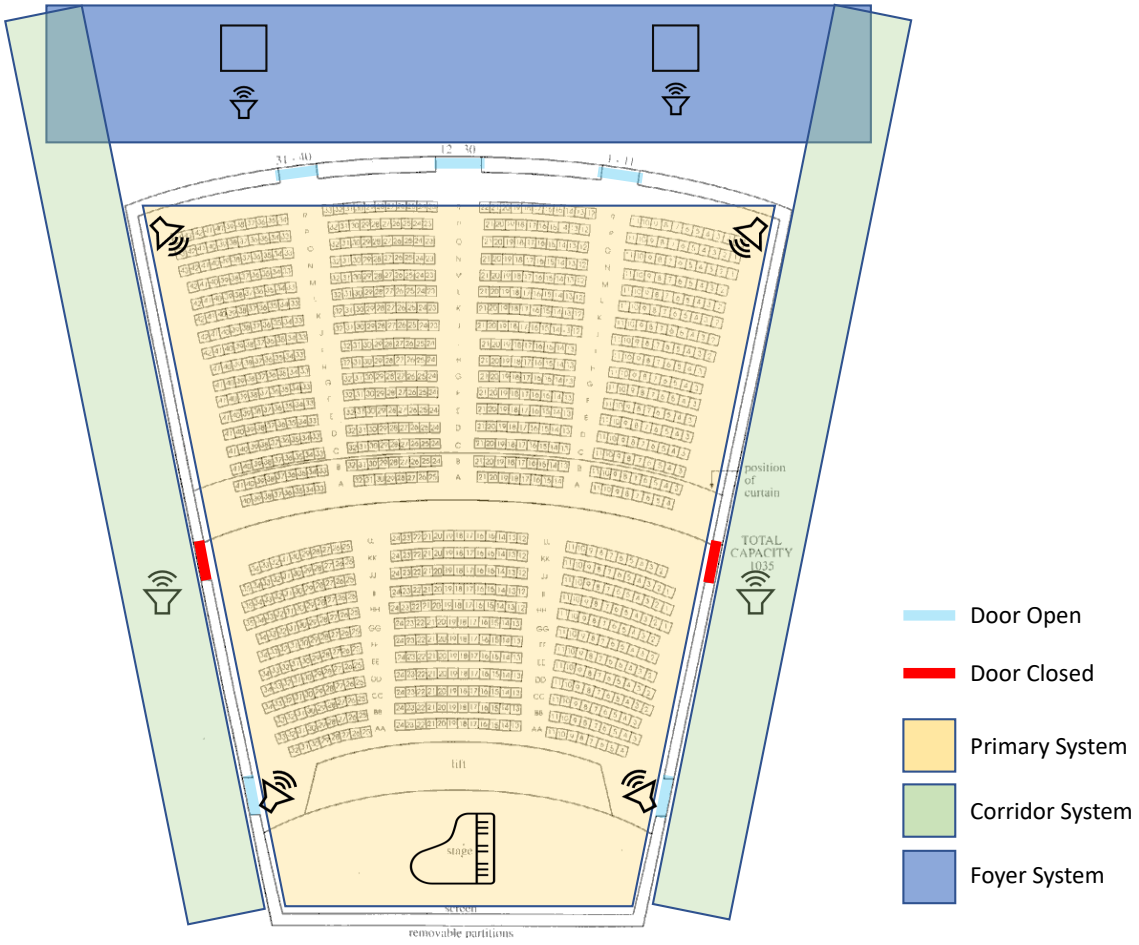


Figure 8 – Map of speaker layout in the Great Hall

The primary system was a fairly traditional quadraphonic loudspeaker setup inside the concert hall. The front speakers were situated next to the lift area in front of the stage and were angled to face the centre point of the concert hall. The rear speakers were situated in the far corners of the hall and were lowered to match the height of the front speakers as far as possible. The rear speakers were also angled towards the centre of the hall. The speakers used were RCF HDL 6A speakers that typically form part of a line array but were here used in a regular point source setup with only one speaker at each position. Although they are typically

used in conjunction with subwoofers, their frequency response, ranging from 65 Hz to 20 kHz, was adequate in covering enough of the range used in the composition and as such the speakers were used as full range speakers. The horizontal coverage angle was 100°, while the vertical coverage angle was 10°. Although the vertical angle was narrow, the positioning of the speakers in relation to the height of the audience area allowed for the sound to be reproduced sufficiently and offered a large enough sweet spot around this area. I refer to this quadraphonic setup as the primary system from hereon.

The second system consisted of two additional RCF HDL 6A speakers that were placed outside the hall in the foyer, facing away from the entrance of the concert hall. They were placed in front of marble columns, facing the column at about 1 m away. The purpose of this setup was to create immediate reflections from the marble columns in order for the sound to spread into the space and was necessary due to the speakers' limited vertical coverage angle. The scattering of the sound against the marble columns and in and around the foyer created a more uniform reverberation field as heard from inside the hall. The signal going to the foyer speakers were filtered with a high pass filter at 3000 Hz. The primary reasons for this were to emphasise the tonal characteristics of the foyer and provide a contrast between sound that was diffused into the foyer and sound that was diffused into the concert hall. There was also a 10 dB gain boost on these speakers to compensate for the loss of amplitude that the sound suffered by travelling back into the hall.

The third system consisted of a pair of subwoofers placed in the corridors next to the hall. Each subwoofer was positioned in the middle of the left and right corridors, facing the back of the concert hall. The doors closest to the stage were left open. The offset of the subwoofers was to allow for the sound to travel through the corridors, reflect, resonate and accumulate before making its way back into the hall. All signals sent to these speakers were filtered with a low pass filter at 80 Hz. Generally, the crossover frequency between the subwoofers and the main loudspeakers would be around the same cut-off point. My decision to keep it at 80 Hz instead of matching it up with the 65 Hz frequency response of the main system was because the subwoofers were not used as an extension of the main system, but rather as an independent system. The subwoofers' frequency response was most effective from this range of 80 Hz and lower. Any signal sent to these speakers would lose temporal definition due to the effect of accumulation ultimately resulting in much longer decay times

than what is actually present in the signal. This was regarded as a feature of the system rather than a limitation. This system was used sparingly and at specific moments during the presentation of the work and it was not intended to form part of the main system as subwoofers typically would in traditional configurations.

More details about how this system was used during the concert will follow in the next chapter, where I analyse the work in terms of its function and relationship to the theory outlined in the previous two chapters. The effect that the presentation of the work through this system had on the sound material will also be examined later.

The Playback System

The work was performed using Reaper 5, a regular DAW with flexible routing possibilities. The material played back on the primary system was pre-spatialised and preconfigured to the four channels, using one of three techniques. Firstly, I used regular amplitude-based panning. Secondly, I used point source spatialisation where certain sounds were played only from one speaker at a time. Lastly, different ambisonic panning methods were used to spread sound across the space. I briefly discuss the use of these methods further in this chapter under *Spatialisation Techniques*.

In addition to the pre-spatialised sound, certain elements of the compositions were sent to separate busses; one bus for the foyer speakers and one bus for the corridor subwoofers. In some of the pieces, these elements were present in these busses throughout the work; however, the volume controls of these busses were mapped to a hardware controller for real-time control where the foyer and corridors could be activated at will. The overall routing is indicated in Figure 9. In some of the pieces, the material going into the foyer and corridors was pre-defined and routed to channels five to eight, but I still had the freedom to send any part to these channels in addition to what was already being sent.

There was also a physical slider connected to the primary system to give real-time control over the balance between the primary system, foyer and corridor speakers. Although simple, this setup gave great control over how the spaces were activated.

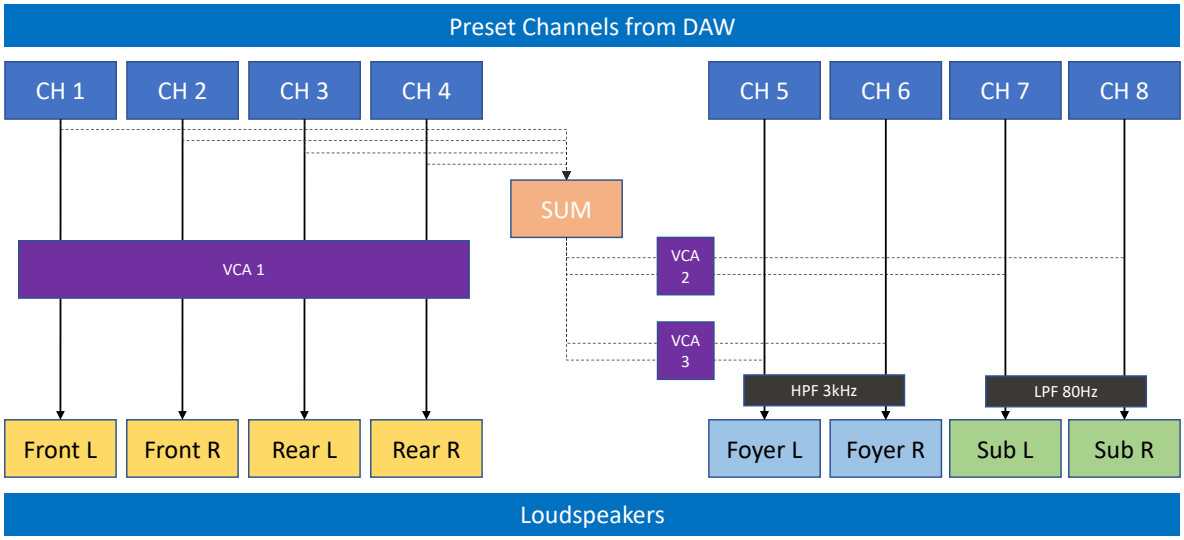


Figure 9 – Signal flow chart

Real-Time Diffusion Techniques

The routing of the pre-spatialised channels one to four into a summed stereo bus afforded me real-time control over when I wanted to move into either the corridors or the foyer. The VCAs controlling the overall level of the signal going to these destinations were mapped to a MIDI controller with sliders in Figure 10. I could therefore, in real-time, pull sound out of the hall by lowering the level of the main system and move the sound into the foyer or send specific moments of the music to the corridors. This real-time aspect allowed me to approach the concert presentation as an active listening experience on my part and explore the space as the music interacts with it. Even though I had spent time in the hall prior to the concert which informed a lot of my decisions in terms of how the music had been spatialised, the live aspect brought with it a performative aspect that proved to be very versatile and responsive while being extremely simple and easy to manage.

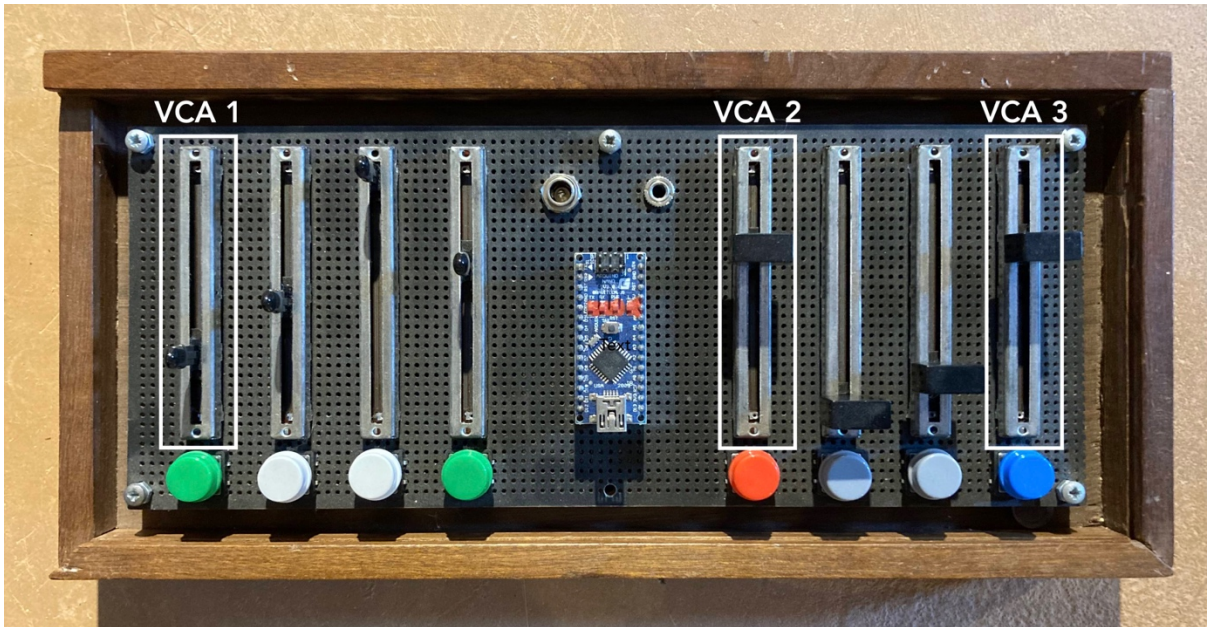


Figure 10 - Homebuilt MIDI controller

The techniques for live diffusion could be summarised into three main possibilities. The first was movement in and out of space, where a particular moment or section of the music could be shifted from inside to outside the hall or vice versa. This shift could be sudden or gradual. The second was movement into the corridors. This shift is perceptually different as the 80 Hz cut-off on the low pass filter removed any sense of detail and recognisability from the sound. The effect was that the sound became more physical due to the sound pressure level that the subwoofers produced. It was rarely used on its own and the movement in and out of space was mostly between the corridors and the hall itself. The third type of diffusion was the expansion and contraction of the acoustic space. By presenting certain sections in the hall and gradually increasing the level being sent into the foyer and the corridor, moments would arise where the acoustics notably changed but it still seemed as though the sound originated from the hall. Likewise, if the balance was pushed so that the foyer was distinctly louder than the hall, it would create the effect of the sound spilling into the hall while maintaining recognisability and definition.

Spatialisation Techniques

In addition to the live diffusion of sound there was a lot of spatial information that was already part of the composition that wasn't performed in real-time. This includes traditional quadraphonic spatialisation, spatial trajectories for individual sounds, scattering of sounds across all the channels and selected moments where sound was sent to specific systems. The

main techniques I employed for the spatialisation of the sound were amplitude-based panning, point source spatialisation, temporal and spectral decorrelation, and ambisonic spatialisation.

The simplest type of spatialisation used in pre-spatialising the material in *Sound Spaces* was regular amplitude-based panning commonly used in stereo systems. Such panning relies on an amplitude difference between channels receiving the same signal to create a phantom image that is localised perceptually between the two loudspeakers. Adapting this approach into a quadraphonic setup involved using the quadraphonic setup as two stereo pairs. The pairs can consist of a front and back pair or a left and right pair. This can be expanded to include all four channels to pan between them around the listening position. Although this is quite simple to achieve, I mostly used different techniques to move sound between the four channels inside the hall, as explained in the discussion on ambisonics.

For the point source spatialisation, each loudspeaker and channel are regarded as a monophonic sound source, with sound spatialised in this manner only going to one loudspeaker at a time. This technique does not rely on a phantom image being created as with stereo and quadraphonic spatialisation and does not require decorrelation to avoid the precedence effect. The result is an extremely localised spatiality with a clear origin and direction. At the same time, this technique has the limitation of not being able to accommodate and convey motion between loudspeakers and only being able to bounce between them in a discrete manner. Because this technique is bound to the use of a specific loudspeaker, it can easily draw the listener's attention to the sound reinforcement technology and away from the imaginary space that is created with other spatialisation techniques. This technique was therefore used sparingly and only in situations where a dramatic emphasis on the localisation of a sound source was required and where the listener's attention was directed towards the listening space itself.

With stereo spatialisation, when the signal is the same across different channels and spatialisation relies on the amplitude differences between the channels, there are a few issues that can arise that will skew the stereo image. This can be true for quadraphonic spatialisation as well. As discussed in Chapter 3, the precedence effect occurs when direct sound and reflected sound are perceptually merged into one. It can, however, also occur when the

reflected version of the sound is replaced by another sound source emitting the same signal. Due to the position of the listener, an amplitude difference and time difference may be imparted on the signal and the phantom image may shift in relation to this position. If a sound is, for example, spatialised across four loudspeakers and the listener happens to be close to one of the loudspeakers, the resulting effect might be that the spatial image is weighted towards the loudspeaker the listener is closest to and the signal from the other loudspeakers are perceptually fused with the signal he or she first heard. A solution for this, when dealing with multichannel audio, is to impart timbral differences between the loudspeakers to create a more immersive and diffuse sound field. The technique most often used for this is decorrelation.

> Decorrelation of audio signals creates timbral colouration and combing due to constructive and destructive interference, which produces a diffuse sound field and does not suffer from image shift and the precedence effect (Kendall 1995; Vaggione 2001). This method does not aim to create a physically correct image, but rather uses psycho-acoustic effects to achieve a diffuse, broad sound image. This effect is related to the inter-aural cross-correlation coefficient (IACC), which has an influence on the apparent source width (ASW) (e.g. Baalman 2002). Like reverberation, decorrelation can be used to fill the space with sound, or to create a broad enveloping sound image. (Baalman, 2010, p. 214)

I used many methods to decorrelate the signal in *Sound Spaces,* including applying time differences to the same sound playing from different channels and applying selective filtering to create timbral differences between the channels.

The last technique used for the pre-spatialised material forms part of a larger spatial audio format, known as ambisonics, of which I only used specific components. Ambisonics is a surround format for recording, synthesising and playing back spatial audio. It allows for these processes to operate in three spatial dimensions: Left to right, front to back, and up and down. It is a form of wavefield synthesis which seeks to resynthesise a recorded sound field in a new location (Anderson, 1999).

Ambisonics is a technological solution to the problem of encoding directionality into sound and reproducing this directionality on a loudspeaker system (Malham & Myatt, 1995, p. 62). The system encodes signals into B-format, a multichannel audio format for containing ambisonic recordings. There are different types of B-format depending on the channel layout and the number of channels. FuMa and AmbiX are among the most common and are

different due to their channel designation. B-format can generally also consist of between four and sixty-four channels, first order ambisonics (FOA) and high order ambisonics (HOA).

Encoding involves taking various formats of sound sources from mono and stereo to surround formats such quadraphonic and 5.1 and putting them into a 360º sound field in a B-format. Different types of ambisonic B-formats, such as FuMa and AmbiX, can also be converted back and forth during the encoding phase. For my application, the purpose of encoding different sound sources into a B-format enabled me to use ambisonic transformation processes to virtually spatialise the sound.

The processes I used were mostly from the Ambisonic Toolkit (ATK) (Lossius & Anderson, 2014) which includes creating spatial trajectories for monophonic sounds in a three-dimensional sound field to scatter or explode monophonic sound in three-dimensional space as well as distribute some recordings I made using a 5.1 microphone into this field for further processing. Other transformations include focussing in on certain angles in the field which was particularly useful for isolating specific components in multichannel recordings.

The last stage of the ambisonics workflow is to decode the sound field for playback. The decoding options that are included in the ATK include stereo, binaural, 5.0, periphonic, paraphonic and quadraphonic. I mostly used the quadraphonic decoding as it was the most suitable for playback on the primary system inside the hall.

It is worth noting that ambisonic formats usually work better at higher channel counts and a quadraphonic loudspeaker configuration is not the most suitable for ambisonic playback as it lacks the resolution of higher channel systems. The accuracy of the sound localisation is thus affected. The purpose of using ambisonic techniques in this situation, however, allowed me to create diffuse sound fields when immersion was required. Also, many of the encoding processes included in ATK allowed me to explode monophonic sound into a three-dimensional sound field which ultimately resulted in monophonic sound being stretched across the quadraphonic setup since the processes created spectral differences between the four channels. The specific tools for transformation in the ATK also provided very efficient ways to create and animate spatial trajectories of sound within the sound field.

As this was not the only way in which I spatialised sound in my composition, the inherent limitations of using ambisonic material on a quadraphonic setup were not as profound.

Chapter 5 – Revisiting a Place

Sound Spaces was recorded during the rehearsal of the performance, using an ambisonic microphone to capture some of the spatial qualities of the work inside the Wits Great Hall. The recordings were decoded to binaural format for listening on headphones. As explained in Chapter 4 the practical component of this project involved a unique placement of sound sources within a specific building and its internal and external structure. Thus, the binaural audio available for reference with this document serves for the reader/listener to navigate the structure of the work and provides a sense of its overall sonic landscape and some of its spatial characteristics but is not intended as a replacement for the live diffused performance. Stereo versions of each piece are also included where the binaural recording might fail to represent certain aspects of the music clearly. Appendix B lists all the included files in both binaural and stereo format. The majority of my references to the work will be highlighted on spectrograms of the stereo version of the work for the sake of clarity and visual detail, and, in certain situations, I include spectrograms of the binaural version when referring to specific spatial effects.

Each spectrogram was created using a frequency range most appropriate for illustrating the matter at hand; therefore, they all have different ranges indicated on the left side of the spectrogram. Where high frequency spectral content is present and relevant to the point being discussed, the spectrogram will have a higher range. Where pitched material and specific gestures are highlighted, the range has been selected to best showcase those elements. A time ruler overlay can also be seen on each spectrogram that corresponds to the exact timestamp of the provided recordings. All spectrograms were rendered using Sonic Visualiser.

Each piece is discussed in its own sub-section which provides an overview that includes a waveform and a spectrogram of the piece derived from the stereo versions. All pieces, except the last, follow the same format, where a table aligns with the waveform and spectrogram, indicating different sections, material use and information about the spatiality of that section.

An animated spatial map of each piece, as discussed in Chapter 3, is also included to illustrate movement within the different spatial zones (see Appendix B). Although I will not

refer to them directly here, all the points that relate to spatial zones are visible on these maps. They should serve as an accompaniment to this chapter.

Tuning

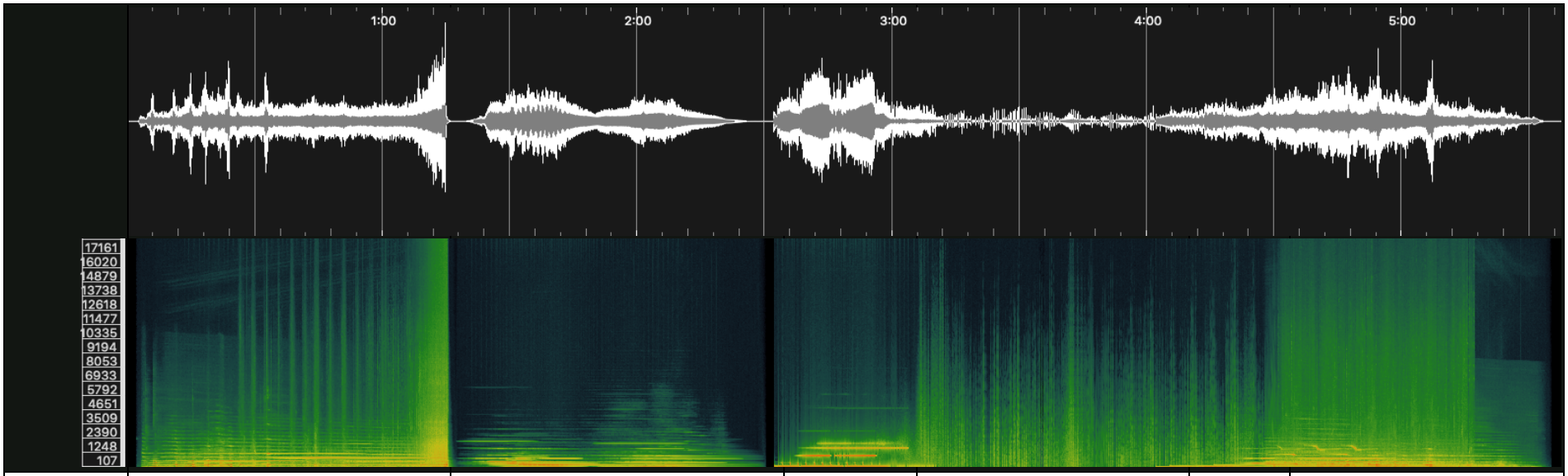
Tuning's first section (0:00 – 1:12) uses a recording of an orchestra tuning as well as murmurs from an audience. The orchestral sound is projected from the front speakers, while the audience's murmurs are projected from the back. The dominant spatiality of this section is perspectival; it sets out to confirm what the archetypal space of the concert hall already suggests. In this case, the material suggests a subject-object relationship that positions the music within the frontal image from the audience's perspective. It carries with it the rules of the positioning of the occupants in terms of hierarchy and demands a particular attitude towards listening. The music happens in the prospective space of the listener. The audience's murmurs start moving around the hall in all directions, establishing the circumspace around the listener.

While perspectival space is likely to be perceived as the dominant spatial zone in this section, the material itself also suggests a source-bonded space which, in this case, is a concert hall as well. This creates a parallel of sorts between what is expected in a concert hall as an archetypal space and what is happening in this electroacoustic presentation. The primary function of this presented duality is to establish the site of the concert hall as a place that is a complex construction. This place cannot be interpreted in only one way and instead consists of a duality of spaces and this piece introduces this key feature that is further explored in other parts of *Sound Spaces*.

Another important highlighted feature of this section is that the listener's memory of what the concert hall might be is acknowledged by using the orchestral material. The possible evocation of these memories, whether real or imagined, is highlighted as an important feature of the work by using this familiar material that is in a sense as archetypal as the concert hall itself.

At 1:12, the piece starts a section in which the orchestral sound is abstracted into granular clouds and streams: Resonant copies and sine wave components, all extracted from

the original recording. The material can be spectrally viewed as a horizontal abstraction of the first section. The focus of this section shifts into the zone of spectral space due to its



Section	Orchestral Tuning	Horizontal Tuning	Transition towards Vertical Tuning	Vertical Tuning	Transition Mixture	Orchestral and Audience sounds re-enter
Material	Orchestral tuning Audience's murmurs and applause Sine wave abstractions Granular applause crescendo	Sine waves abstracted from orchestral tuning	From horizontal to vertical material	Impulses abstracted from the applause	Mixture	Orchestral tuning Audience's murmurs and applause Sine wave abstractions Granular applause crescendo More abstracted than first section
Dominant Spatial Zone	Orchestra Front in prospective space – Source-bonded space diffused in circumspace: Enacted space – performance space Audience Back – behind listener – enacted space	Listening space Perspectival space – Circumspace	Listening space Perspectival space – Circumspace	Listening space Perspectival space – Circumspace		Orchestra Back Audience Front – a shift in circumspace Egocentric space Archetypal space Enacted space
Perspective	The sound of an orchestra tuning is projected from the stage. The murmurs of an audience are projected from the back of the hall. The relationship between the audience and the performer is re-established spatially	Focal point: Listening space with an emphasis on spatial dimensions		Focal point: Listening space with an emphasis on temporal dimension		Perspective reversal

Table 2 – Tuning overview

abstracted nature and movement from second order surrogacy and remote surrogacy of the raw material.[9] Such processing occurs in the rest of the pieces in *Sound Spaces* as well and so its use establishes it as a motif to the listener in terms of the types of transformation that form part of the work's vocabulary.

In relation to the rest of *Tuning*, the function is to pull the listener into a different kind of space, while retaining links to the first section, and to link it to the sections that follow. While this section's focus is predominantly situated in the zone of spectral space, the horizontal material causes the listening space itself to begin to react to it. Viewed in relation to Emmerson's language grid (1986), outlined in Chapter 3, there arises an interesting blend between mimetic and aural discourse, while the orchestral material (even when abstracted) is situated in aural discourse the referentiality in the work points back to the listening space itself.

This section continues with a slow downward portamento as the sound of the orchestra shifts in pitch. As this downward trajectory moves through the frequency spectrum, certain resonances of the hall are found as the room starts responding acoustically; here, the piece is tuning itself to the dimensions of the hall. A number of acoustic artifacts of the space are foregrounded along the way. In the comparative spectrograms, the upper part is a representation of the piece before the projection, while the second row represents the piece after projection into the space as captured by the ambisonic microphone. These spectrograms are mixed down to mono for the sake of visual clarity. The first spectrogram in Figure 11 shows a certain resonance that causes vibration in the hall at around 1:30. This shifts the focus of the piece towards the acoustics of the space and serves as a primer for experiencing the rest of the music with the awareness of the boundaries of the space as revealed by its acoustic signature. The resonance defines the listening space as a spatial zone that will actively be involved in and explored in the rest of the work. This exploration of the hall is an exploration of physical space.

[9] Surrogacy specifically belongs to the indicative field of gesture. Second order surrogacy retains vestiges of human gestural activity, but also contains morphologies with no apparent link to the sound causing gesture (Smalley, 1996, p. 85).

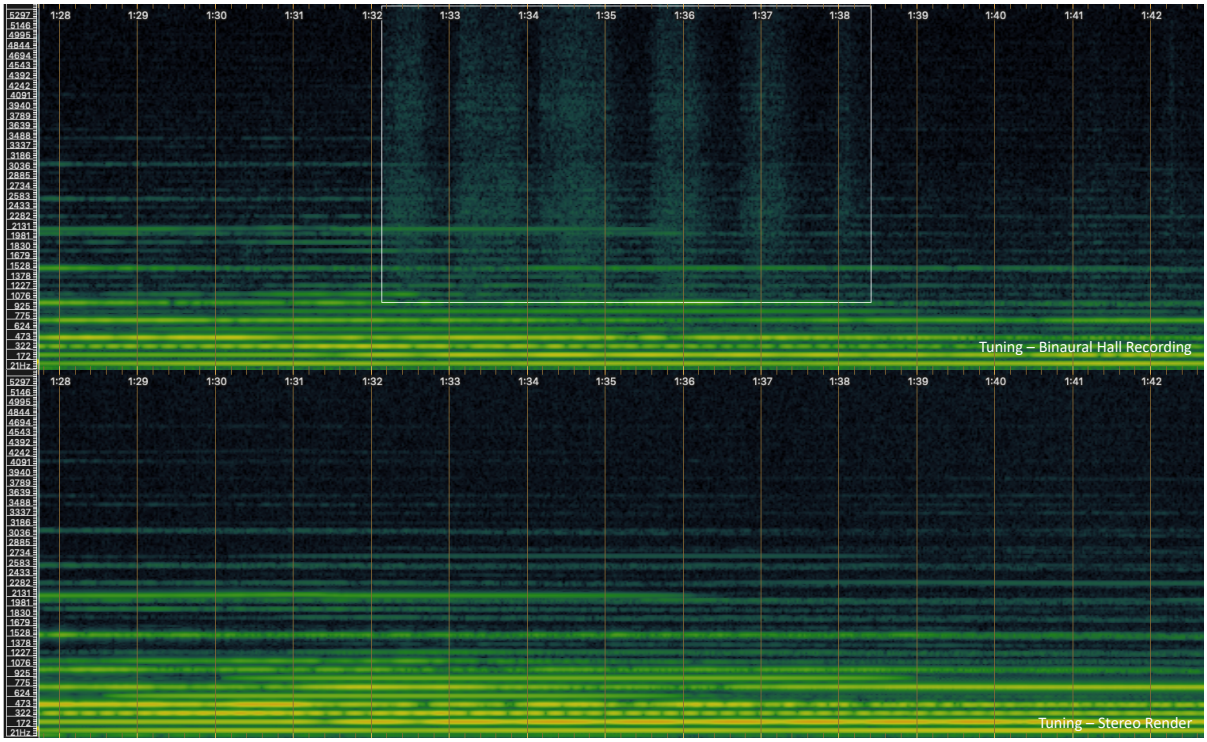


Figure 11 – Comparative Spectrogram 1 – Tuning

A transitional section enters after the horizontal tuning is concluded. Still containing some horizontal abstractions of the orchestral sound, it starts to shift into a vertical abstraction of the applause. While this transition takes place, it is also noticeable in Figure 12 how certain frequencies create resonance in the hall, while other components of the material are smoothed out and filtered by the acoustics of the space.

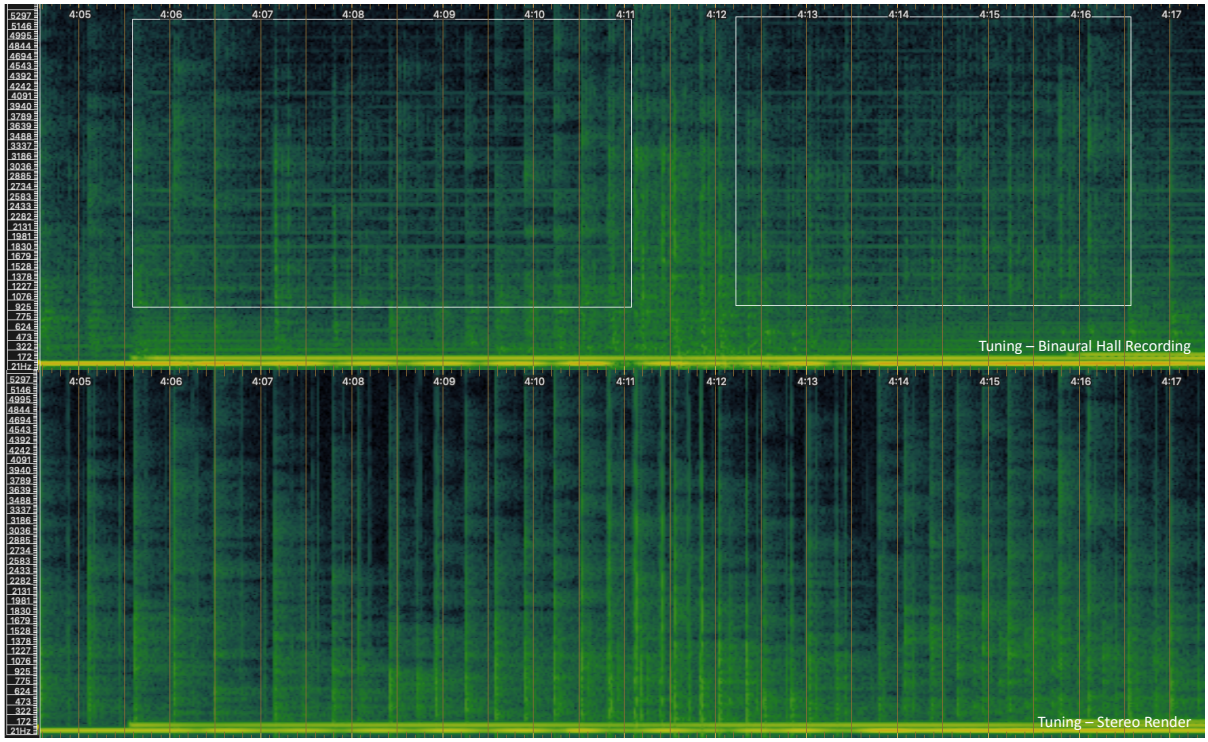


Figure 12 – Comparative Spectrogram 2 - Tuning

The next section, starting at 2:29, maps out the physical dimensions of the space through impulses projected into the hall. This spatial exploration of the hall is an exploration viewed in the domain of time. These impulses are the vertical sound material in the work: Claps, clicks and short bursts of noise. The function of this material in the space is to explore the reverberation time of the concert hall. This can be seen as a continuation of the previous section, but with focus on the vertical axis. Shifting from the horizontal to the vertical is a formal aspect of the piece that allows for one aspect of space to be explored at a time.

When measuring the reverberation time of a room, it is common to produce a sweeping sine wave across the frequency range to measure the response of the room at each frequency at a given point during the sweep. This can, however, also be achieved with an impulse: A short burst of noise across the entire frequency range where the reverberation time is measured at once across all frequencies, effectively giving the same result. These impulses are then projected and spread around the hall and reflected back to the listening position at different times and amplitudes, depending on how the room absorbs, reflects and diffuses the sound. Although no measurements are taken in this case, it is an attribute of enclosed spaces that is easy to perceive but this perception often happens unconsciously, as discussed in the firsts section of Chapter 3. By presenting this material on its own, the acoustic effect is brought into the foreground as the impulses echo across the room. The impulses are

smoothed out and filtered by the space as reverberation accumulates around them. This effect is visible in Figure 13 where the onsets of the impulses are rounded off and the tails are elongated as they merge with the reverberation.

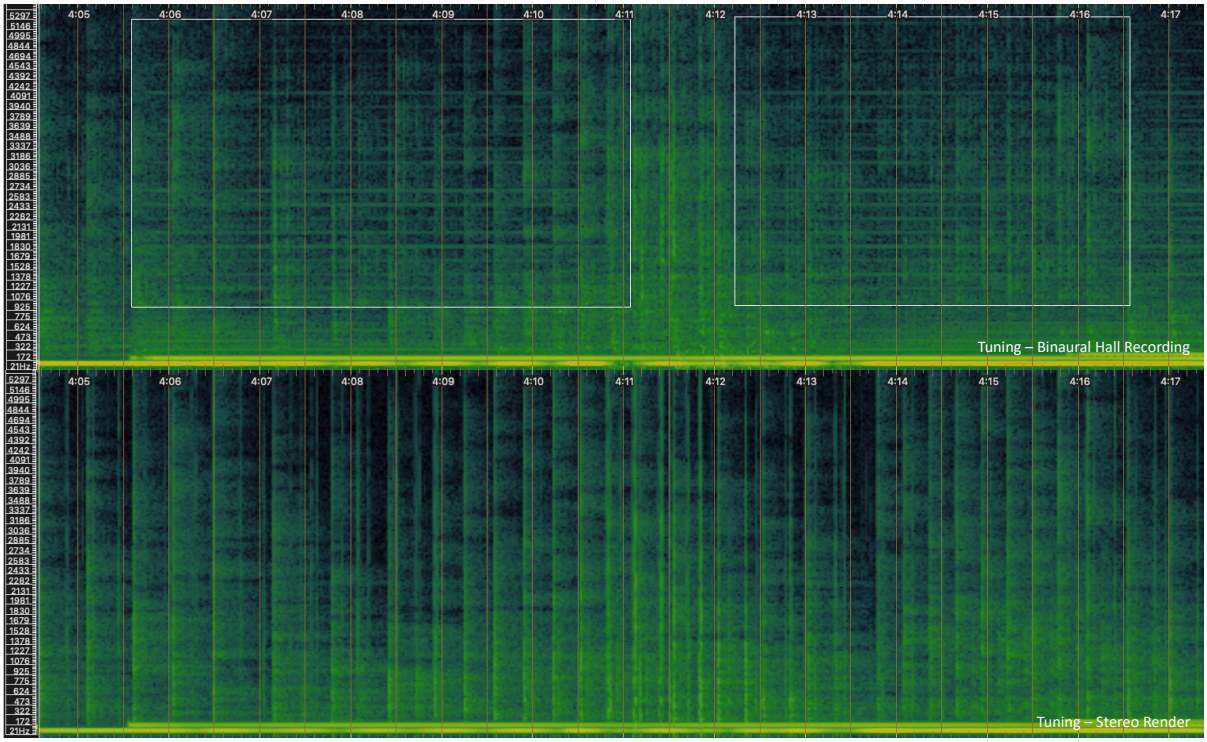


Figure 13 – Comparative Spectrogram 3 – Tuning

In addition to the acoustic effects on the material, there is also some processing applied to the impulses in the form of artificial reverberation and filtering. The impulses soon start to sound as if they are being emitted from beyond the boundary of the visible space, thus occupying the extended panoramic space. The outcome of this effect is to define the boundaries of the space as central to the experience of the work and highlight how sound has the ability to transform and augment even what seems to be a physical fact about the space. It suggests a central theme of the music to the listener, namely the augmentation of space. It is worth noting that, at this point in the work, none of the secondary diffusion systems are employed and all the sound is still being projected from the primary system within the concert hall.

Throughout the second and third section of the piece, the material undergoes a transformation between horizontal and vertical, showing how these two physical attributes of the hall are connected as one through sound. Sound in *Tuning* is set to express the meeting point between time and space on a metaphorical and physical level.

More broadly speaking *Tuning* approaches the concert hall as an acoustic ecology, where the space and its occupants have an equal role in defining the sonic experience of the place. As the piece unfolds, the vertical and horizontal material is brought together in the space and is spatialised across all four channels of the primary system, thus encircling the listener. By enveloping the listeners by occupying their circumspace, the listeners' egocentric space is brought into light as they are emplaced in the centre of the sound field. To elaborate on this, it is useful to move the analysis into the zone of enacted space. The source-cause of the main material of *Tuning* can easily be identified as previously highlighted. In this context, the orchestral sounds bring about a sense of a performed space. As Smalley (2007) suggests, the listeners' understanding of this is linked to their multimodal sensorial experience and brings into the forefront their apprehension of the musical event by means of their proprioceptive knowledge of the physical act of a musical performance. It also evokes an image of a stage that is filled with members of an orchestra and of an audience that occupies an imagined space.

The impulse material from the second section is slowly transformed into recognisable clapping sounds, again occupying enacted space albeit a different kind, that of an audience member. The murmurs of an unidentified audience are also scattered around the hall. Relating this to how a concert hall is typically structured in respect to the roles its occupants play, there arises a confusion of spatial positioning and configuration. Leading up to the conclusion of the piece, the performed space of the orchestral sounds and the agential space of the audience are scattered around the hall and as a result their relationships to each other are questioned and ultimately broken.

Tuning ends with similar material as its beginning, but an exchange of roles has occurred as the spatial positioning of the sound elements has been shifted. The orchestral sounds are moved to the back of the audience, while the utterances of the unidentified audience are thrown onto the stage, now inhabiting the listeners' prospective space. By manipulating the structural and temporal aspects of these sounds, the relationship between them is re-evaluated, situating the audience and figurative performer on the same playing field. This also establishes the relationship that this work has with works such as John Cage's 4'33'' where at least on one level it shifts the focus away from what is expected to be presented towards an inclusive model where context forms an essential part of the work. The

emphasis on context has already been described as a key component in the formation of place in Chapter 2, with reference to Chaves and Rebelo as well as Truax.

The approach that *Tuning* takes towards the function and perception of the listening space as well as the role of its occupants is similar to the way in which Norman (2012) states that space is delineated by extent, but a place begins and ends with a relationship between the perceiver and the perceived. *Tuning* is the establishment of both space and place, its first sections delineate space by extent whereas its overall structure establishes the relationship between the audience and the work itself, thus establishing the concert hall and specifically *Sound Spaces*, even if just temporarily, as place.

The acknowledgement of the role of the physical space and the relationship between the audience and presentation also helps to address what Truax (2012) calls the aesthetic dilemma in soundscape composition, namely that the context in which music is heard is out of the composer's control, while it contributes greatly to the understanding and reception of the work. It can be argued that such approaches to the environmental sounds can be a remedy to this dilemma (Truax, 2012). The opposing poles on the continuum of the internal and external aspects of the music are presented in parallel to each other and are made to co-exist. The tuning of the orchestra is an inherent trope of the archetypal space of the concert hall and can thus be considered an external factor, engaging with context more than text. However, it also suggests, as with a traditional orchestral concert, that what is to follow will step away from this context and shift focus to the composed pieces performed by the orchestra or, in this case, the rest of the electroacoustic presentation. This expectation is confronted by the sounds of the audience that become part of the material of the piece and are placed in the foreground through their spatialisation.

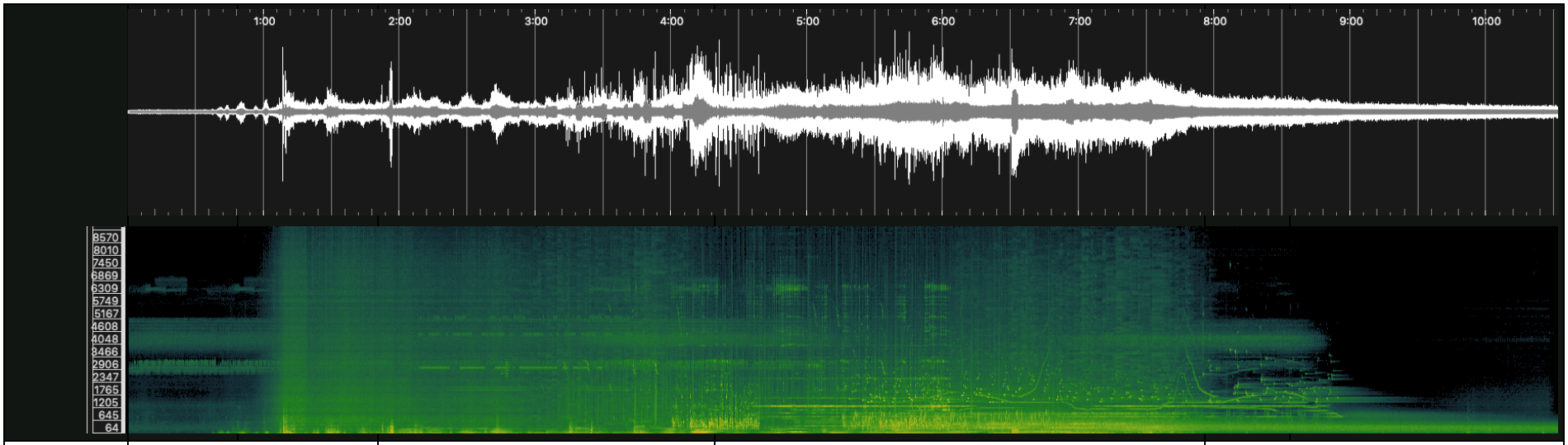
Drones, bells and bowls

In Feld's *Rainforest Soundwalks,* the listener is emplaced in a hyper-realistic soundscape that is representational of the composer's own experience of place as translated through sound. Luc Ferrari's *Preque Rien Suite* also forms a hyper-real reinterpretation of recordings on a beach compressed in time (1995). *Drones, bells and bowls* explores this sense of a hyper-realistic space and frames it as an integral part of the process of emplacing the listener by establishing the imaginary domain as a component of place.

> [The] term *hyper-reality* refers to a situation where events appear to be 'more real than real'. Although these events are undoubtedly produced by the processes of simulation, the result has all the gestures and signs of reality. Luc Ferrari's *Presque rien* (Ferrari, 1995) series demonstrates hyper-reality in audio-art. *Presque rien no. 1* compresses the timescale on which real events happen. Although the work is clearly the product of extensive editing processes, the end result is the aural impression of a heightened reality, where time, it seems, has no consequence. (Field, 2000, p. 46)

Although the method of attaining a hyper-real representation of the soundscape in *Drones, bells and bowls* does not rely on a temporal compression, it does achieve this through other means. The abstraction through processing the material maintains a strong link with the source-cause of the sound. The piece consists of a layering of similar sounds that gradually build up into a drone-like density of sound sources.

At its core, *Drones, bells and bowls* is a work about crickets. The cricket is a common source of sound that occupies places from domestic to urban, public to private, in one form or another. It is not evocative of a specific experience but evokes a multitude of possible experiences. The sense of place that it evokes is thus not specific but generic and ambiguous. It is within this ambiguity that the listening imagination is activated and where the listeners imprint their own interpretation of these sounds onto the soundscape. A hyper-real representation of the material organisation directs the listening towards the imaginary as it lacks a material logic associated with a causal kind of listening. I also choose this common referential material because of its general allusion to an outside area. The use of this material in the context of *Sound Spaces* symbolises that which occurs outside the concert hall. It is with this material that the corridor and foyer system is first used to make this metaphorical link of alluded space into a literal shift outward into the adjacent spaces.



Section	Field Recording	Abstraction I – Rhythmic	Abstraction II – Rhythmic and Harmonic	Abstraction III – Harmonic
Material	Field recording of crickets and rain	Synthesised crickets and rain mixed with field recordings	Abstracted versions of both synthesised and recorded material, focusing on rhythmical and harmonic gestures	Only abstracted versions, mimetic link maintained
Discourse	Mimetic	Mimetic	Mimetic + aural (both abstracted)	Mimetic + aural (both abstracted)

Table 3 – Drones, bells and bowls overview

The evolution of this piece is perhaps best explained by a number of encounters I had when working with field recordings as well as when I thought about immersive audio techniques. The seeds for this work were part of a sketch I prepared for my research proposal when I began experimenting with binaural synthesis. Artificially placing the sounds in a 360° sound field highlighted some limitations of such an approach. Even though it is possible to scatter sounds in all kinds of ways in this field through ambisonic panning, spectral decorrelation, and elevational shifts by means of filtering, there are more aspects to an immersive soundscape that one must account for. Of course, this is mostly possible with currently available tools, but the density of soundscapes in terms of how sound sources occupy space and how these are scattered in extremely precise locations is difficult to achieve.

As an investigation of the complexity of real-world soundscapes in relation to its spatiality, I started considering methods to capture the spatial characteristics of sonic environments. The first method used was to capture stereo recordings of crickets from varying distances and layer them on top of each other to recreate the density of the soundscape that is lacking in a single layer stereo recording. I spatialised the layers not only stereophonically but also quadraphonically so that the listening space would be filled with the sound of crickets from all directions. The second method used was to capture the crickets with a surround sound microphone typically used for recording ambiences for film and sports events in 5.1 format. I used the Holophone H3-D microphone for this.[10] Since the recording format of this microphone is in 5.1, I encoded it into ambisonic format and decoded it to match the quadraphonic speaker configuration used in *Sound Spaces*.

Similar processes were followed with the recordings of rain; however, the main difference was that I focussed the recording of rain from different vantage points and different locations. Some of the recordings of rain were taken under a tin roof, while others were taken inside buildings next to the windows. This resulted in many versions of the rain sound that clearly include these different perspectives as well as spatial cues. As I layered the recordings, it was unclear where the rain is heard from and the perspective that the source-bonded space carries with it becomes ambiguous and unreal.

[10] http://www.holophone.com

After the main material, consisting of the recordings of rain and crickets, is presented the piece swiftly moves into realms of abstraction. The raindrops are accompanied by a synthesised version that maintain a mimetic relationship with droplets falling on surfaces, but with a less complex timbre. These clicking sounds start to speed up and slow down in an attempt to break away from the rhythmical patterns of rain, following a more deterministic and regular pattern reminiscent of the vertical section in *Tuning* (see Figure 14). The repetition of this pattern in *Drones, bells and bowls* establishes it as a motif that is used throughout *Sound Spaces* (see Figure 15). In the context of this piece, the timbre of these clicks start to shift away from representing rain completely.

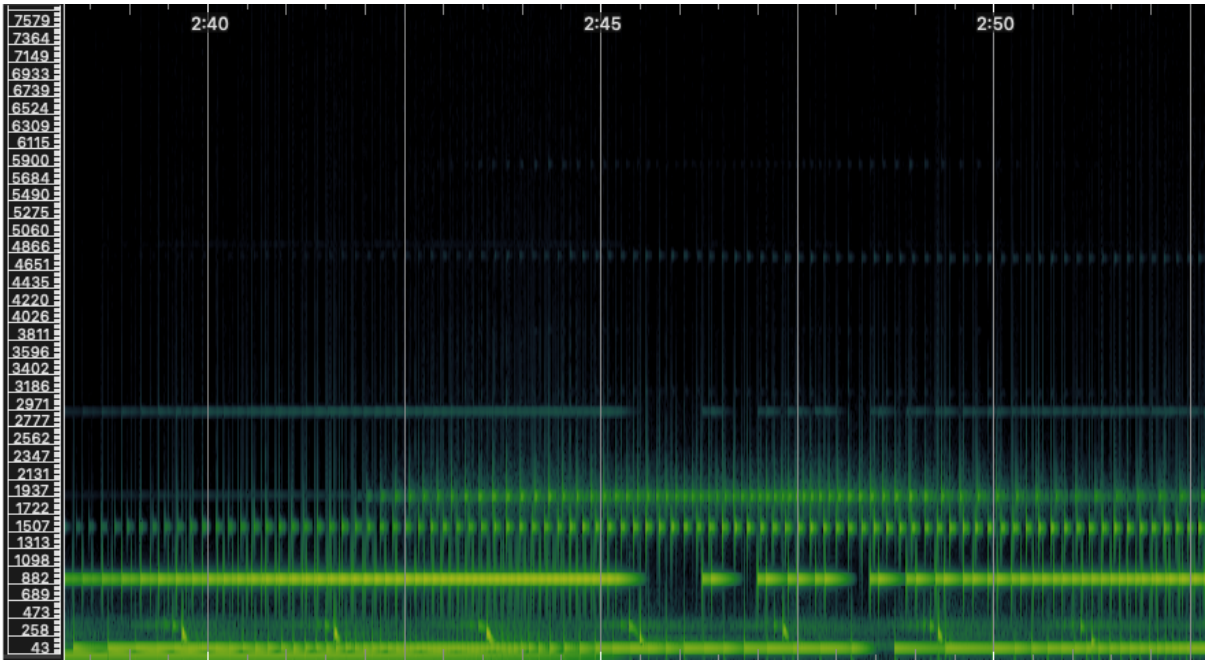


Figure 14 – Rhythmic motif in Tuning (vertical section)

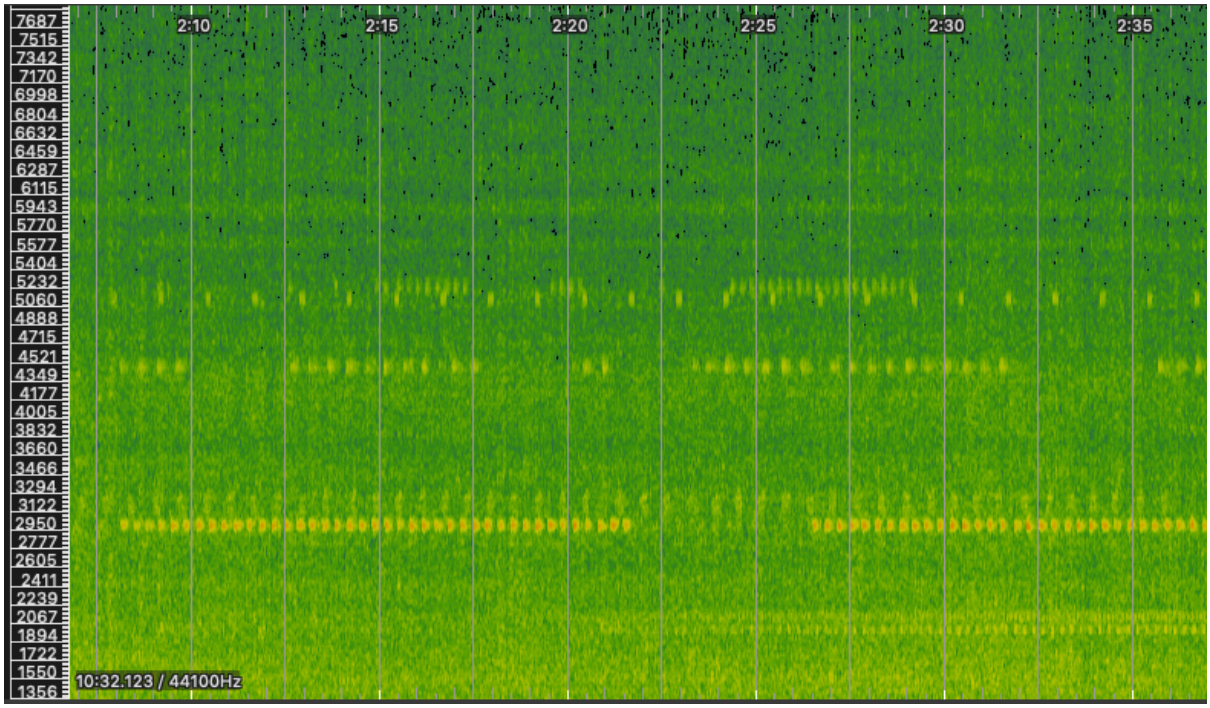


Figure 15 – Rhythmic motif in Drones, bells and bowls

The cricket sounds start to move around the hall in unrealistic trajectories, decoupling them from their original source while maintaining a timbral connection to their origin. Synthesised crickets and cicadas start entering the work, gradually replacing all the recorded crickets. These trajectories are spatialised in the listener's circumspace and in the spectral space as dramatic doppler shifts are applied to the sound (see Figure 16). As these synthesised elements become denser, the sound itself is expanded into the foyer to create a larger-than-life representation of the soundscape. The acoustic space is expanded beyond what is seemingly possible inside the hall. The function of this spatialisation is not only to expand the space outwards, but also to invite the outside into the concert hall.

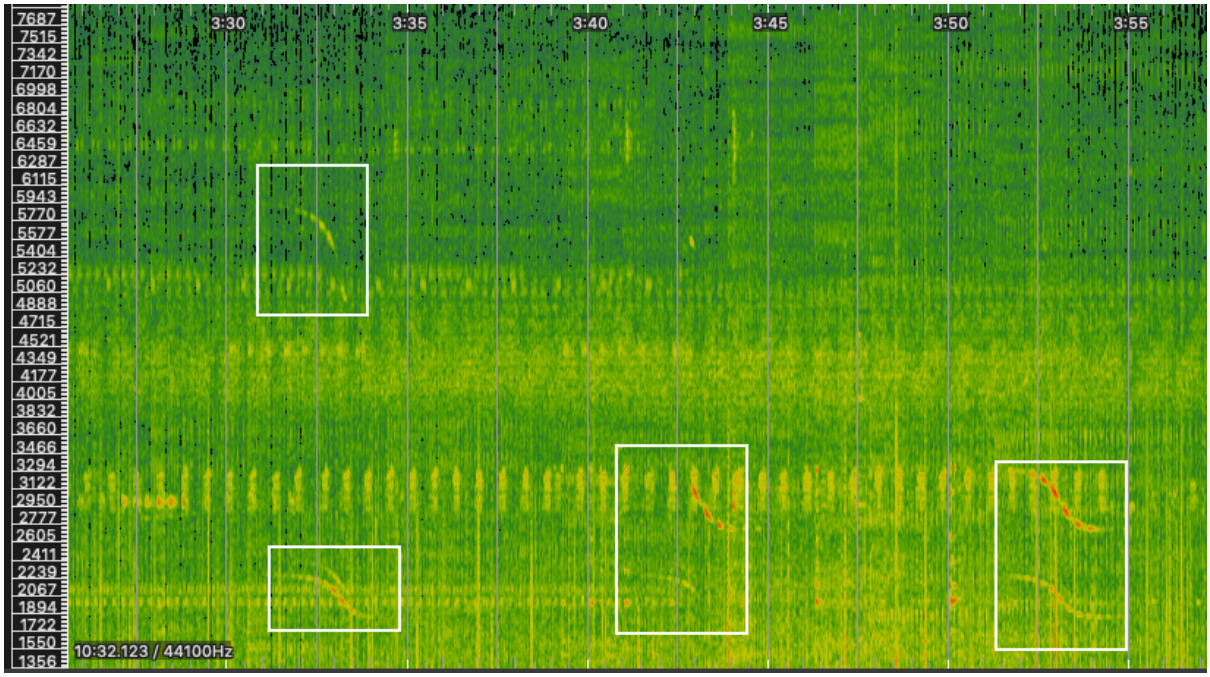


Figure 16 – Doppler shifts, creating trajectories in spectral space

As the synthesised counterparts of the rain and crickets become dominant, the work starts following a more aural discourse. This is achieved by focusing on the pitched material in these sounds that are emphasised by harmonic resonators. The percussive clicks become resonant bell-like textures, as seen in Figure 17.

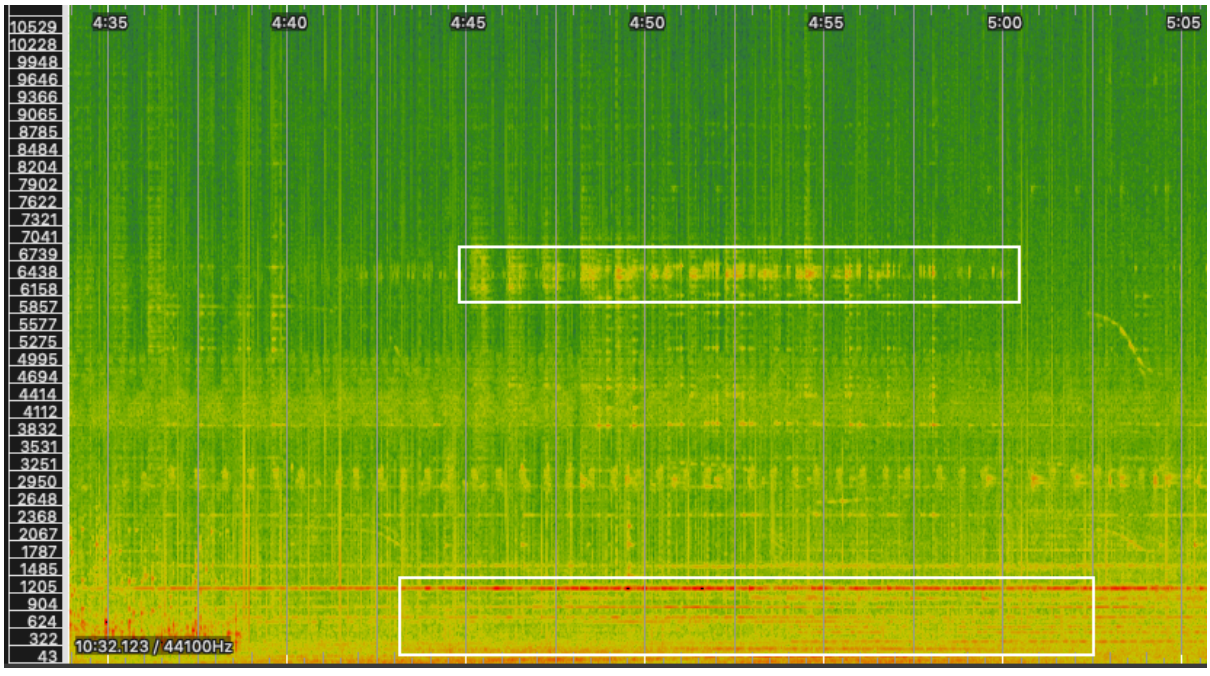


Figure 17 – Resonators building up pitched material in marked areas

The relationship between aural abstract and mimetic abstracted material runs in parallel, sometimes reinforcing each other and sometimes running their own courses. The aural material itself can be viewed as a motif that was established in *Tuning* and becomes synonymous with the concert hall, while the field recordings and their mimetic and referential counterparts are meant to transport the listener to external places. Within this piece, the two again coexists and their dynamic relationship sculpts place as a multidimensional phenomenon that transcends time and space. There is a constant shift between what is within the foreground and background as different elements of the composition demand to be the focal point. The overall impression is that of hyper-realism and surrealism; the piece is almost dreamlike and acknowledges the internal state of mind as a component of place.

Interlude

This piece can be described as the most abstracted of all the pieces in *Sound Spaces*. Although there is source-bonding, it remains very remote if at all relatable to recognisable sound sources. Only towards the end of *Interlude* are the cricket recordings from *Drones, bells and bowls* reintroduced, establishing a link with its source-cause again. The overall focus is to explore and elaborate on motivic material already highlighted in the first two pieces through its aural discourse.

Where *Drones, bells and bowls* moved from a referential space into a hyper-realistic representation of everyday sounds, *Interlude* delves deeper into non-concrete space as a metaphor of internal processes connected to the process of making place.

The first section, from 0:00 to 2:00, is a rhythmical exploration in spectral space. The material consists mostly of frequency modulated percussive sounds, similar to what can be heard in other parts of *Sound Spaces*. The rhythmical patterns fluctuate between regular and irregular patterns, as a way of mimicking the rain drops and cricket rhythms first heard in *Drones, bells and bowls*. There is also a play with the idea of the illusion of space, with artificial reverberation added to the sounds. The illusion is somewhat broken when the reverberation goes beyond what is typically expected of real-world acoustic spaces. This is achieved by freezing the reverberation tails in place. The underlying reverberation is visible in the marked areas of Figure 18. The breaking of this illusion shifts the piece into a more

abstract realm and attempts to pull the idea of space along with it. Other motivic material includes long static pitches as heard in the first two pieces of *Sound Spaces*.

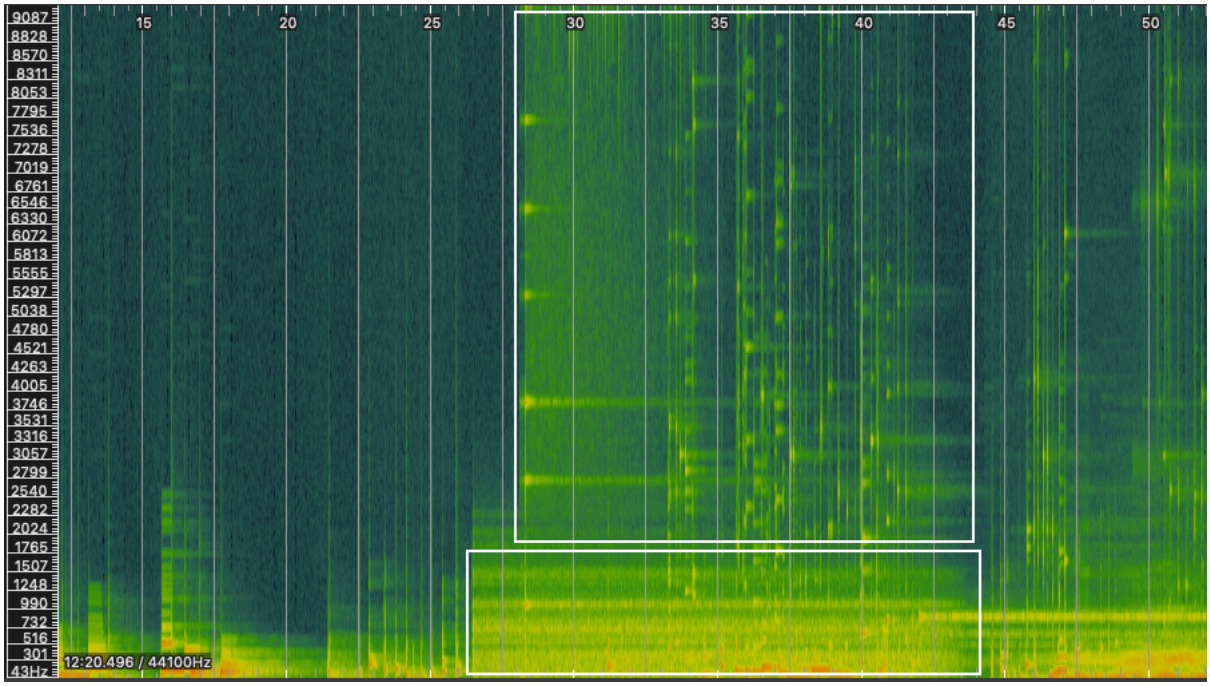
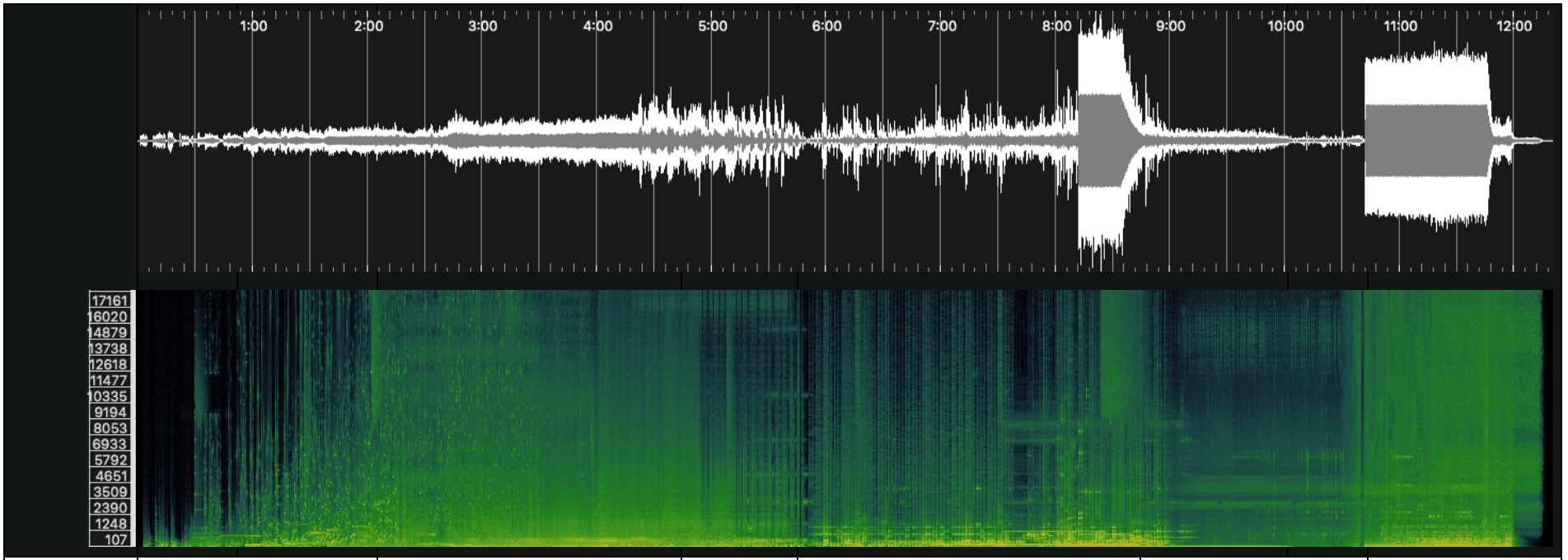


Figure 18 – Frozen reverberation tails

At 2:00, the *Escape* section begins. The main material consists of a low-pitched drone with filter shifts; as the percussive elements around the drone continue, the drone can be heard as trying to escape through the percussive layers. This was achieved by applying compression to the drone with the percussive elements as the sidechaining signal. The amplitude envelope is thus animated around the percussive elements and the gestural aspect of the drone is shaped according to that. On a metaphorical level, the sound is trying to escape the structure that it is in which it does on the spatial front. The spatial trajectory of the sound keeps shifting as the sound expands into circumspace. Parts of the sound are also projected into the corridor and foyer systems at times when the amplitude reaches a certain threshold. The rest of this section builds up energy until the spatial boundaries that contain the sound is broken.



Section	Percussive	Escape	Transition	Bouncing	Flashback	Abstraction
Material	FM percussion and sustained synthesised material	Synthesised drone with some FM percussion	Abstracted versions of both synthesised and recorded material	Abstract elements	Field recordings of crickets and rain	Synthesised abstracted versions of same field recording
Dominant Spatial Zone	Perspectival Spectral	Listening space Perspectival	Perspectival	Spectral Listening space Perspectival Source-bonded	Source-bonded	Source-bonded to Spectral

Table 4 – Interlude overview

A new rhythmical motif is introduced in the *Bouncing* section, starting at around 5:30, which has not been heard in any part of *Sound Spaces*. As a result, it claims a different place in the listener's mind which is unrelated to any of the material prior to it. It is also emphasised by repetition and occupies the foreground of this section. The section is freestanding and attempts to establish a place in and of itself, albeit a musical one, which has no reference to the outside world apart from the bouncing gesture it imitates. Later on, this motif is used in a different context as a way of returning the listener to the moment it was first heard. This section also has a strong spatial aspect with these bouncing gestures being projected out of specific locations in the hall. After a while, they start to dynamically move around the space as well. Ultimately, they are projected outside the hall into the foyer. They are as such also set up as a spatial motif, situating the spatiality of the music in the foreground of the musical experience. The dramatic movement of these elements in and out of the space, along with some being reverberated heavily and others being left dry, functions as the theme of this work.

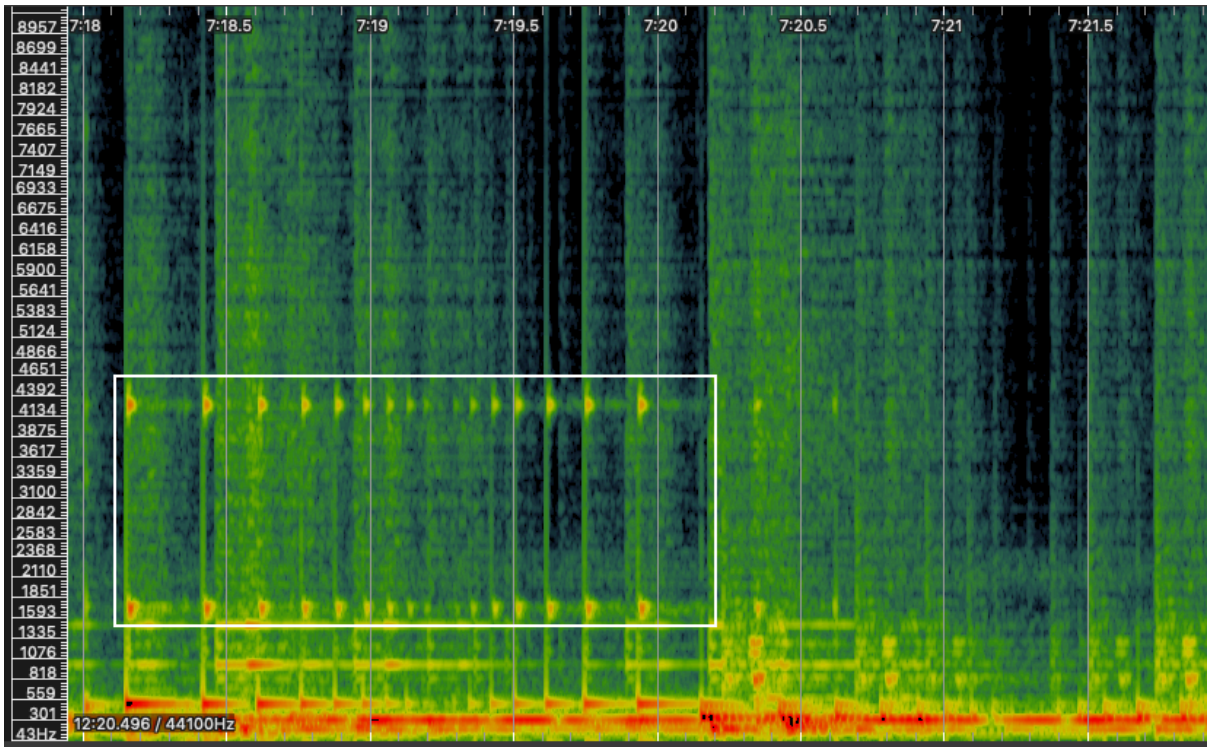


Figure 19 – Bouncing motif

The last section takes on the shape of a hyper-realistic representation of an environment, which is similar to what was already heard in *Drones, bells and bowls*. The sound material is organised into a soundscape that consists of insects, rain, wind and water droplets bouncing on surfaces. The material is a mixture between field recordings of similar elements, synthesised versions of those as well as unrelated material that mimics the

spectromorphologies of these elements. An example of this is seen in Figure 20 where a previously established rhythmic motif is stamped on the synthesised sounds that represent unknown biotic life reminiscent of insects like crickets or cicadas. This mixture of elements almost serves to contextualise the previously heard abstract material into a coherent and recognisable soundscape, even though it remains quite far away from a realistic representation as such. The abstract materials heard in the *Bouncing* section are still audible but only faintly as they are only projected in the foyer. Some of the more biotic elements in this section takes on the spectromorphologies of the abstract elements which is indicated in Figure 21.

The recycling of the material from *Drones, bells and bowls* and the recontextualization of the bounce motif in the last section function as pointers to the past as if they are representations of memories. With the first pointing to a piece heard prior to this material and the last pointing to a section heard moments ago. Metaphorically, it points to the process of place-making as non-linear, being informed by current and past experiences simultaneously. It presents itself as non-linear, trying to reveal the internal process of making place through repetition and remembrance.

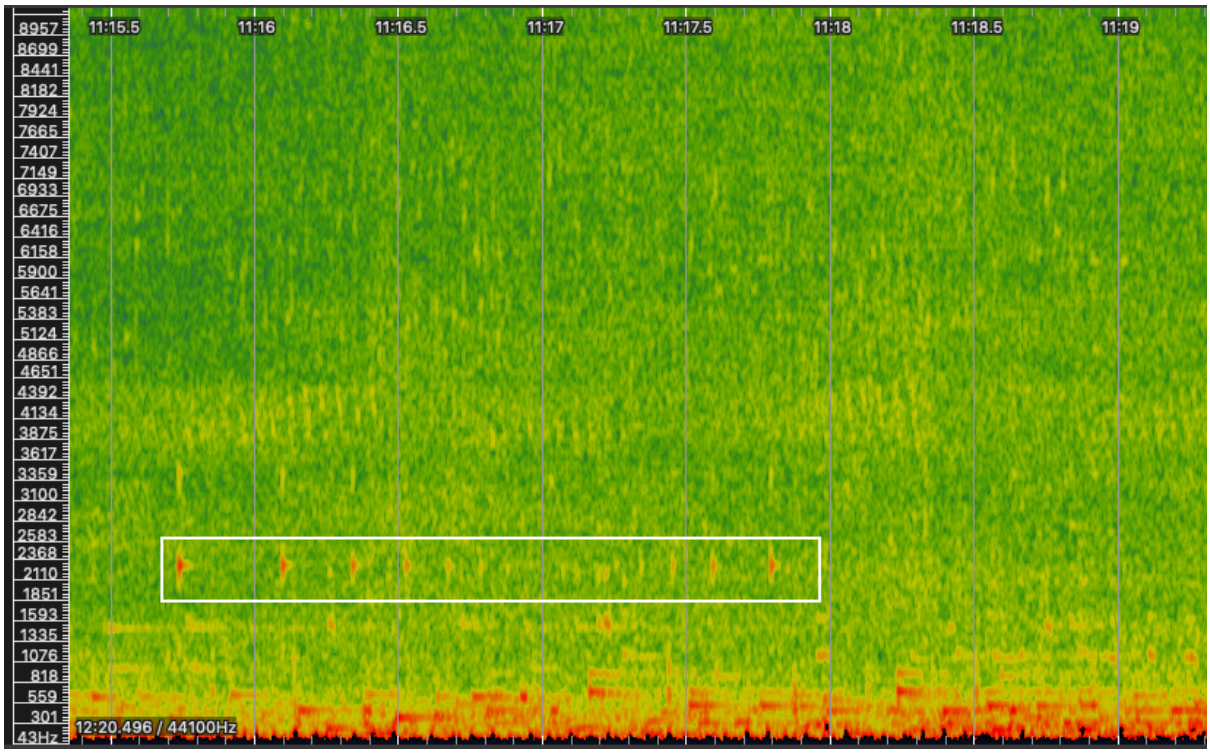


Figure 20 – Bouncing motif applied to biotic elements

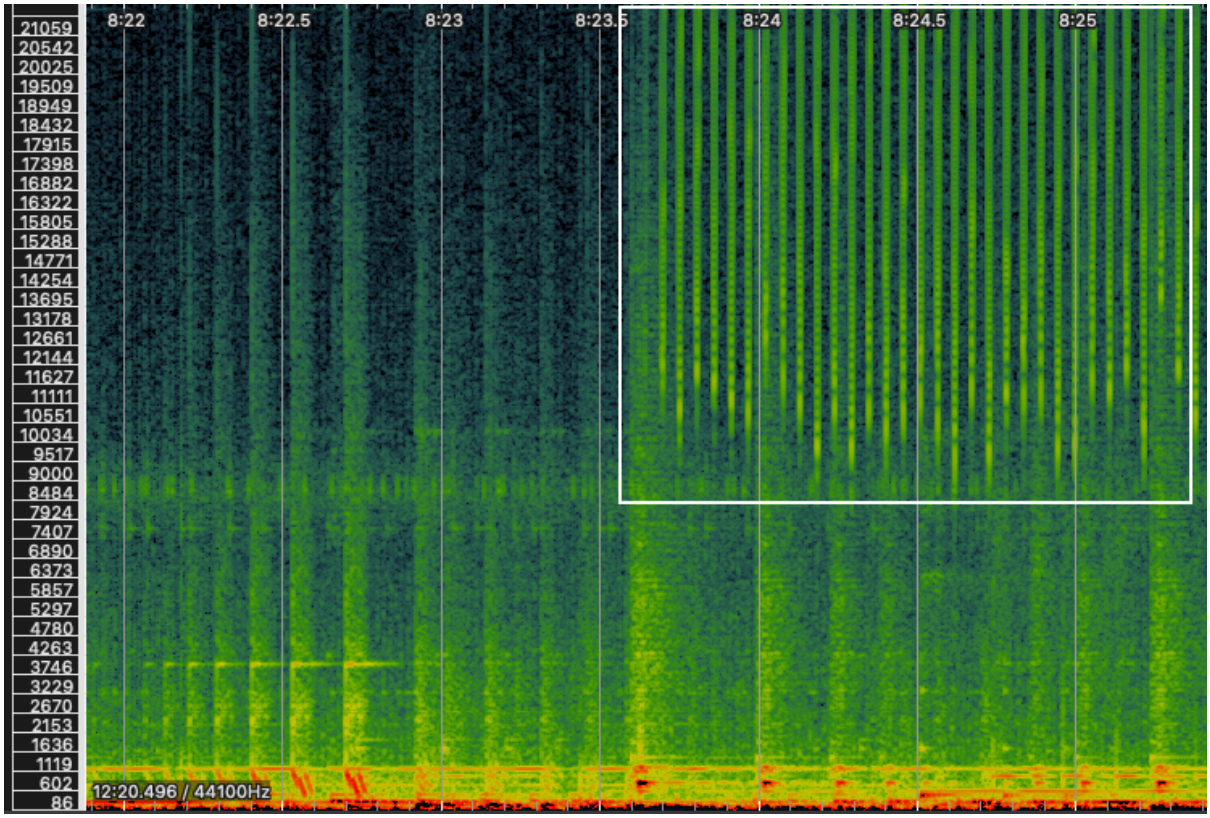


Figure 21 – Abstract insect texture

In this piece, there is a push and pull between spaces; some sounds are moved outside the hall, for example the rhythmic motif in the *Bounce* section, while source-bonded sounds from *Drones, bells and bowls* are placed in the listener's circumspace. This move is also from abstracted material to referential material. Thus, the listener is moved from one space into another. The illusion of space is also shifting constantly, with sounds that are heavily reverberated to sounds that are completely dry and upfront. There is a play between inside and outside as well as abstract and referential, and the listeners are meant to create their own connection between these aspects.

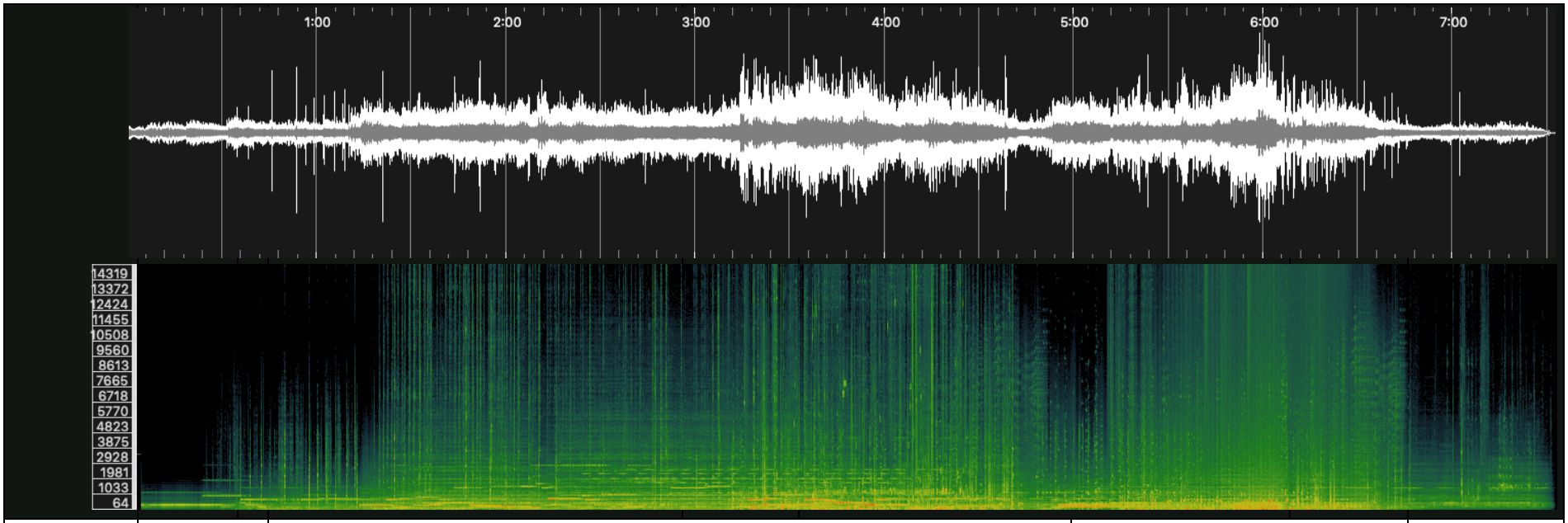
In Ulf Holbrook's (2019) article titled "Sound Objects and Spatial Morphologies" in *Organised Sound*, Holbrook speaks about extending Schaeffer's sound objects to spatial morphologies and highlights the inherent importance and recognisability of space in the listener's perception. "The room is an object which the listener forms in his or her conscious mind while listening to music and this emerges in response to an auditory experience" (Holbrook, 2019, p. 27). In *Sound Spaces* in general this establishment of space as an object of perception is important and is what this piece specifically attempts to work with. The room is an object that can also be transformed and abstracted in the same way that the sound

objects can. This is one of the mechanisms that allows for the formation of place, as the listeners are exposed to a space that constantly changes and is animated through the music and through the perception of the music.

Re:construction

Re:construction comes to terms with silence as a sanctuary but also admits the idea of suburbia as a common and shared space. *Re:construction* uses recordings of lawnmowers, weed eaters, construction vehicles, builders and common nature sounds which have all been captured at my home. It sets out to construct a subjective representation of this soundscape with the aim of sharing a personal point of view with the listener. For most of the work, the material is obscured through abstraction. Synthesised surrogates are arranged in pitch space and could be considered a part of *Sound Spaces* that more directly finds itself in aural discourse. Metaphorically, it draws parallels between the hand that culture has in constructing place as the aural discourse and a construction that heavily depends on culture. For the most part, pitch materials that are dominant are only found here and there throughout *Sound Spaces*. My decision to situate it within aural discourse was due to my frustration with the lack of control I had over the soundscape that was plagued by noise production. My reaction was to abstract the noise into a melodic and harmonic space, reframing my own experience of the soundscape which I regarded as noisy.

Numerous elements were abstracted from the field recordings made for this piece. These abstractions, along with the raw material, are weaved together and transformed throughout the duration of the piece in which their relationship is reconfigured. In Figure 22, which is a section at the end of the piece, the rhythmical pattern of a truck reverse signal is visible. This sound is mimicked rhythmically by a synthesised tone of the same pitch audible from the start of the piece. Pitch changes are applied to this motif throughout the piece, but the rhythmical mimesis remains intact. Figure 23 illustrates the use and transformation of this motif.



Section	Mixed	Escape	Saturation	Suburban
Material	Lawnmowers, manual construction, vehicles	Synthesised, abstracted versions of elements of the field recordings mixed with original field recordings	White noise	Lawnmowers, manual construction, vehicles, suburban ambience, hadedas
Dominant Spatial Zone	Source-bonded	From Source-bonded to Spectral Space	Spectral Space	Source-bonded Space

Table 5 – Re:construction overview

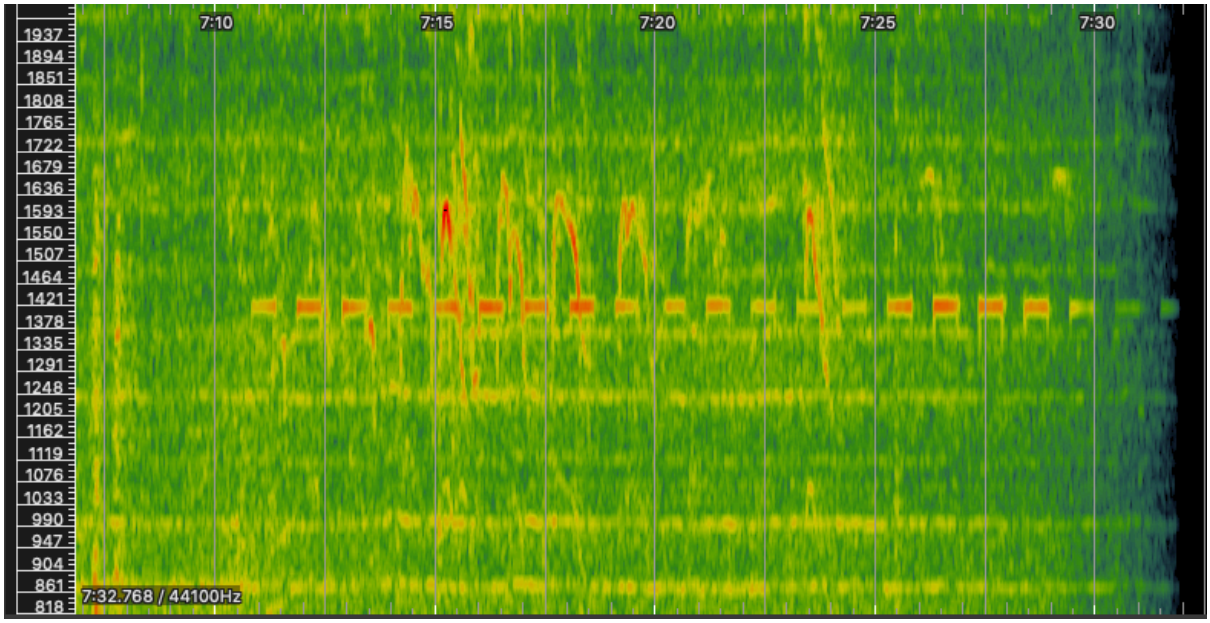


Figure 22 – Truck reverse signal from field recording

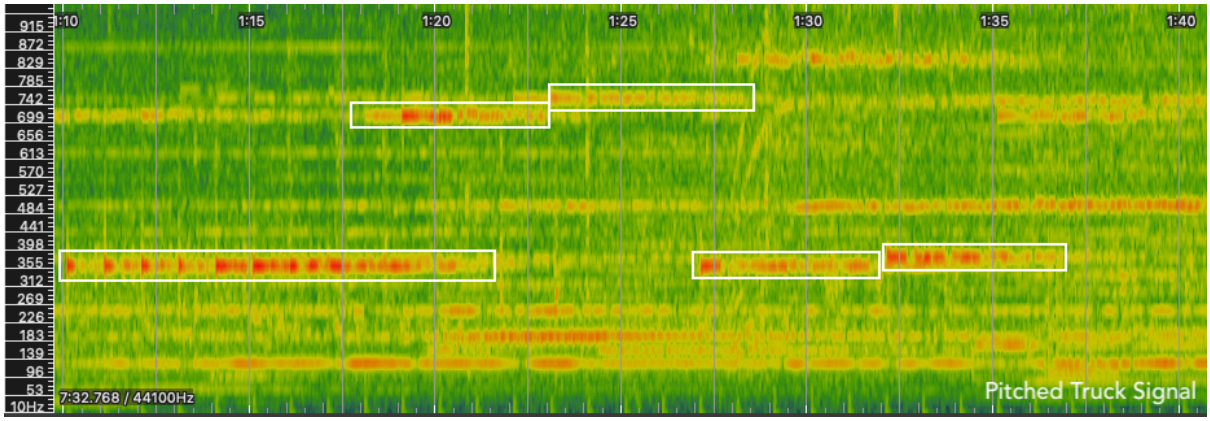


Figure 23 – Synthesised truck signal at various pitches

The second set of main elements are the lawnmowers and weed eaters in the original field recording. Figure 24 illustrates the pitch trajectory of the original lawnmower recording heard in the piece. There is a notable pitch change as the motor of the lawnmower starts up and reaches its target speed. This has been mimicked in the synthesised version as well (see Figure 25), and the overall fluctuation of pitch in the drone-like material has been expanded on throughout the piece. Additionally, more pitch layers are added to create a higher and expanding spectral density. Higher pitched resonant copies of the sound start to accumulate and their pitches are derived from the construction vehicle's signal sounds, resulting in these two layers being blurred into one source-cause.

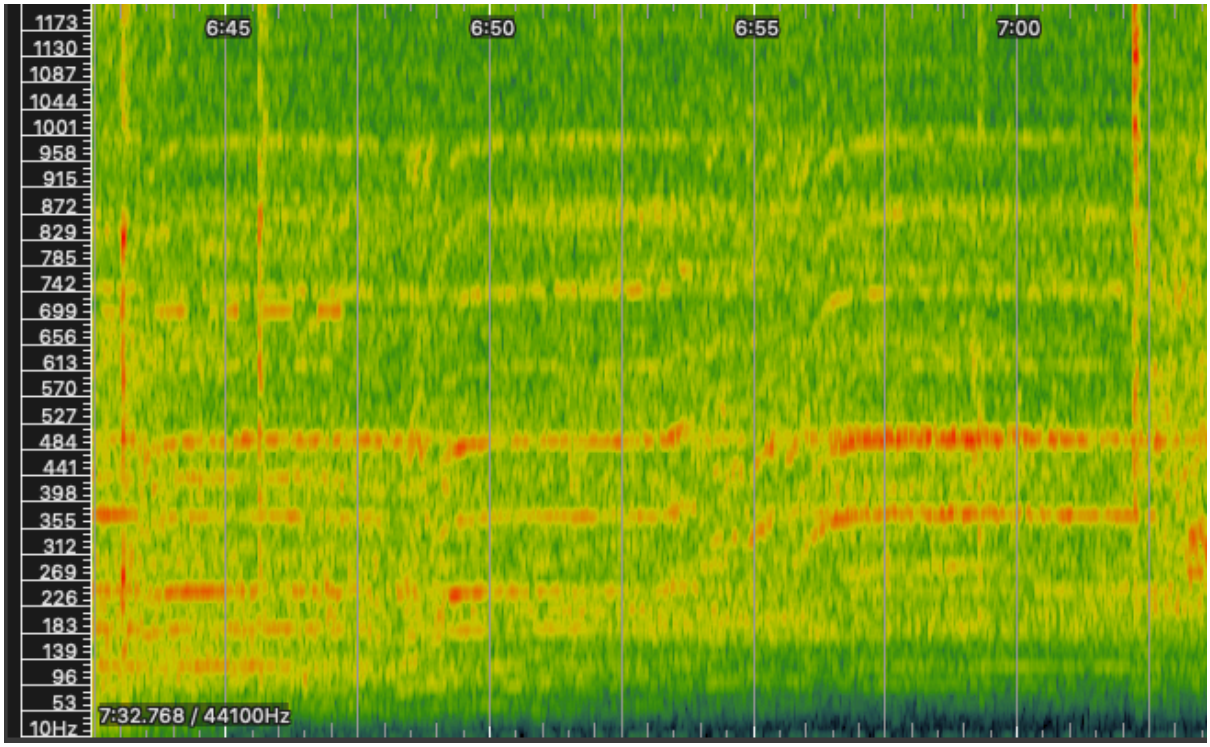


Figure 24 – Lawnmower pitch trajectory from field recording

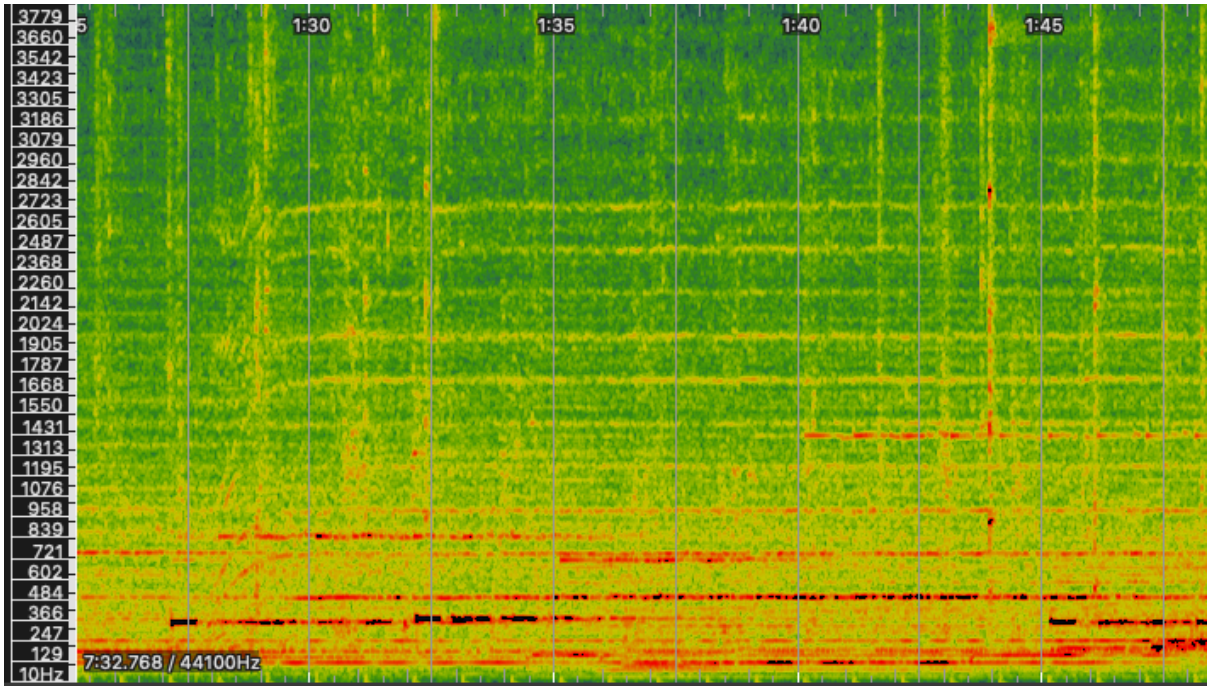


Figure 25 – Resynthesised and stretch version of lawnmower

The construction workers' sounds are mimicked by metallic frequency modulated percussive sounds, taking on unrealistic trajectories and rhythmical patterns. The percussion slowly starts becoming noisier and their envelopes more extended, with longer attacks and decays. The spectral envelope of a hadeda (a type of Ibis, audible in other parts of this piece) is stamped onto the percussive sounds, resulting in a similar blurring between source-causes.

The overall intension with the abstractions was to create material that has some connection to the original source-cause but to such an extent that the causes might be confused with each other. I aimed to break down the logic of the sonic environment with the hopes of establishing new relationships between the elements of that environment, a kind of reconstruction of the environment.

In the *Saturation* section, the piece builds up in density in the spectral domain. The droning materials are gradually stacked on top of each other, filling up the spectral space. Noise is projected one part at a time from each corner of the main system. Once the noise is present in all the quadrants, the focus shifts away from any particular direction as the sound occupies the listener's full circumspace. Together with the perspectival spatial saturation, the spectral space is also saturated. This is, however, momentary as the full saturation of perspectival and spectral space is interrupted as the listener is pulled towards the source-bonded space of the suburban landscape.

The work is mostly situated within the aural discourse domain; the focus is thus primarily on spectral space, although the source-bonding recognition is encouraged by the revelation of the material at the start and end of the piece. This material is firstly presented in an already abstracted version at the start of the piece, but is revealed at the end in a way that should be recognisable. This is reinforced by the title of the piece as the field recording mostly consist of construction work. The hadeda is also a very recognisable sound that can often be associated with the suburban landscape.

The aim of the piece is thus not to emplace the listener into the suburban context in which the recordings were made, but rather to showcase my journey into the subjective experience I had with this particular soundscape. It continues along the lines of *Drones, bells and bowls,* but rather than representing the soundscape as a hyper-real version of the field recordings, the aim here is to enter a dreamlike reimagining of the soundscape. A kind of forward-looking and optimistic construction of reality. It takes inspiration from works such as Westerkamp's *Kits Beach Soundwalk* where the piece is about the journey of a composer through a particular experience rather than the creation of an environment.

Montage

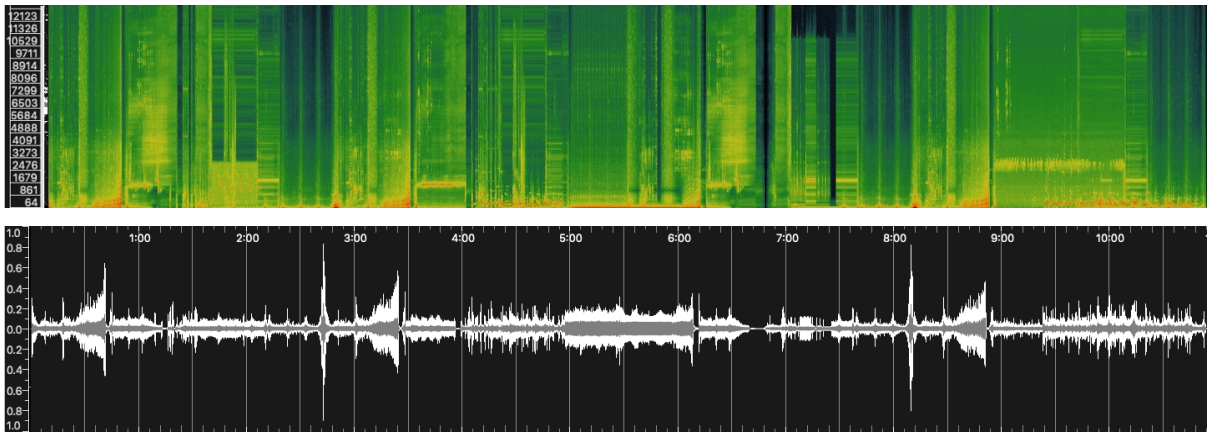


Figure 26 – Montage overview

Montage navigates through a series of short soundscapes. The structure takes the form of a routine and a process of moving through spaces. With every repetition, the soundscape is auditioned in a slightly different way, exposing the multi-layered experience that can be extracted from these soundscapes. The layers include field recordings of directly audible sound, radio emissions from both publicly accessible frequency bands and encrypted communications, electromagnetic field recordings and synthetic re-imaginings of these layers from the composer's perspective. There are four cycles that form the overall structure of *Montage*. Each cycle is identical in duration and consists of the same sections. The sections are indicated in Tables 6 to 9.

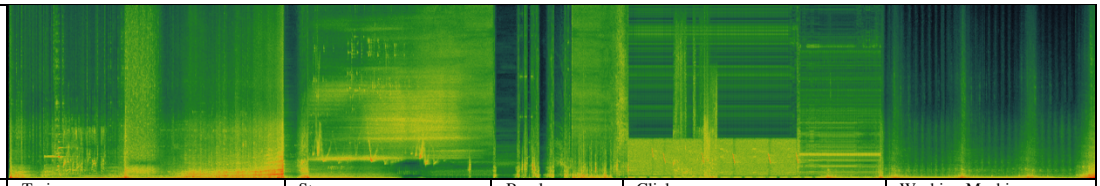
Cycle A					
Section	Train	Steam	Bowls	Clicks	Washing Machine
Material	Train departing from platform, scattered grains derived from glass and impact sounds, granulated utterances, radio communications	Hyper-realistic and abstracted material reminiscent of *Drones, bells and bowls*. Espresso machine steam sounds	Bowls, scraping and moving, gestural material	Encrypted SDR, constant rhythmical abstract click morphing into pedestrian crossing signal sounds	Washing machine with mimetic link with train, footsteps
Spatial Zone	Cultural and natural source-bonded space Mediatic space	Natural source-bonded space and mechanised space Shift from distal to proximate	Agential space Mechanised space	Spectral space, source-bonded space, cultural and mechanised	Mechanised, agential, cultural

Table 6 – Montage Cycle A

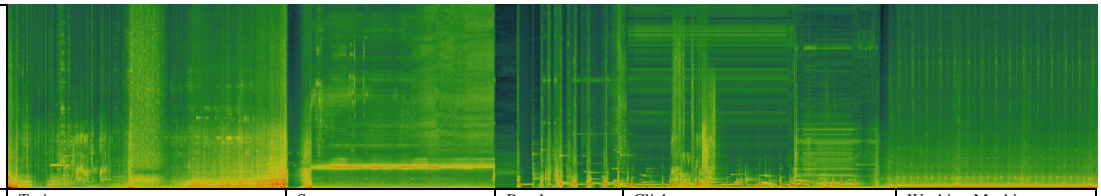
Cycle B					
Section	Train	Steam	Bowls	Clicks	Washing Machine
Material	Train departing from platform, scattered grains derived from glass and impact sounds, granulated utterances, radio communications. More abstracted than Cycle A.	Hyper-realistic and abstracted material reminiscent of *Drones, bells and bowls*. Bird calls with bouncing gesture. Espresso machine steam sounds	Bowls, scraping and moving, gestural material. Melodic bell sounds abstracted from bowls	Encrypted SDR, constant rhythmical abstract click morphing into pedestrian crossing signal sounds. Melodic bowls	Washing machine with mimetic link with train, footsteps. Low frequency pulse. Distant bird calls
Spatial Zone	Cultural and natural source-bonded space Mediatic space	Natural source-bonded space and mechanised space Shift from distal to proximate	Agential space Mechanised space	Spectral space, source-bonded space, cultural and mechanised	Mechanised space

Table 7 – Montage Cycle B

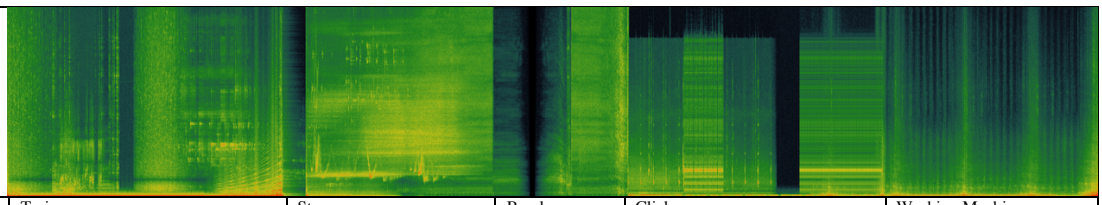
Cycle C					
Section	Train	Steam	Bowls	Clicks	Washing Machine
Material	Scattered grains derived from glass and impact sounds, granulated utterances, radio communications. Low pulse continues. More abstraction	Hyper-realistic and abstracted material reminiscent of *Drones, bells and bowls*. Espresso machine steam sounds	Abstracted steam	Pedestrian crossing sound morphing into abstracted version	Washing machine with mimetic link with train, footsteps
Spatial Zone	Cultural and natural source-bonded space Mediatic space	Natural source-bonded space and mechanised space	Mechanised space	Spectral space, source-bonded space, cultural and mechanised	Mechanised, agential, cultural

Table 8 – Montage Cycle C

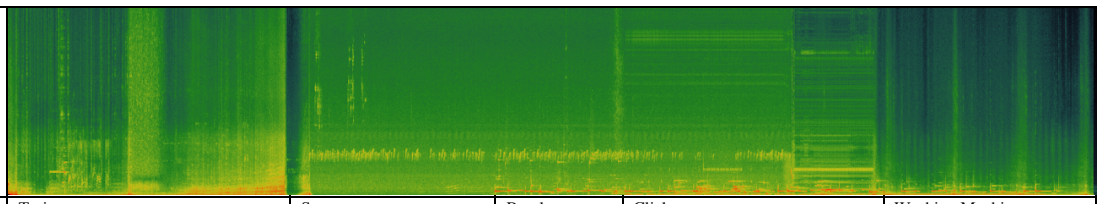
Cycle D					
Section	Train	Steam	Bowls	Clicks	Washing Machine
Material	Train departing from platform, scattered grains derived from glass and impact sounds, granulated utterances, radio communications. Similar to Cycle A	Frogs and river field recording. Distant motorcycle. No abstraction. Melodic bowls	Frogs and river field recording. Melodic bowls, pedestrian crossing	Melodic bowls, pedestrian crossing, frogs and river	Washing machine, melodic bowls, footsteps
Spatial Zone	Cultural and natural source-bonded space Mediatic space Shifts from proximate to distal	Natural source-bonded space and mechanised space Shift from distal to proximate	Agential space Mechanised space	Spectral space, source-bonded space, cultural and mechanised	Mechanised, agential Shifts outside the hall into distal space

Table 9 – Montage Cycle D

If the purpose of the montage form is to condense time, space and information, this piece serves as the best conclusion to the work. Where time and space were mapped out in *Tuning,* and space and time were gradually expanded beyond the walls of the concert hall in the pieces that followed, *Montage* brings space and time all back into a contained idea. It consists of a series of sound scenes that repeat four times and with each iteration the sound is gradually transformed as a play on previous material, associations with different sounds, and memory. The work is summed up at the end, as it leaves the concert hall.

The sound leaving the concert hall signals the end of the performance and suggests a similar trajectory for the audience to follow. This also suggests that the audience leaving the hall and continuing the rest of their evening is as an important feature of the experience of the work as the rest of the concert in establishing the meaning of the entire work. It emphasises their role in the work as well as the context in which the work finds itself. The music does not merely exist in the moment in which it is performed or played back but continues to find meaning outside its occurrence in time and space.

Montage's material consists of different layers of place: proximate with sounds from the surroundings, placed outside of time with references to material used in earlier sections; remote with recordings made by strangers around the world; virtual with recordings of electromagnetic fields transposed into audible range; and without specific space with recordings from software defined radio.

Throughout the piece, material is reframed by omitting and adding certain components to each section. An interplay also arises between the sounds as they take on each other's spectromorphologies. The most noticeable example of this is in the *Clicks* section. Here the listener is presented with atmospheric base material with rhythmical clicking sounds overlaid on top of it. In Cycle A, the base layer is the recording made with the SDR. The rhythmical material consists of a dramatically spatialised and periodic clicking sound. The sound is then replaced with the single recording of a pedestrian crossing signal sound, maintaining the rhythm presented at first. In Cycle B, the SDR recording is replaced by the melodic bowl sounds from the preceding section and accompanied by radio transmissions. The clicking sound made from the recoding of the pedestrian crossing signal sound is further abstracted into obscurity. In Cycle C, the pedestrian crossing recording is presented without alteration in

the preceding section; once the piece enters the *Clicks* section, the reference to the source has already been established. Once the material is presented as such, it immediately reframes the previous cycles and the origin material has been revealed. In the last cycle, the *Clicks* section starts with a recording of a river and frogs that was already presented in the preceding section. The clicking remains abstract and the pedestrian crossing can only be heard faintly in the background.

Even though the sections are quite discernible in terms of the motifs and thematic material used in them, it becomes difficult to distinguish between them due to how the material from adjacent sections bleed into each other. There is, however, always a link that justifies why a particular recording is used over different sections. It is either for its spectromorphological similarities, whether imposed through processing or already existing, or for its referential similarities. It creates an elaborate network of references to place, both in spectral space as well in its source-bonding. The clicking makes a syntactic mimetic link with the pedestrian crossing as the source is later revealed.

As with source-bonding, recognition is not always possible as a composer knows to what extent the sources will be recognised and the same is true with mimetic links. Wishart and Emmerson state that the more familiar the composer is with mythic and symbolic structures of the culture of the potential audience, the greater his or her control can be over how mimetic links are made (2002). In a large portion of the concrete sound used in *Sound Spaces,* the sources are commonplace in everyday life and in certain cases, for example the pedestrian crossing in *Montage* and the crickets in *Drones, bells and bowls*, the referenced material is already in close proximity to the site of the presentation. I deliberately decided to work with sound that the audience might encounter directly before or after the concert as well as soundscapes that are already familiar to them as I wished to address the ambiguity that might arise in the interpretation of the material as a listener. The abstraction through transformation of this material is where the interpretation and imagination are brought into the foreground and although a degree of recognisability is maintained the experience of the sound becomes inherently more subjective and personal. This is true both for the audience members as they might start to wander off into an imagined cause of the sound and create their own links between the sounds and for me as the composer as my abstractions are defined by my reference point as well as my aesthetic preferences.

Montage is the closing piece of the concert and uses the most dramatic spatialisations of all the pieces; at certain times during the piece all the sound comes from the foyer and corridors. The piece concludes with the sound of bowls (bell-like sounds) exiting the concert hall. During the actual performance, there were also people in the foyer talking. This shifted focus to outside the hall. Only feint reverberation could be heard directly in the hall, while the sounds found their way out of the space. Where in a typical concert performance the noise from the foyer is blocked out as much as possible by closing the doors, in *Sound Spaces* the doors were left open to invite whatever might occur outside into the hall. These elements that are out of my control can be regarded as a distraction that detracts from the musical experience. However, my view is that it serves as a reminder of what Ingold identifies so accurately about sound and its dynamic nature when he states in his critique of soundscape that sound is not an anchor and that it does not root but rather pulls away through its movement in and out of place (2011b, p. 138). *Montage* itself reveals the perimeters of place by exposing the adjacent areas to each other by the simple act of leaving the doors open, allowing for the dynamic movement of sound. It can be argued that sound is not what creates place, but rather what reveals place, at least to some degree.

Chapter 6 – Leaving the Concert Hall

Sound Spaces is not a document of places, but rather a process of creating place that existed only in and around the moment of its presentation. It can be said that the recordings provided with this research are phonographs of a place or a document of a transient environment. Neither *Sound* nor *Spaces* indicate an explicit relationship to place, and, on the surface, it might appear not to have a direct link to the notion of place. The intention behind this is, however, to embed into the title of the work the idea that place cannot be created by the musical work alone. The place that is created and occupied in relation to this work arises in the meeting point of sound, space and the presentation and reception thereof.

Sound Spaces uses spatialisation techniques that create illusions of and allusions to space. Augmenting space by morphing spaces into each other, expanding and contracting the listening space, and shifting what falls within the listener's perspectival space allow for motion to be created. This motion is transferred to the listener as events enter into and spatial zones interact with their egocentric space. The listening body is incorporated into the work by sympathetic proprioception of the human presences which are audible throughout *Sound Spaces*. Layers of place are explored from the concert hall to the outside area, the pedestrian crossing, familiar soundscapes from suburbia, unknown topologies from SDR, virtual, remote and hyper-realistic soundscapes, internal and external, dreamlike and surrealistic, material and non-material. The use of motifs, repeating material and spectromorphologies, such as the rhythmical motifs, the crickets, the pedestrian crossing and FM percussive sound, all serve as memory triggers throughout the piece and as flags for the listener to guide them through the navigation of *Sound Spaces*. The listeners are invited to find their own way in the complex web of references and allusions to place and form their own sense of place amidst these dense soundscapes.

It is through these mechanisms that the notion of place is explored and incorporated into the composition; how it is sensed, experienced and created become the primary compositional aspects in question. The integration of these elements can be considered on multiple levels, including the selection of sound sources, considerations of the immediate sonic environment around the presentation space, the acoustics of the listening space and a more direct incorporation of this space into the composition. The extent to which place-making through soundscape composition is brought into the foreground of the listening

experience is greatly enhanced by considerations of the listening space, the musical space and the incorporation of these into the experience. It addresses the question initially proposed on p. 12 regarding place and how it can be explored as a primary and active domain of composition in electroacoustic music.

Spatiality, although not the only component of the notion of place, can be used to a great extent to create senses of place. Soundscape composition and more broadly electroacoustic music have the benefit of allowing spatiality to be placed in the foreground, applying transformational and structural processes to the sense of space that is being created and occupied. Spatiality can also consist of multiple spatial zones that are activated simultaneously, allowing a complex network of relationships to arise and thus creating the opportunity for a sense of place to be developed and explored as a multi-layered occurrence. The centrality of space inherently ties the corporality of the listener into the musical experience by virtue of its physicality and rootedness in three-dimensional space.

By bringing all these spatial layers together, *Sound Spaces* establishes the soundscape as a sonic environment in which the listeners can find their place. It can be viewed as an ecology where place can happen. The experience of place is layered and complex; a sense of emplacement relies not only on the use of evocative material or pictorial references to existing places but also on the dynamic layering of the experiential aspects of a musical work. This experience is defined not only by the musical work itself but also by the listeners' imagination, their experiences of everyday life, the space in which the concert takes place, and the timeframe during which the concert occurs. As such, the implication is that the listeners have an equal role to play within this ecology, as an inhabitant of the environment. The sound material in many moments of *Sound Spaces* is evocative of a multitude of experiences unique to each listener, and the evocative nature of the sound affords the listeners a way of engaging as participants and inhabitants of place. At times, there are also aspects of the recordings that are commonplace in everyday life, resulting in a shared experience among the audience members. *Sound Spaces* and soundscape composition more generally thus have the potential to serve as a mediator between subject and object: The self, space and time.

Although not the primary aim of this research, a framework of approaches to emplacement in electroacoustic music from an analytical and compositional point of view

can be a future development that builds on the research conducted. It can serve as a way of equipping composers with a defined toolkit to incorporate place as a primary component of composition. This framework can take a holistic view at music that includes the aspects explored in *Sound Spaces,* which are considerations not only around the work itself but also for the listening environment, the listener, and the act of listening as approached from an ecological perspective. Different approaches to the presentation outside the concert hall can form part of a further investigation into site-specific musical presentation where place itself in its existing form can be the raw material on which soundscape compositions can be built.

The title of this chapter is derived from the ending of *Montage,* where the bells signal a future trajectory for the audience. I will take heed of this call and propose, among other things, to revisit my initial idea of an interactive soundwalk, extending this concept of place as an active domain of composition to contexts other than the concert hall. Since the adaptation of the initial project into what became *Sound Spaces* and during the course of this research, technology has developed significantly and what was impossible at the start in terms of the technical requirements may have changed. Regardless, different approaches to interactive soundwalks could be investigated and will allow for the incorporation of place-making metaphors and strategies to be further explored as an active compositional domain. If one is to reimagine the "frame" of time and space that is created by a structured concert, in a structured space like the Wits Great Hall, and shift this towards an open frame where the listener determines the time and space in which the work is experienced, it could allow for greater exploration of the notion of place and soundscape composition's role in creating that sense of place. An interactive soundwalk would be a way of opening up this frame. The effect that this has on structure can contribute to place as something that is mapped out. If the listeners are in control of when and where they experience the work, the non-linear mapping-out will form part of the structuring of the work and by extension the making of place around the work.

The notion of place is always evolving as social structures evolve and as spaces are reappropriated, demolished and rebuilt. The implication that the recent pandemic has had on what place might mean is largely unexplored, with remoteness and spatial separation becoming the default. In addition, space has also fallen subject to a new kind of compartmentalisation where private domestic spaces have had to simultaneously function as

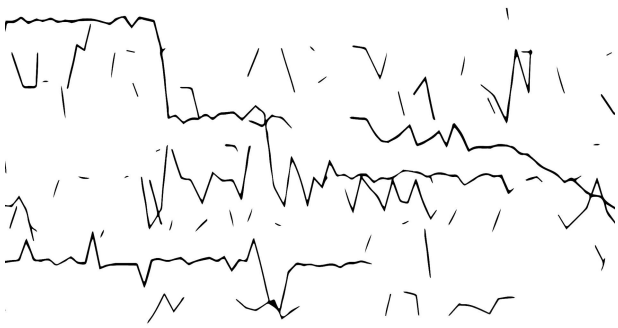
professional office spaces which are virtually shared with others. How this new fragmented landscape has affected the types of places we now regard as private and public and what the role of the physical body is in a world where we find ourselves increasingly in digital online spaces are ripe for investigation. When considering Norman's metaphors of place-making, it might be possible to extend it to different models that reflect these changes that have occurred in our current landscape.

Leading from this, the assumptions of what can be considered as "everyday" sounds can also be challenged and expanded. The role that sound plays in the formation, comprehension and participation in place is as dynamic as the medium itself and a deeper look into these relationships can be a future direction of any work that foregrounds the subjective experience of the listener within a particular sonic environment. A more thorough investigation can be based on the question of how place can inform our comprehension of sound, expanding the discussion from how sound can create a sense of place.

Appendix A: Programme Notes

SOUND SPACES

LOUWRENS FERREIRA



Tuning

Tuning approaches the concert hall as an acoustic ecology, where the space and its occupants have an equal role in defining the sonic experience of this place. The raw material consists of tropes from the concert hall, such as the sound of an orchestra tuning and the sounds emitted by an audience. By manipulating the structural and temporal aspects of these sounds, the relationship between them is re-evaluated, situating the audience and the figurative performer on the same playing field.

Drones, bells and bowls

A journey from a familiar soundscape into a synthesised dream-like interpretation. This composition attempts to maintain a sonic link with its source material and almost hints towards a hyperreal representation of the soundscape.

Interlude

Interlude is situated between abstract musical material and field recordings reaching neither of the two entirely. *Interlude* functions as a bridge between the two, where motifs and sound transformation patterns are established. On a different level, *Interlude* attempts to reveal the internal process of finding one's own sense of place.

Re:construction

Re:construction is a personal response to a suburban soundscape that the composer is part of on a daily basis. The piece builds up abstract musical layers in an attempt to engage with this soundscape, perhaps drowning out the noise with more noise and coming to terms with the soundscape's most prominent components: Lawnmowers, construction vehicles and construction work, hadedas and dogs.

Montage

Montage navigates through a series of short soundscapes. The structure takes the form of a routine and a process of moving through a space. With every repetition, the soundscape is auditioned in a slightly different way, exposing the multi-layered experience that can be extracted from these soundscapes. The layers include field recordings of directly audible sound, radio emissions from both publicly accessible frequency bands and encrypted communications, electromagnetic field recordings and synthetic reimaginings of these layers from the composer's perspective.

Appendix B: List of Media

Sound Spaces Stereo

1 – Tuning – Stereo.wav

2 – Drones, bells and bowls – Stereo.wav

3 – Interlude – Stereo.wav

4 – Re-construction – Stereo.wav

5 – Montage – Stereo.wav

Sound Spaces Binaural

1 – Tuning – Binaural.wav

2 – Drones, bells and bowls – Binaural.wav

3 – Interlude – Binaural.wav

4 – Re-construction – Binaural.wav

5 – Montage – Binaural.wav

Spatial Maps

1 – Tuning – Spatial Map.mp4

2 – Drones, bells and bowls – Spatial Map.mp4

3 – Interlude – Spatial Map.mp4

4 – Re-construction – Spatial Map.mp4

5 – Montage – Spatial Map.mp4

Works Referenced

Barry Truax – *Riverrun*

David Monacchi – *Integrated Ecosystem*

Francisco López – *La Selva*

Hildegard Westerkamp – *Kits Beach Soundwalk*

Janet Cardiff and George Bures Miller – *Alter Bahnhoff Video Walk*

Janet Cardiff and George Bures Miller – *Forty Part Motet*

John Cage – *4'33"*

Luc Ferrari – *Presque Rien Suite*

Steven Feld – *Rainforest Soundwalks*

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